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DT60 Series Distributed AC Drive

User Guide

Industrial Automation | New Energy Vehicle | Intelligent Elevator | Intelligent Robot | Digital Energy | Rail Transit

Data code PS00018531A01

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The contents are subject to change without notice due to product upgrade.

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The storage, use, and disposal of this product (including optional accessories) must comply with local laws and regulations.

Qualified Personnel

The product/system described in this documentation may be operated only by personnel qualified for the specific task in accordance with the relevant documentation, in particular its warning notices and safety instructions. Qualified personnel can identify the risks of the product/system and prevent possible dangers.

Proper Use of the Product

Proper transportation, storage, assembly, installation, commissioning, operation, and maintenance are required to ensure the safe operation of the product without any problems. The required ambient conditions must be met. All operations must follow the guidelines provided in this documentation.

Preface

Introduction

The DT60 series distributed AC drive features high reliability, high protection, high safety, and flexible installation and configuration. It supports high-speed bus communication solution and applies to drive applications such as conveyors and lifts in automotive and logistics industries.

The drive covers a power range of 0.37 kW to 2.2 kW (3.0 kW to 15 kW under planning) and comes with three sizes (size 1 released at present).

This user guide focuses on mechanical design, electrical design, installation, wiring, commissioning, communication, functional applications, troubleshooting, and maintenance of the product.

Note

- The drawings in the user guide are shown for demonstration only, which may not match the product purchased.
- The user guide is subject to change without notice due to product upgrade, specification modifications as well as efforts to improve the accuracy and convenience of the user guide.

Document information

Name	Code	Description
DT60 Series Distributed AC Drive User Guide (This user guide)	PS00018531	Presents mechanical design, electrical design, installation and connection, commissioning and operation, communication configuration, fault handling, specifications, maintenance, common EMC faults and solutions, and certifications/ standards compliance.

Revision History

Date	Version	Software version	Revision
October 2025	A01	Version: A02 Version tag: A2-22=U60.02/A2-23=U60.02/ A2-24=000.00/ A2-25=000.00	**Revision:** • Added the "Compliance with Certifications and Standards" section. • Added the "Basic Safety Instructions" section. **Revision:** • Updated the nameplate information in *"2.2 Model and Nameplate" on page 36*. • Updated the LAN1 and LAN2 terminal assignment table in *"18.7.2.4 Assignment of AC Drive Terminals" on page 1308*. • Merged the "Safety Precautions" section and the "Industrial Information Security" section into the "Basic Safety Instructions" section.
August 2025	A00	-	First release

Access to the guide

This user guide is not delivered along with the product. You can download the PDF version in the following ways.

- Visit *https://www.inovance.com/global*, choose Service&Support > Support > Documentation Download.
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Warranty

Inovance provides warranty service within the warranty period (as specified in your order) for any fault or damage that is caused by proper operation of the user. Maintenance can be charged after the warranty expires.

Within the warranty period, maintenance can be charged for the following damage:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or abnormal voltage
- Damage caused by unintended use of the product
- Damage caused by use beyond the specified scope of application of the product
- Damage or secondary damage caused by force majeure (natural disaster, earthquake, and lightning strike)

The maintenance is charged according to the latest Price List of Inovance. If otherwise agreed upon, the terms and conditions in the agreement shall prevail.

For details, see Product Warranty Card.

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List of terms

Table –1 List of terms

Function	Name	Description	Alias
Input/Output	DI	Digital input terminal	-
	VDI	Virtual digital input terminal	-
	DO	Digital output terminal	-
	VDO	Virtual digital output terminal	-
	RO	Relay output terminal	-
Application macro	Application macro	Multiple default parameter sets are available. One macro is usually used as the basis, with parameters modified based on function requirements. The modified parameters are then saved as the user-defined parameter set to simplify the commissioning process. Application macros are divided into interface macros and industry-specific macros.	-
	Terminal macros	The parameter set in the terminal macro mainly applies to control terminals such as digital input (DI), digital output (DO), and analog input (AI), facilitating commissioning on control interface parameters.	-
	Industry macros	The industry macros mainly apply to specific industrial applications, such as fans and water pumps, facilitating commissioning during application.	-
Frequency detection	Frequency detection (FDT)	Used to set the detection value for the output frequency and the hysteresis value for output action deactivation. The hysteresis value is active only during deceleration. Hysteresis does not occur in detection during acceleration.	-
	Jump frequency	Allows the drive to avoid mechanical resonance point of the load.	-
Current detection	Current detection	The DO terminal outputs an active signal when the output current of the drive keeps lower than the setpoint for a specified period of time.	-

Function	Name	Description	Alias
Load monitoring	Load monitoring	Used to monitor input signals related to the output speed (such as output current, output torque, output power) of the drive, including load loss monitoring and overload monitoring.	-
	Load loss monitoring	Used to detect whether a load has been lost, such as a broken conveyor belt or a broken mechanical shaft.	-
	Overload monitoring	Used to detect whether a load is blocked, such as motor stall.	-
	Overload	After the motor actual speed enters the user-defined monitoring range, the drive samples the current motor speed and monitoring signal, and finds the corresponding upper and lower boundary points of the monitoring signal on the multi-point curve based on the current motor speed. If the current monitoring signal exceeds the upper boundary point, overload occurs.	-
	Load loss	If the current monitoring signal exceeds the lower boundary point, load loss occurs.	-
Process PID Control	Process PID Control	As a general process control method, PID process control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and derivative calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the drive output frequency.	-
	PID	Proportional, integral, and derivative	-
	Kp	Proportional coefficient	-
	Ti	Integral time	-
	Td	Derivative time	-
Acceleration and deceleration/ Jog	Ramp function generator (RFG)	Ramp function generator	-
	JOG1/2	Jog 1/2	-
Motorized potentiometer	Motorized potentiometer	Refers to the virtual potentiometer output by the software, which can be set through parameters in group P3.	-
Connector	Connector	Read-only parameters that allow the drive status and data to be viewed by users or be read and used by other parameters.	-
	Bit connector (B connector)	The bit connector is sourced from the bit, which can be 0 or 1 only. It can be used to monitor the digital signal status in the system or used as a binary signal source for certain functions.	-
	Word connector (K connector)	Word connectors and double-word connectors are available. The connector can be used as the signal source of some functions or used to monitor the status word in the system.	-
	Floating-point connector (F connector)	Used to monitor floating-point type data in the system or acts as a signal source for certain functions.	-

Function	Name	Description	Alias
Free function module	Free function module	Multiple status signals and control signals are used together to implement engineering control requirements. Free function modules include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, constant setting models. You can set related parameters as needed to achieve simple logic operation.	-
Speed reference	Droop control	The operating frequency is automatically reduced upon excessive load.	Softening control, speed drop
	Jump frequency	The target frequency is automatically adjusted to skip the resonance point.	Dangerous speed, jump speed
	Rotational direction of the motor	Used to switch the motor operating direction without changing the positive and negative signs of the frequency reference.	Motor phase sequence switchover, motor phase sequence

Function	Name	Description	Alias
Vector control	Vector control	The three-phase U/V/W current is divided into id/iq to control the magnetic flux and torque respectively. The speed and torque can be controlled with high accuracy and dynamic response, which is similar to DTC control.	-
	FVC/SVC	Feedback vector control/Sensorless vector control	-
	Acceleration torque feedforward	Used to calculate the acceleration/deceleration torque needed and make corresponding compensation during reference speed change, which can greatly reduce the demand for speed loop Kp, Ti, and dynamic response of the loop.	Acceleration feedforward, acceleration feedforward compensation, torque feedforward, acceleration compensation
	Kp	Indicates the proportional gain of the PI controller. The higher the Kp, the stronger the control effect can be, such as the SVC speed loop Kp.	-
	Ti	Indicates the integral time of the PI controller. The lower the Ti, the stronger the integral effect can be, such as the SVC speed loop Ti.	-
	Ki	Indicates the integral gain of the PI controller. The higher the Ki, the stronger the integral effect can be (Ki = Kp/Ti).	-
	I/F control	The reference speed is used as the frequency for the output current at speeds close to 0 rpm in SVC mode. It improves the stability at zero speed in SVC mode.	Speed open loop control
	Electromechanical time constant	Indicates the time for the motor to drive the load to reach rated speed at rated torque.	Mechanical time constant, rated motor startup time
	Overspeed controller	The overspeed controller operates once motor overspeed occurs to prevent further acceleration.	Stall control
	V/f control	Indicates constant voltage/frequency ratio control, which features stable control and is insensitive to parameters. However, the dynamic response and accuracy of V/f control mode is not as high as other control modes.	Scalar control, V/f control
	DTC control	Indicates direct torque control, which can control the speed and torque and features high accuracy and dynamic response. This mode corresponds to the vector control mode.	-

Function	Name	Description	Alias
V/f control	Slip compensation	The rotor speed of the asynchronous motor is lower than the set speed after the load is applied. In slip compensation, the magnitude of the load is estimated and the reference frequency is boosted automatically to improve the speed accuracy.	Slip compensation
	Overcurrent suppression	When the output torque is high, the frequency is automatically adjusted to reduce the output current to prevent overcurrent during high load or acceleration/deceleration.	Overcurrent stall suppression
	Torque boost	Indicates low-speed compensation for the stator resistance voltage drop to ensure a constant air gap flux (voltage/frequency) of the motor during operation in V/f mode, keeping a good load carrying capacity at low speed.	Torque compensation, voltage boost, IR compensation
	Oscillation suppression	In V/f control, the motor may oscillate during no-load operation. In this case, use the oscillation suppression function.	Resonance suppression

Function	Name	Description	Alias
Basic control	Active short circuit control	In synchronous motor control, the drive shorts the UVW output terminals together through IGBT control to form a braking torque. The higher the speed, the higher the braking torque. This function can prevent motor runaway, preventing the motor from rotating reversely at low speed or coasting for a long time.	Electronic motor stator shorting, internal armature short-circuit braking
	Carrier frequency	Indicates the frequency of the output pulse voltage.	Carrier frequency, pulse frequency, and switching frequency
	DPWM/PWM	DPWM indicates 5-segment discontinuous pulse width modulation and IGBT is switched on/off 4 times per one carrier cycle. CPWM indicates 7-segment continuous pulse width modulation and IGBT is switched on/off 6 times per one carrier cycle.	5-segment discontinuous pulse width modulation/7-segment continuous pulse width modulation
	Overmodulation	The output voltage in general control is low in the field weakening range. Overmodulation can increase the output voltage by up to 5%, reducing the output current effectively under the same load. However, the output harmonics may be increased slightly.	Edge modulation, hexagon field weakening control
	Carrier ratio	Indicates the ratio of effective carrier frequency to the output frequency. The carrier ratio indicates the number of pulses in a sinusoidal wave current cycle. If the carrier ratio is low, the pulse voltage is low, and the output current cannot be controlled properly, which may result in motor control error, overtemperature, and demagnetization.	Carrier frequency/ Output frequency
	Random PWM	The carrier frequency changes randomly during operation, so that the sharp noise of the carrier frequency can be dispersed. After random PWM is enabled, the motor may generate rustling sound.	Pulse frequency modulation
	Overvoltage suppression	Used to prolong the motor deceleration time during regenerative braking, preventing overvoltage during quick deceleration.	VdcMax, overvoltage stall suppression, overvoltage control
	Undervoltage suppression	Used to reduce the motor speed automatically upon power dip to prevent bus undervoltage. After the power grid is recovered, nomral operation applies again. In long-term power failure, you can enable undervoltage suppression to allow the motor to stop properly, preventing the motor from coasting.	Power dip ride-through, power dip suppression, VdcMin, undervoltage stall suppression, undervoltage control

Function	Name	Description	Alias
Basic control	Over-excitation	The excitation current is automatically increased during deceleration, which increases the energy loss. The overvoltage during deceleration can be reduced and the motor can decelerate faster.	Flux braking
	Speed tracking	In V/f and SVC modes, a rotating motor can be started only after the motor speed is tracked before start. The speed tracking algorithm can estimate the motor speed upon start to allow bumpless start.	Flying start, restart at rotating
	Energy-saving control	In energy-saving control of the asynchronous motor, the output voltage is adjusted automatically based on the magnitude of the load to achieve the energy-saving effect by reducing the output current.	Efficiency optimization
	Back EMF	When the motor is being driven to operate at rated speed without load, the effective voltage on the output cables (UV/VW/WU) is the rated back EMF of the motor.	-
	No-load current	During no-load operation in the non-field weakening range of the asynchronous motor in V/f mode, the output excitation current is the no-load current.	-
	Mutual inductance	Indicates the main flux that can be generated per unit current and the conductivity of the magnetic circuit between the stator and the rotor.	-
	Inertia ratio	Indicates the inertia reference value for internal calculation of the motor (Inertia ratio = Auto-tuned inertia/Inertia reference value).	-
	Number of motor pole pairs	Determined by the internal structure of the motor. The higher the number of poles, the higher the output torque, and the lower the mechanical speed can be.	-
	Rated motor slip	Indicates the deviation between the actual rotor frequency output and the reference frequency during operation of asynchronous motors with rated load.	-
	Current Loop	Used to keep the feedback current be consistent with the current reference through different model control to ensure dynamic responsiveness.	-
	Speed loop	Used to keep the motor speed feedback be consistent with the speed reference to meet the requirements for speed control.	-

Function	Name	Description	Alias
Parameter auto-tuning	Parameter auto-tuning	Used to auto-tune motor parameters (such as motor resistance and inductance) in vector control to establish accurate mathematical model for calculating the magnetic flux, torque, and speed of the motor. Parameter auto-tuning must be performed for FVC/SVC control. It is also recommended to perform parameter auto-tuning in V/f control to obtain better performance.	Auto-tuning, motor data auto-tuning
	Static auto-tuning	In static auto-tuning, the motor does not need to rotate or disconnected from the load.	-
	Dynamic auto-tuning	In dynamic auto-tuning, the motor must rotate and be disconnected from the load.	-
	With-load auto-tuning	In with-load auto-tuning, the motor can be connected to the load and the motor may rotate during auto-tuning.	-
	Magnetic pole position auto-tuning	Before starting the motor, perform magnetic pole position auto-tuning because a motor that connected to the load can be started properly only with an accurate field position.	Phase searching and magnetic pole position auto-tuning
	Stator resistance, per-unit value of rotor resistance	The standard per-unit value is generally a percentage value. The actual motor parameters can be calculated through the reference value. Per-unit reference value of the resistor = Rated motor voltage/(1.732 x Rated current) in Ω. Actual resistance value = Per-unit value of the resistor x Reference value of the resistor.	-
	Leakage inductance, mutual inductance, and Ld/Lq inductance per-unit value	The standard per-unit value is generally a percentage. The actual motor parameters can be calculated through the reference value. Per-unit reference value of inductance = Per-unit reference value of the resistor /(2 x pi x rated frequency) in units of H. Actual inductance value = Per-unit inductance x Reference value of the resistor.	-

Description of Data Flow Diagram





Set values through parameters.



This parameter stores a 16-bit or 32-bit value, which can be read by other parameters through address.



This parameter stores a bit value (0 or 1), which can be read by other parameters through address.



Read the value of another parameter (16- or 32-bit) through the parameter address.



Read the value of another parameter (one bit) through the parameter address.



If EXT1 is active, the value is set by parameter 1.



If EXT2 is active, the value is set by parameter 2.



Read a 16- or 32-bit value through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.



Read a bit value (0 or 1) through the parameter address.
If EXT1 is active, the value is set by parameter 1.
If EXT2 is active, the value is set by parameter 2.



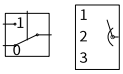
Calculate the differential



Calculate the integral



PID regulator



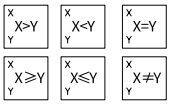
Selection switch. Select one output from several inputs based on the condition



Logic AND/OR/XOR



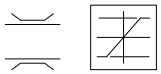
Logic NOT/OR/XOR



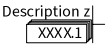
Compare the two input values



Select the maximum/minimum value



Limit the input value





Current motor and motor control parameters.
Four groups of parameters corresponding to different motors can be set.
Current motor data is selected through MDS1/2.



Read a 16- or 32-bit value through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2,
corresponding to current motor control parameters.



Read a bit value (0 or 1) through the parameter address.
4 groups of motors can be set separately.
Current motor data is selected through MDS1/2,
corresponding to current motor control parameters.



Low-pass filter



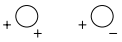
High-pass filter
with integral of small inertial element



Low-pass filter. When the input signal increases or decreases, it has different time constants.



Rate of change of the input signal is limited, with a rise time of 1/T.



Add/subtract the input value



Multiply the input value



Divide the input value(x/y)



Absolute value of signed values



Opposite to the signed values



Set dead zone. When the input value is in the dead zone, the output is always 0.



Enable delay, delay occurs when in the rising edge (0->1).



Disable delay, delay occurs when in the falling edge (1->0).



Bi-directional delay, delay occurs when the level changes.



Delay the input signal by one pulse.

1 Fundamental Safety Instructions

1.1 Safety Precautions

Safety Disclaimer

- This chapter presents essential safety instructions for a proper use of the equipment. Before operating the equipment, read through the guide and comprehend all the safety instructions. Failure to comply with the safety precautions may result in death, serious injury, or equipment damage.
- "CAUTION", "WARNING", and "DANGER" items in the guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements; otherwise, a fault may occur. Malfunction or damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper use.

Safety levels and definitions



Indicates that failure to comply with the notice will result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in severe personal injuries or even death.



Indicates that failure to comply with the notice may result in minor or moderate personal injuries or equipment damage.

General Safety Instructions

- Drawings in the guide are sometimes shown without covers or protective guards. Remember to install the covers or protective guards as specified first, and then perform operations in accordance with the instructions.
- The drawings in the guide are shown for illustration only and may be different from the product you purchased.
- Operators must take mechanical precautions to protect personal safety and wear protective equipment, such as anti-smashing shoes, safety clothing, safety glasses, protective gloves, and protective sleeves.

Unpacking
 • Do not install the equipment if you find damage, rust, or signs of use on the equipment or accessories upon unpacking. • Do not install the equipment if you find water seepage or missing or damaged components upon unpacking. • Do not install the equipment if you find the packing list does not conform to the equipment you received.
 • Check whether the packing is intact and whether there is damage, water seepage, dampness, and deformation before unpacking. • Unpack the package in sequence. Do not hit the package violently. • Check whether there is damage, rust, or injuries on the surface of the equipment and equipment accessories before unpacking. • Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation
 • Large-scale or heavy equipment must be handled by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injury or equipment damage. • Before hoisting the equipment, ensure the equipment components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage. • Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment. • When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.
 • Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage. • When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries. • Store and transport the equipment based on the storage and transportation requirements. Failure to comply may result in equipment damage. • Do not store or transport the drive in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration. • Do not store the drive for more than three months. Long-term storage requires stricter protection and necessary inspections. • Pack the drive strictly before transportation. Use a sealed box for long-distance transportation. • Never transport the equipment with other device or materials that may harm or have negative impacts on the equipment.

Installation
DANGER . The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.
WARNING . Read through the guide and safety instructions before installation. . Do not install the equipment in places with strong electric or magnetic fields. . Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply will result in mechanical hazards. . Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock. . When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire. . Do not retrofit the equipment. . Do not fiddle with the bolts used to fix equipment components or the bolts marked in red. . When the equipment is installed in a cabinet or final assembly, a fireproof enclosure providing both electrical and mechanical protections must be provided. The IP rating must meet IEC standards and local laws and regulations. . Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction. . Install the equipment onto an incombustible object such as a metal. Keep the equipment away from combustible objects. Failure to comply will result in a fire.
CAUTION . Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on the top of the equipment to prevent over-temperature caused by poor ventilation due to blocked ventilation holes. . Resonance may occur when the equipment operating at a constant speed switches to variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

Wiring
DANGER . Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals. . Before wiring, cut off all the power supplies of the equipment. and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply can result in an electric shock. . Do not perform wiring, remove the equipment cover, or touch the circuit board with power on. Failure to comply can result in an electric shock. . Check that the equipment is grounded properly. Failure to comply can result in electric shock.
WARNING . Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire. . When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation. . Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end. . Tighten the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may result in overheat, damage to the connecting parts, or a fire. . After wiring is done, check that all cables are connected properly and no screws, washers or exposed cables are left inside the equipment. Failure to comply may result in electric shock or equipment damage.
CAUTION . Follow the proper electrostatic discharge (ESD) procedure and wear an anti-static wrist strap to perform wiring. Failure to comply may result in damage to the equipment or to the internal circuit of the product. . Use shielded twisted pairs for the control circuit. Connect the shield to the grounding terminal of the equipment for grounding purpose. Failure to comply will result in equipment malfunction.

Power-on
DANGER . Before power-on, check that the equipment is installed and wired properly and the motor can be restarted. . Check that the power supply meets equipment requirements before power-on to prevent equipment damage or a fire. . After power-on, do not open the cabinet door or protective cover of the equipment, touch any terminal, or disassemble any unit or component of the equipment. Failure to comply will result in an electric shock.
WARNING . Perform a trial run after wiring and parameter setting to ensure the equipment operates safely. Failure to comply may result in personal injuries or equipment damage. . Before power-on, check that the rated voltage of the equipment is consistent with that of the power supply. Failure to comply may result in a fire. . Before power-on, check that no one is near the equipment, motor, or machine. Failure to comply may result in death or personal injuries.

Operation
 . The equipment must be operated only by professionals. Failure to comply will result in death or personal injury. . Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply will result in an electric shock.
 . Do not touch the equipment enclosure, fan, or resistor with bare hands. Failure to comply may result in personal injury. . During operation, prevent metal or other objects from falling into the equipment. Failure to comply may result in a fire or equipment damage.

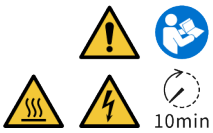
Maintenance
 . Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals. . Do not maintain the equipment with power ON. Failure to comply will result in an electric shock. . Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label. . In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.
 . Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair
 . Equipment installation, wiring, maintenance, inspection, or component replacement must be performed only by professionals. . Do not repair the equipment with power ON. Failure to comply can result in an electric shock. . Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
 . Submit the repair request according to the warranty agreement. . When the fuse is blown or the circuit breaker or earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal injuries or equipment damage. . When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record. . Replace quick-wear parts of the equipment according to the replacement instructions. . Do not use damaged equipment. Failure to comply may result in death, personal injuries, or severe equipment damage. . After the equipment is replaced, check the wiring and set parameters again.

Disposal
WARNING • Dispose of retired equipment in accordance with local regulations and standards. Failure to comply may result in property damage, personal injury, or even death. • Recycle retired equipment in accordance with industry waste disposal standards to avoid environmental pollution.

Safety Label

For safe operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the meaning of the safety labels.

Safety Label	Description
	• Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. • Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result in an electric shock.

1.2 Industrial Information Security

This product provides an interface to connect to the network and transmit data through the network interface. To protect factories, systems, machines, and networks from cyber attacks, appropriate industrial information security protection mechanisms need to be implemented to ensure the safe operation of factories, systems, machines, and networks.

The customer is responsible for providing and continuously ensuring a secure connection between the product and the customer's network or any other network, to prevent unauthorized access to their factory, systems, machines, and networks. The system or machine may only be connected to the corporate network or the Internet when a secure connection is established and proper security measures are in place (for example, using antivirus software and installing firewalls).

INOVANCE continuously develops and improves its products and solutions to enhance safety. It is strongly recommended that you update your products promptly and always use the latest product versions.

Caution

Malware (such as viruses, Trojans, and worms) can bring the device into an unsafe operating state, resulting in death, serious injury, and property damage. Observe the following precautions strictly:

- Always use the latest software version. If the product version is no longer supported or the latest program version is not applied, customers are at increased risk of cyberattacks.
- Implement and maintain appropriate security measures (including but not limited to deploying anti-virus software, firewall, WAF, IPS/IDS, situational awareness system, ID verification, and data encryption) to prevent files in the removable storage device from being damaged by malware and to protect products, networks, systems, and interfaces from unauthorized access, disruption, intrusion, data leakage, or information theft.
- Check all safety-related interfaces and settings after commissioning.

2 Hardware Description

2.1 Components

The distributed drive consists of the electrical module and drive module. The drive versions are divided into gland version and heavy-duty quick connector version based on the power terminals of the drive module.

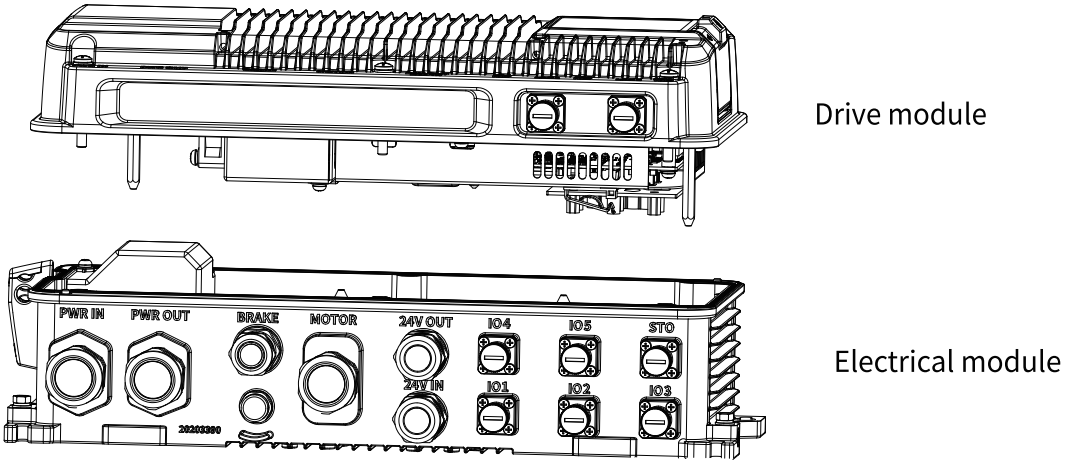


Figure 2-1 Drive assembly (gland version)

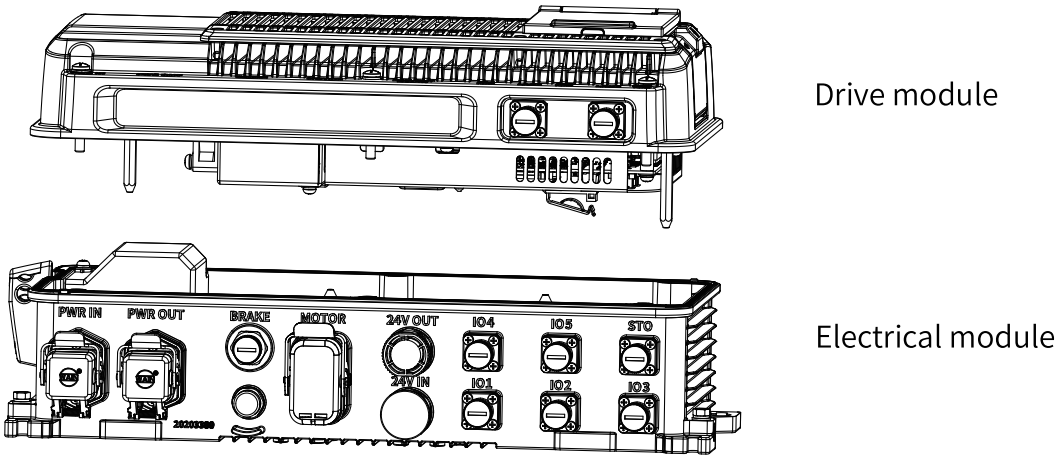


Figure 2-2 Drive assembly (Heavy-duty quick connector version)

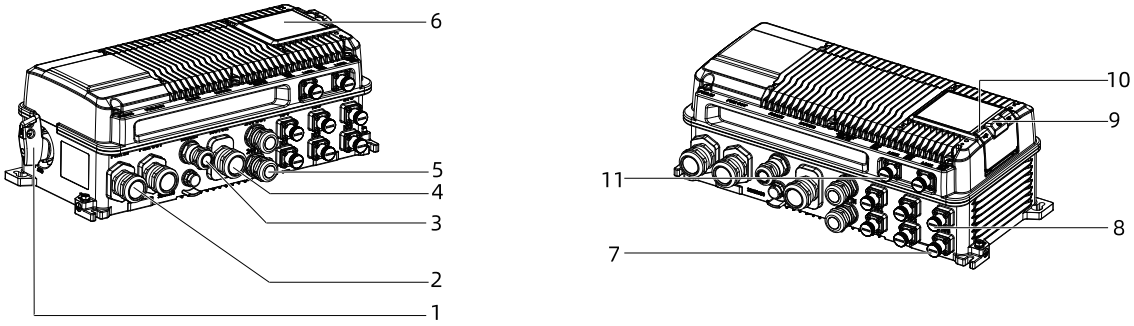


Figure 2-3 Drive components (gland version)

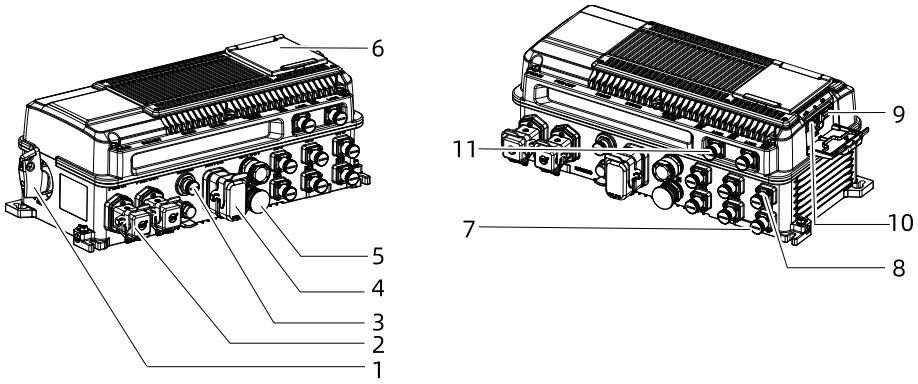


Figure 2-4 Drive components (heavy-duty quick connector version)

Table 2–1 Components

No.	Name	Description	Reference
1	Maintenance switch	Maintenance switch of the main power supply of the drive, which can be padlocked or turned to the "OFF" setting to disconnect the main power supply.	-
2	Main power supply terminal	Input power supply terminals of the drive, which are connected to the input cables and cascaded output cables	See details in *"4.6.1 Descriptions of Main Circuit Terminals" on page 65*
3	Braking terminal	External braking resistor terminal (used when the braking capacity of the built-in braking resistor is insufficient)	
4	Motor terminal	Wiring terminals of the motor, which include brake control cable and motor temperature sensor cable	
5	24 V interface	24 V terminal of the control power supply of the drive, which is connected to the input cable and cascaded output cable	See details in *"4.7.1 Control Circuit Terminals" on page 74*.
6	LED display unit	Indicators for the power supply, I/O, communication, operation, and fault, which locate in the display and operation area of the operating panel	See details in *"4.7.3 Wiring of STO Terminals" on page 80* and *" Display and Operation" on page 103*
7	I/O terminals	I/O signals for the control signals	See details in *"4.7.1 Control Circuit Terminals" on page 74* and *"4.7.3 Wiring of STO Terminals" on page 80*
8	STO terminal	STO function control signal input	See details in *"4.7.1 Control Circuit Terminals" on page 74* and *"4.7.3 Wiring of STO Terminals" on page 80*
9	SD card interface	SD card interface	See details in *"4.7.1 Control Circuit Terminals" on page 74*
10	Type-C interface	USB - Type-C commissioning interface	
11	EtherNet cable interface	EtherNet communication interface	See details in *"4.7.1 Control Circuit Terminals" on page 74* and *" Communication Connection" on page 85*

2.2 Model and Nameplate

Model description

Description of **DT60N-4T1R6QB1** as example

DT60	**Name** DT60: Distributed AC drive series
N	**Network configuration** N: Network type, with PROFINET and EtherNet/IP supported
4T	**Voltage class** 4T: Three-phase 380 V to 480 V
1R6	**Rated current** 1R6: 1.6 A 2R4: 2.4 A ... 6R0: 6.0 A Note: The rated current is configured based on heavy-duty models, which is composed of two digits and one letter. The letter R represents the decimal point ".".
Q	**Power terminal type** H: Gland Q: Heavy-duty quick connector
B1	**Brake configuration** B0: 180 VDC output brake function supported B1: 380 VAC output brake function supported

Nameplate description

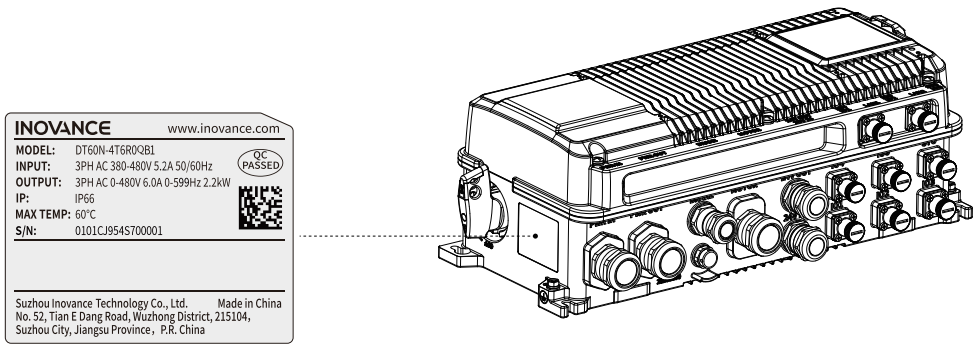


Figure 2-5 Product nameplate

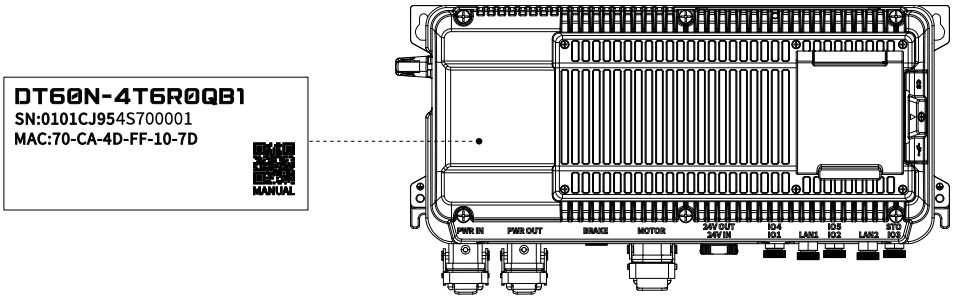


Figure 2-6 Laser MAC address

Description of serial number

0101CJ95 ① 4 ② S ③ 7 ④ 00001 ⑤

①	**Internal code** Material code	④	**Month** 1: January 2: February 3: March ... A: October C: December
②	**Manufacturer code** 4: Suzhou Inovance	⑤	**Lot number** 00001: First 00002: Second 00003: Third ... Range: 00001 to 99999
③	**Year** S: 2024 T: 2025 U: 2026 V: 2027 W: 2028 X: 2029 Y: 2030 Note: I/L/O/Q is not used.	-	

2.3 Product Model List

See the mapping relationship between the product model and structure in the following table.

Table 2–2 Relationship between product structures and models

Model	Structure	Model	Power (kW)	Output current (A)	Input current (A)	Power capacity (kVA) under 400 V power grid	Power capacity (kVA) under 480 V power grid
T1	Power terminal: Gland, 380 VAC brake output	DT60N-4T1R6HB1	0.37	1.6	1.2	0.9	1.1
		DT60N-4T2R0HB1	0.55	2	1.6	1.2	1.5
		DT60N-4T2R4HB1	0.75	2.4	2	1.5	1.8
		DT60N-4T3R1HB1	1.1	3.1	2.5	1.9	2.3
		DT60N-4T4R1HB1	1.5	4.1	3.3	2.5	3.0
		DT60N-4T6R0HB1	2.2	6	5.2	4.0	4.8
	Power terminal: Gland, 180 VDC brake output	DT60N-4T1R6HB0	0.37	1.6	1.2	0.9	1.1
		DT60N-4T2R0HB0	0.55	2	1.6	1.2	1.5
		DT60N-4T2R4HB0	0.75	2.4	2	1.5	1.8
		DT60N-4T3R1HB0	1.1	3.1	2.5	1.9	2.3
		DT60N-4T4R1HB0	1.5	4.1	3.3	2.5	3.0
		DT60N-4T6R0HB0	2.2	6	5.2	4.0	4.8
	Power terminal: Heavy-duty, 380 VAC brake output	DT60N-4T1R6QB1	0.37	1.6	1.2	0.9	1.1
		DT60N-4T2R0QB1	0.55	2	1.6	1.2	1.5
		DT60N-4T2R4QB1	0.75	2.4	2	1.5	1.8
		DT60N-4T3R1QB1	1.1	3.1	2.5	1.9	2.3
		DT60N-4T4R1QB1	1.5	4.1	3.3	2.5	3.0
		DT60N-4T6R0QB1	2.2	6	5.2	4.0	4.8
	Power terminal: Heavy-duty, 180 VDC brake output	DT60N-4T1R6QB0	0.37	1.6	1.2	0.9	1.1
		DT60N-4T2R0QB0	0.55	2	1.6	1.2	1.5
		DT60N-4T2R4QB0	0.75	2.4	2	1.5	1.8
		DT60N-4T3R1QB0	1.1	3.1	2.5	1.9	2.3
		DT60N-4T4R1QB0	1.5	4.1	3.3	2.5	3.0
		DT60N-4T6R0QB0	2.2	6	5.2	4.0	4.8

3 Mechanical Design

3.1 Requirements for Extending Device Service Life

In the following environmental conditions, the service life of the drive is 10 years, which is an estimated value based on the specified operating conditions and is not a guaranteed value, as the actual service life of the drive may be shortened due to harsh installation environments and operating conditions.

- Ambient temperature: Annual average 30°C
- Load rate: 80% of rated load, S3 duty cycle - 50% load time;
- Operating time: 24-hour continuous operation per day;
- Other factors: humidity lower than 95% RH without condensation; no conductive dust, oil, salt mist, or halogen-containing corrosive gases; balanced three-phase power supply voltage; no other capacitive load switchover on the same power grid

When the following harsh conditions exist, the internal temperature of the drive can rise, leading to a shortened service life of the drive.

- Excessively high ambient operating temperature; dust or fibrous materials blocking the cooling fins;
- Excessively high output current, frequent overload, or frequent excessive load fluctuation;
- Excessive product service life, natural lifespan degradation, components worn-out
- Conductive dust, oil, salt mist, or halogen-containing corrosive gases can cause premature component failure. Unbalanced grid voltage may lead to abnormal and excessive bus voltage fluctuation.

To extend the service life of the drive, the following measures are recommended.

- Reduce ambient temperature (such as installing air conditioner in the machine room), regularly clean the cooling fins on the device surface, and improve the heat dissipation design on site.
- For applications with excessive loads or frequent overload, it is recommended to replace with a drive of higher power rating.
- For drives used beyond their intended lifespan, to prevent unexpected damage and unnecessary shutdown, it is recommended to perform maintenance in advance or replace the drive. For details, contact Inovance.
- Enhance external environmental protection to reduce the impact of harsh environments on the drive. If three-phase power supply unbalance exists on site, premature drive failure may occur. Therefore, it is recommended to install an input AC reactor.

3.2 Environmental Requirements

3.2.1 Standard Environmental Resistance Requirements

Standard environmental resistance requirements include standards and requirements for transport of drives with packaging, installation and operation of drives, and long-term storage of drives with packaging. The following table lists standards and specifications for the drive, violation of which

can affect the device service life or result in faults. Make sure that the following standards and requirements are met.

Item	Specifications
Environmental conditions during Transport with packaging	
Ambient temperature	Temperature: -25°C to +70°C
	Relative humidity: < 95% RH, without condensation Compliant with IEC60721-3-2 2K1 (GB/T 4798.2 2K1)
Mechanical environmental requirements	Vibration resistance: 5 Hz to 200 Hz, 1.5 g; Compliant with EN 60721-3-3 standard 3M4 class
	Shock: Half-sine wave; 25 g/6 ms: 1000 shocks per direction
Protection requirement	Harmful chemical prevention: 3C2; Compliant with IEC60721-3-2 3C2 (GB/T 4798.2 3C2)
	Mechanically active substance: 3S2; Complies with IEC60721-3-2 3S2 (GB/T 4798.2 3S2)
Environmental conditions during installation and operation	
Ambient temperature	Temperature: -20°C to +60°C (For temperatures above 50°C, derate 5% for every additional 1°C.)
	Relative humidity: <95% RH, without condensation
Installation altitude	For altitude equal to or below 1000 m, derating is not required. For altitudes above 1000 m, derate 1% for every additional 100 m. For altitudes above 3500 m, contact Inovance.
Mechanical environmental requirements	Vibration resistance: 5.0 Hz to 10.3 Hz, 3.5 mmp; 10.3 Hz to 200.0 Hz, 1.5 g, 10 cycles per axial direction Complies with IEC60721-3-3 3M4 (GB/T 4798.3 3M4)
Overvoltage category of the power grid	OVC III
Protection requirement	Harmful chemical prevention: 3C2; Compliant with IEC60721-3-2 3C2 (GB/T 4798.2 3C2)
	Mechanically active substance: 3S2; Complies with IEC60721-3-2 3S2 (GB/T 4798.2 3S2)
Environmental conditions for long-term storage with packaging	
Ambient temperature	Temperature: -25°C to +55°C
	Relative humidity: <95% RH, without condensation; Compliant with IEC60721-1-1 1K4 (GB/T 4798.1 1K4)
Protection requirement	Harmful chemical prevention: 1C2 In areas with corrosive gases, the maximum relative humidity cannot exceed 60%. Compliant with IEC60721-1-11C2 (GB/T 4798.1 1C2)
	Mechanically active substance: 1S2 Complies with IEC60721-1-1 1S2 (GB/T 4798.1 1S2)

3.2.2 Reliability Design for Special Environmental Conditions

Standards and requirements for special environments with high temperature, low temperature, vibration, or greasy dirt are shown below.

Temperature

Use the drive within the temperature range specified in *"3.2.1 Standard Environmental Resistance Requirements" on page 39*. If the specified temperature range is exceeded, the service life of electronic components can be significantly shortened. Therefore, take the following measures to keep the drive temperature within the specified range.

Measures against high temperature:

- Install the drive in a production hall with temperature adjustable.
- Use forced ventilation in the production hall.
- Minimize the installation of multiple inverters closely side by side. If unavoidable, see guidelines in *"3.4.2.3 Installation Space" on page 46* for installation.

Measures against low temperature:

- Do not disconnect the drive power supply to avoid starting after prolonged exposure to low temperatures without power.

Rapid temperature change:

- Install the drive in a production hall with temperature adjustable.
- Keep the drive away from high-power devices that generate heat during operation.

Humidity (condensation)

Use the drive within the humidity range specified in *"3.2.1 Standard Environmental Resistance Requirements" on page 39*. Excessive humidity may cause corrosion and reduced insulation performance.

Measures against high humidity:

- Install the drive in a production hall with temperature adjustable.
- Keep the drive away from devices that generate water mist.

Condensation

Rapid changes in the ambient temperature may cause condensation. Condensation may lead to reduced insulation or rusting.

Countermeasures:

- Take the preceding measures against high humidity.
- Do not disconnect the drive power supply to avoid starting after prolonged exposure to low temperatures without power.
- In environments with condensation and high humidity, it is recommended to start the heater for at least half an hour before powering on a drive that have been idled for a long time, preventing damage to the drive caused by condensation.

Airborne dust

Dust can result in poor contact at contact points. Accumulated dust can absorb humidity, which degrades the insulation performance and cooling effect. The dust accumulation in the cooling fins

can lead to temperature rise inside the drive. In addition, environments with floating conductive powder can cause malfunction, insulation aging, or short circuit within a short period of time.

Countermeasures:

- Regularly clean dust accumulated on the device surface.
- Minimize the frequency of device disassembly.
- Purify the air around the drive.

Corrosive liquids

Corrosive liquids adhering to high-voltage positions may induce tracking and creepage discharge. Certain alkaline solutions may cause surface corrosion of equipment and stress cracking of non-metallic materials.

Countermeasures:

- Minimize the frequency of device disassembly.
- Pay attention to sealing at the equipment outlet holes during installation.

Corrosive gases

Corrosive gases can easily corrode PCBA, connectors, and metal structural parts, and may cause sulfidation corrosion of surface-mounted resistors.

Countermeasures:

- It is recommended to install electrical products in an indoor environment with temperature and humidity control, and where indoor and outdoor air does not circulate.

Settled dust

Dust can block the cooling fins of the drive, leading to overtemperature or shortening the service life of power components.

Countermeasures:

- Install filters at the intake vents in the production hall, and regularly clean the device surface.

Conductive fibers

Conductive fiber-like substances may cause electrical short circuit at exposed high-voltage parts of the product.

Countermeasures:

- Install filters at the intake vents in the production hall and clean them regularly.
- Use a vacuum cleaner for routine device maintenance. Do not use an air gun to blow dust off the device.

Conductive powder

Conductive powder may accumulate on exposed high-voltage parts, causing electrical short circuit.

Countermeasures:

- Use drive with high protection ratings. Contact Inovance for details.
- Clean the device surface regularly.
- Minimize the frequency of device disassembly.

Vibration/Shock

Use the drive within the vibration level range specified in *"3.2.1 Standard Environmental Resistance Requirements" on page 39*. Exceeding the vibration range may cause loosening of structural parts, poor contact of the connector, and detachment of large components. Pay special attention in environments with continuous shocks.

3.3 Product Dimensions

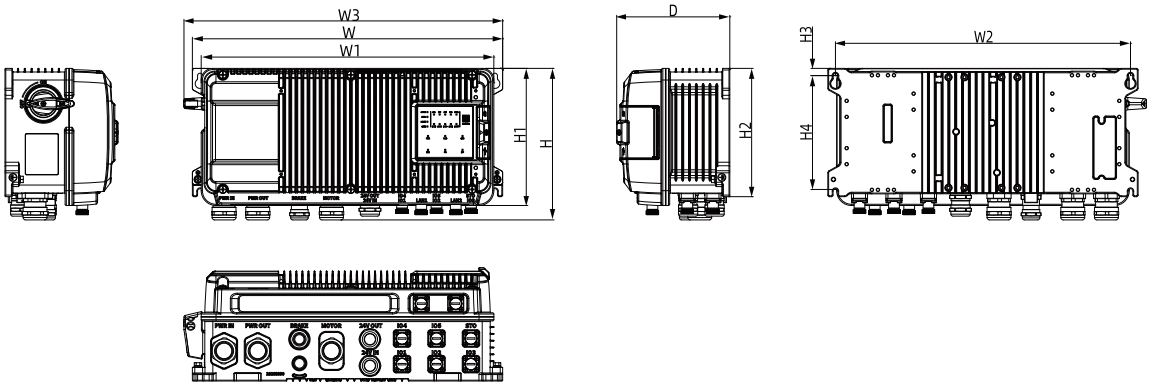


Figure 3-1 Dimensions of T1 models (0.37 kW to 2.2 kW) (gland version)

Table 3–1 Outline and mounting hole dimensions of T1 models (0.37 kW to 2.2 kW) (gland version)

Structure	Mounting hole mm (in.)			Outline dimension mm (in.)							Mounting hole diameter mm (in.)	Weight (Net weight) kg (lb)	Weight (Gross weight) kg (lb)
	W2	H3	H4	W	W1	W3	H1	H2	H	D			
T1 (0.37 kW to 2.2 kW)	368 (14.49)	9 (0.354)	144 (5.67)	387 (15.24)	365 (14.37)	397.5 (15.65)	171 (6.73)	160 (6.3)	189 (7.44)	141.2 (5.77)	Φ6 (0.24)	7.5	8.5

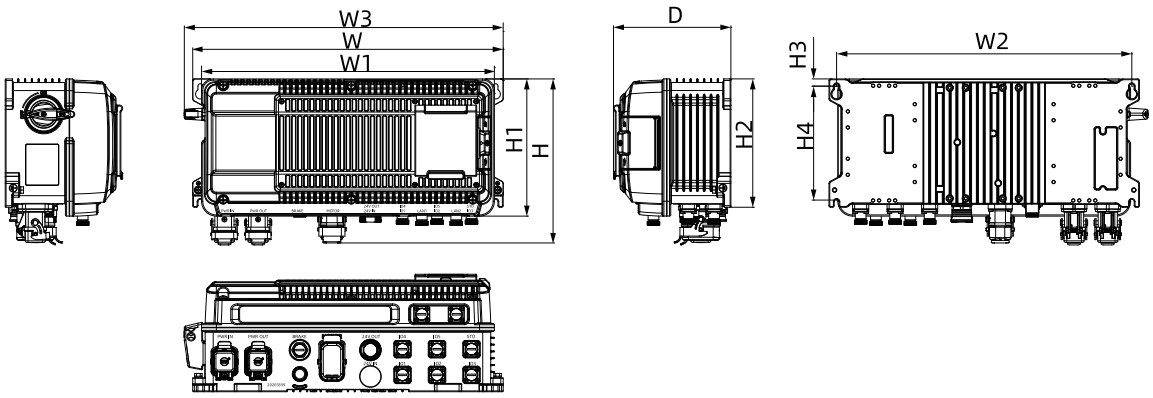


Figure 3-2 Dimensions of T1 models (0.37 kW to 2.2 kW) (heavy-duty quick connector version)

Table 3–2 Outline and mounting hole dimensions of T1 models (0.37 kW to 2.2 kW) (heavy-duty quick connector version)

Structure	Mounting hole mm (in.)			Outline dimension mm (in.)							**Mounting hole diameter mm (in.)**	Weight (Net weight) kg (lb)	Weight (Gross weight) kg (lb)
	W2	H3	H4	W	W1	W3	H1	H2	H	D			
T1 (0.37 kW to 2.2 kW)	368 (14.49)	9 (0.354)	144 (5.67)	387 (15.24)	365 (14.37)	397.5 (15.65)	171 (6.73)	160 (6.3)	204.4(8.05)	146.5(5.77)	Φ6 (0.24)	7.5	8.5

3.4 Installation Description

3.4.1 Safety Precautions

The equipment must be operated only by professionals with electrical knowledge.

Warning

- Thoroughly read the safety instructions and user guide before installation.
- Do not install this equipment in places with strong electric or magnetic fields.
- Before installation, check that the mechanical strength of the installation site can bear the weight of the equipment. Failure to comply can result in mechanical hazards.
- Do not wear loose clothes or accessories during installation. Failure to comply may result in electric shock.
- When installing the equipment in a closed environment (such as a cabinet or casing), use a cooling device (such as a fan or air conditioner) to cool the environment down to the required temperature. Failure to comply may result in equipment over-temperature or a fire.
- Do not modify this equipment.
- Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- When the equipment is installed in a cabinet or a terminal device, an protective enclosure against file, electrical disturbance, and mechanical damage must be provided. The IP rating must meet IEC standards and local laws and regulations.
- Before installing devices with strong electromagnetic interference, such as a transformer, install a shielding device for the equipment to prevent malfunction.
- Install the equipment on an incombustible object such as metal and do not touch or attach the equipment to combustibles. Failure to comply can result in fire.
- Cover the top of the equipment with a piece of cloth or paper during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from falling into the equipment and causing faults. After installation, remove the cloth or paper on top of the equipment. Failure to comply can block ventilation holes, resulting in over-temperature caused by poor ventilation.
- Resonance may occur when the equipment operating at a constant speed switches to variable speed operations. In this case, install the vibration-proof rubber under the motor frame or use the vibration suppression function to reduce resonance.

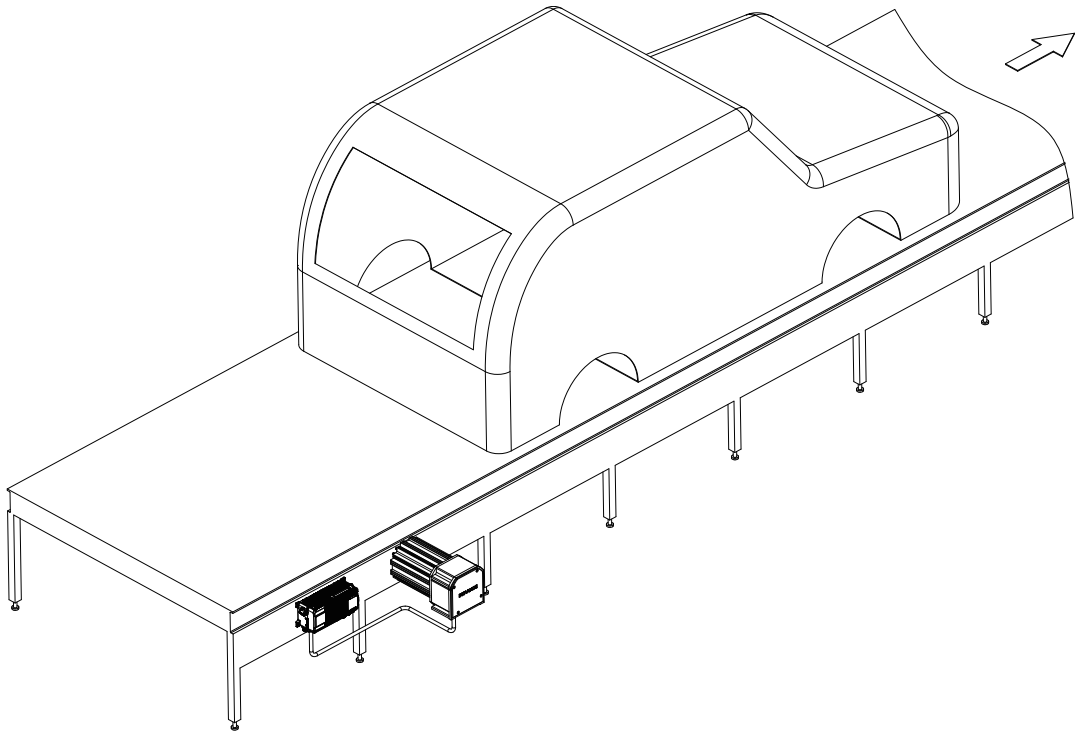
3.4.2 Installation Method

3.4.2.1 Installation method

Table 3–3 List of installation methods

Rated voltage (V)	Structure (kW)	Installation method		
		Backplate mounting	Through-hole mounting	Rail mounting
380	T1 (0.37 to 2.2)	Yes	-	-

3.4.2.2 Recommended Installation Layout



3.4.2.3 Installation Space

Reserve sufficient clearance according to the power rating of the drive.

- Installing one drive

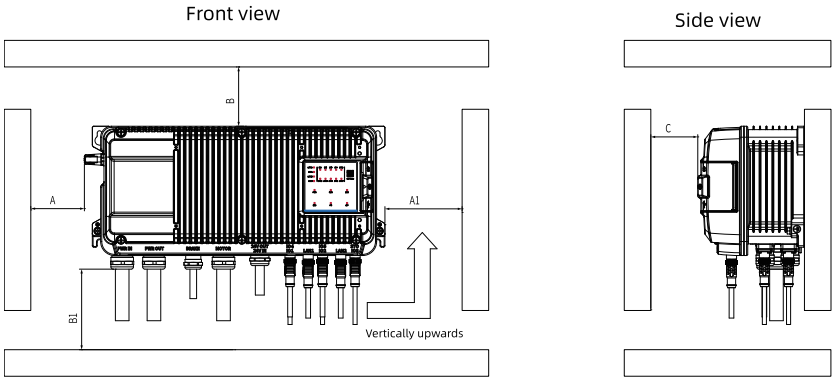


Figure 3-3 Installation space for an individual drive (gland version)

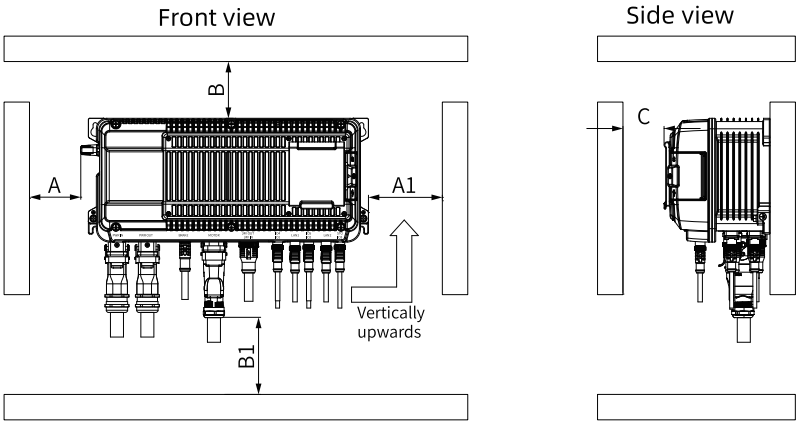


Figure 3-4 Installation space for an individual drive (heavy-duty version)

Table 3–4 Installation clearance

Power rating	Clearance (mm)				
0.37 kW to 2.2 kW	A ≥ 150	A1 ≥ 150	B ≥ 100	B1 ≥ 180	C ≥ 100

Note

The distance between the air inlet and outlet of the AC drive is revered according to the extreme operating conditions. If the distance required by customers is lower than the recommended value, contact Inovance for details.

- Multi-drive installation

  The drive dissipates heat from bottom to top. When multiple drives need to work together, install them side by side. Keep their tops level with each other, especially for those of different sizes.

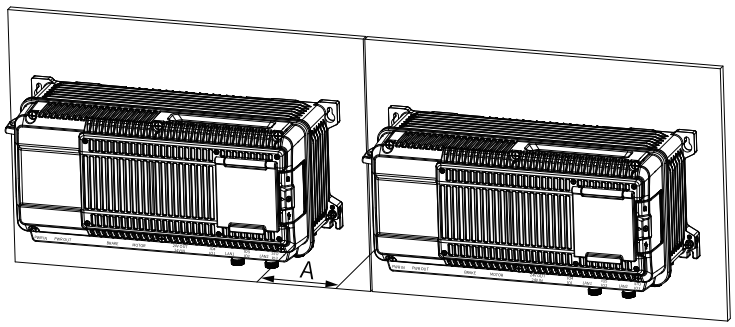


Figure 3-5 Installing multiple drives side by side

Table 3–5 Installation clearance

Power rating	Clearance (mm)
0.37 kW to 2.2 kW	A ≥ 200

Note

The distance between the air inlet and outlet of the drive is designed according to the extreme operating conditions. If the distance required by customers is shorter than the recommended, contact Inovance.

3.4.2.4 Thermal Protection Design

To prevent burns, the main heat dissipation area of the drive module is equipped with a heat-resistant bracket, preventing direct touch with the metal area on the lid that dissipates heat when you open the operating panel cover.

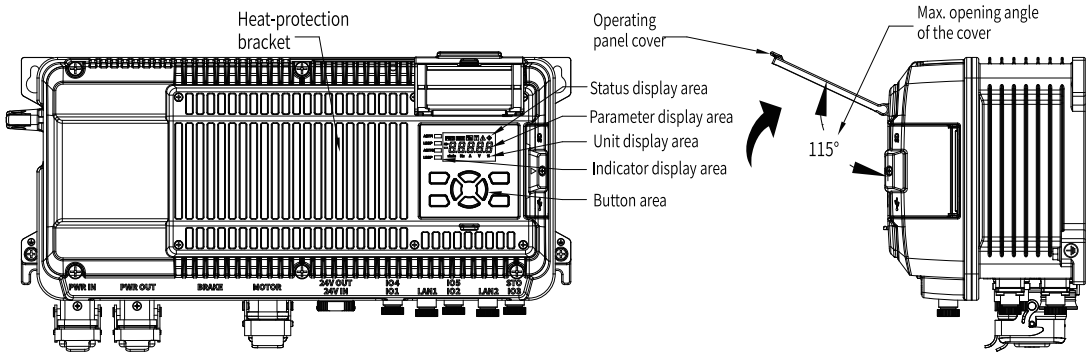


Figure 3-6 Heat-resistant operation

3.4.3 Installation Direction

Warning

- Incorrect installation direction may cause overtemperature alarm or damage.
- Install the AC drive upright, as shown in the following figure. Do not lie the AC drive on its back or side, or install it in the upside-down direction.

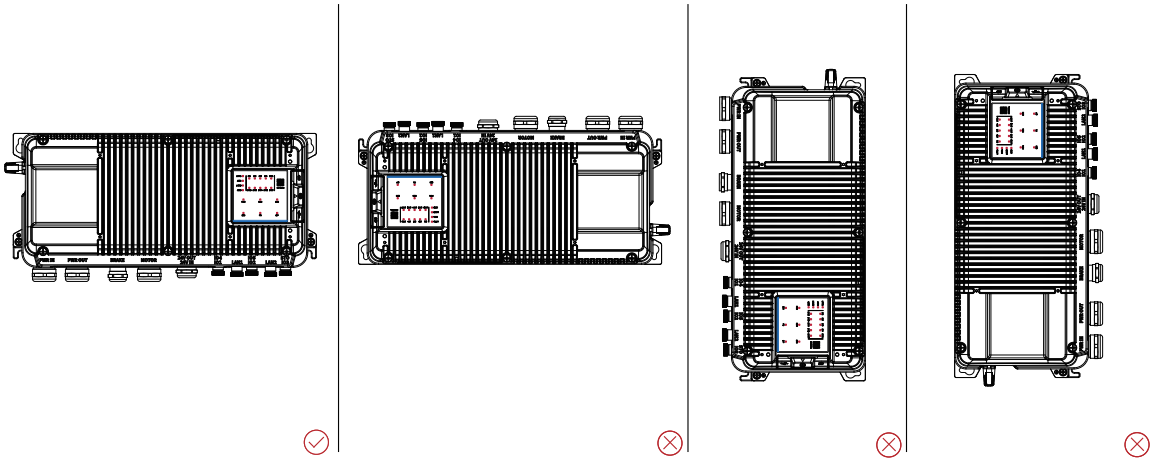


Figure 3-7 Installation direction

3.4.4 Installation Tools

Table 3–6 Mechanical installation tools

Tool	Description	Illustration
Electric drill and drilling bit	Used to drill mounting holes on the mounting surface.	
Phillips screwdriver	Used to tighten or loosen screws. For screwdriver models corresponding to different power ratings, see Table 2-4.	
Straight screwdriver	Used to disassemble the top cover and the knock-out holes.	
Tape measure	Used to measure the mounting dimensions of the equipment.	
Gloves	Used to prevent static electricity.	
Torque wrench	Used to verify the torque during installation.	
Socket wrench	Used to adapt to different bolt models.	
Extension bar	Used to operate a torque wrench in narrow spaces.	

In backplate mounting, the screw specifications required for installing the drive with screws are shown in the table below.

Table 3–7 Specifications of the screw and screwdriver

Structure	Power rating (kW)	Screwdriver model	Spec. and qty of screw	Tightening torque (N•m)
T1	0.37 to 2.2	Phillips slot PH2	Four M5 SEMS screws	2.8

3.5 Installation Accessories

Connector sealing plug

Connector sealing plugs can protect unused terminals. Select the appropriate plug model based on the actual type of unused terminal.

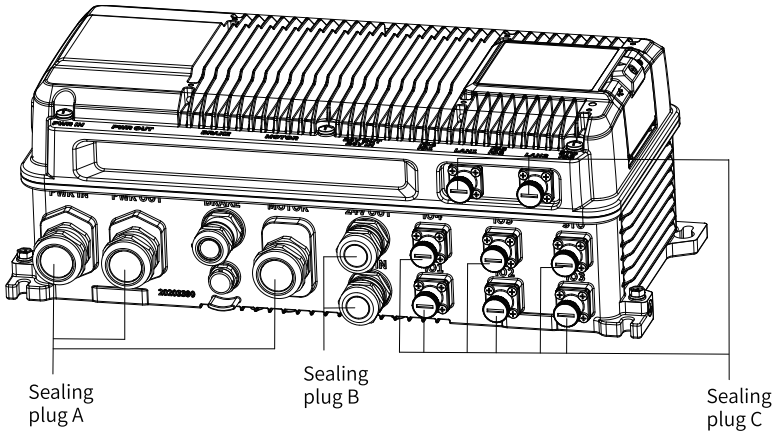
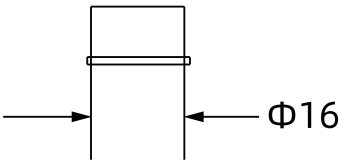
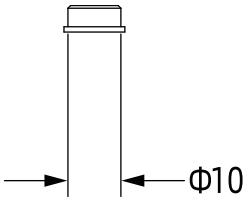
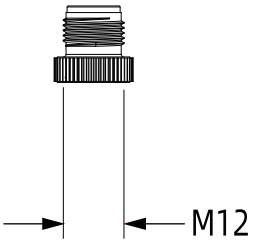


Figure 3-8 Connector sealing plug for gland version

Name	Code	Appearance (mm)
Sealing plug A	21020567	
Sealing plug B	21021143	
Sealing plug C	15051230	

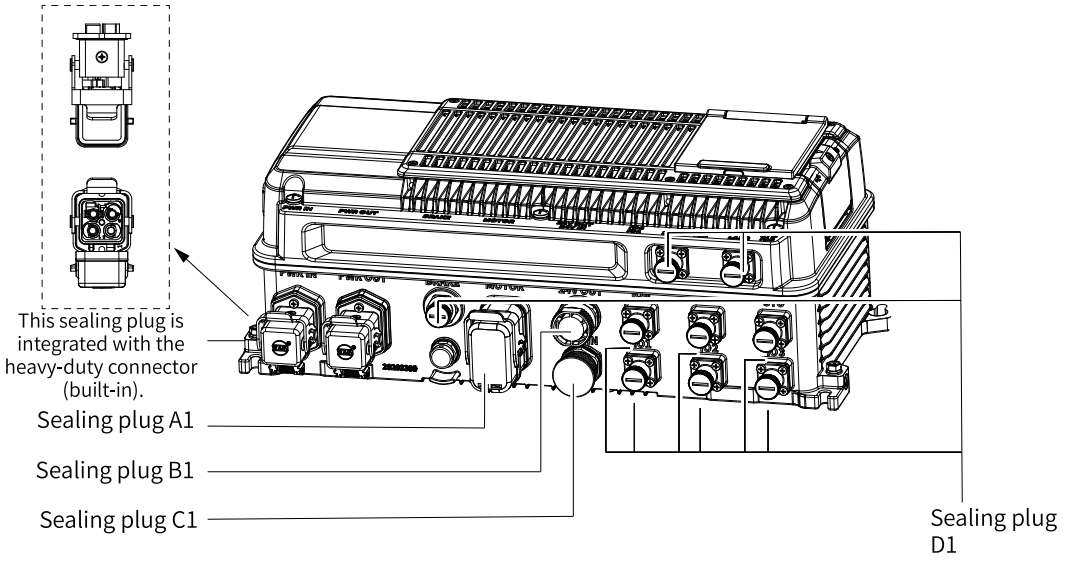
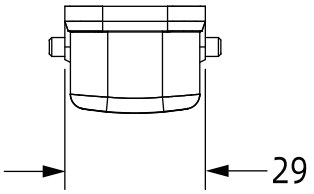
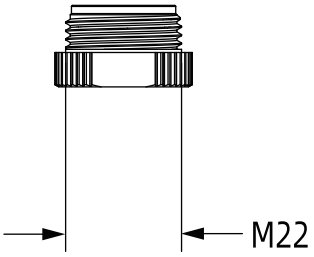
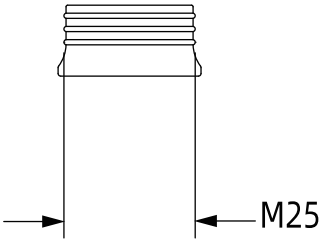
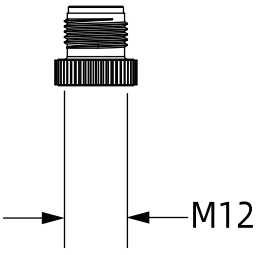


Figure 3-9 Connector sealing plug for heavy-duty version

Name	Code	Appearance (mm)
Sealing plug A1	-	
Sealing plug B1	15051271	
Sealing plug C1	-	
Sealing plug D1	15051230	

Drive module

When the drive module fails and cannot be quickly rectified, replace this component quickly to rectify the fault and restore normal operation of the drive. See *"17.4.4 Replacing the Drive Module" on page 1282* for how to replace the drive module.

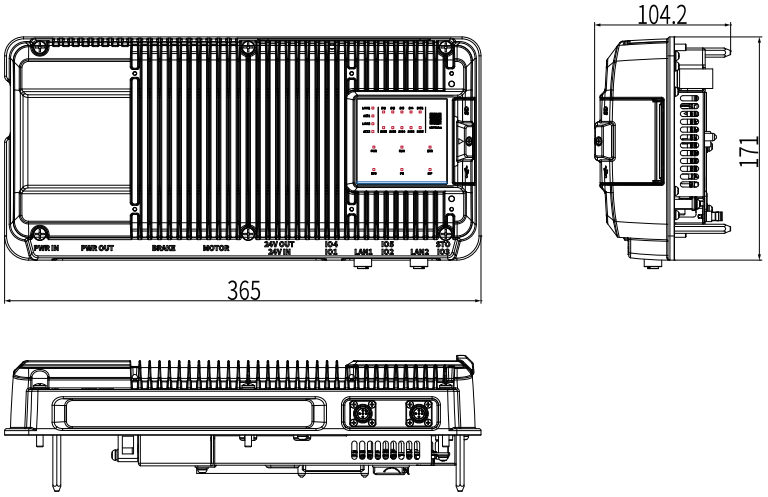


Figure 3-10 Drive module for the gland version (unit: mm)

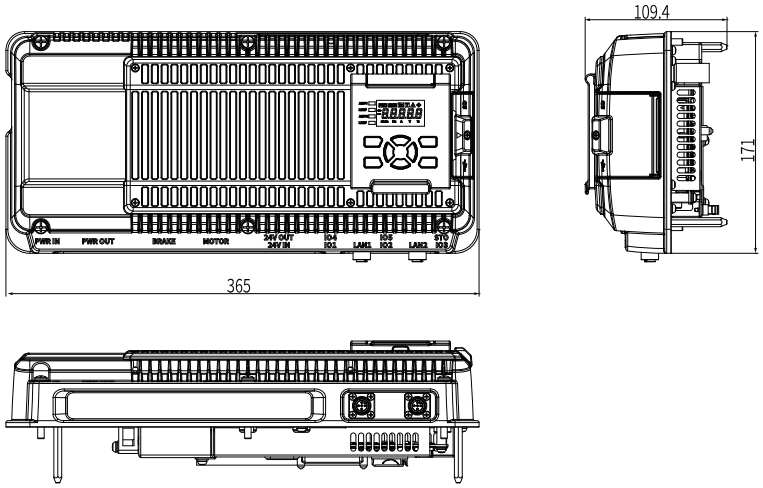


Figure 3-11 Drive module for the heavy-duty version (unit: mm)

4 Electrical Design

4.1 AC Drive and Peripherals

When the drive is used to control motors, you must install a variety of electrical devices on the input and output sides of the drive to ensure system safety and stability. The following figure shows the system composition.

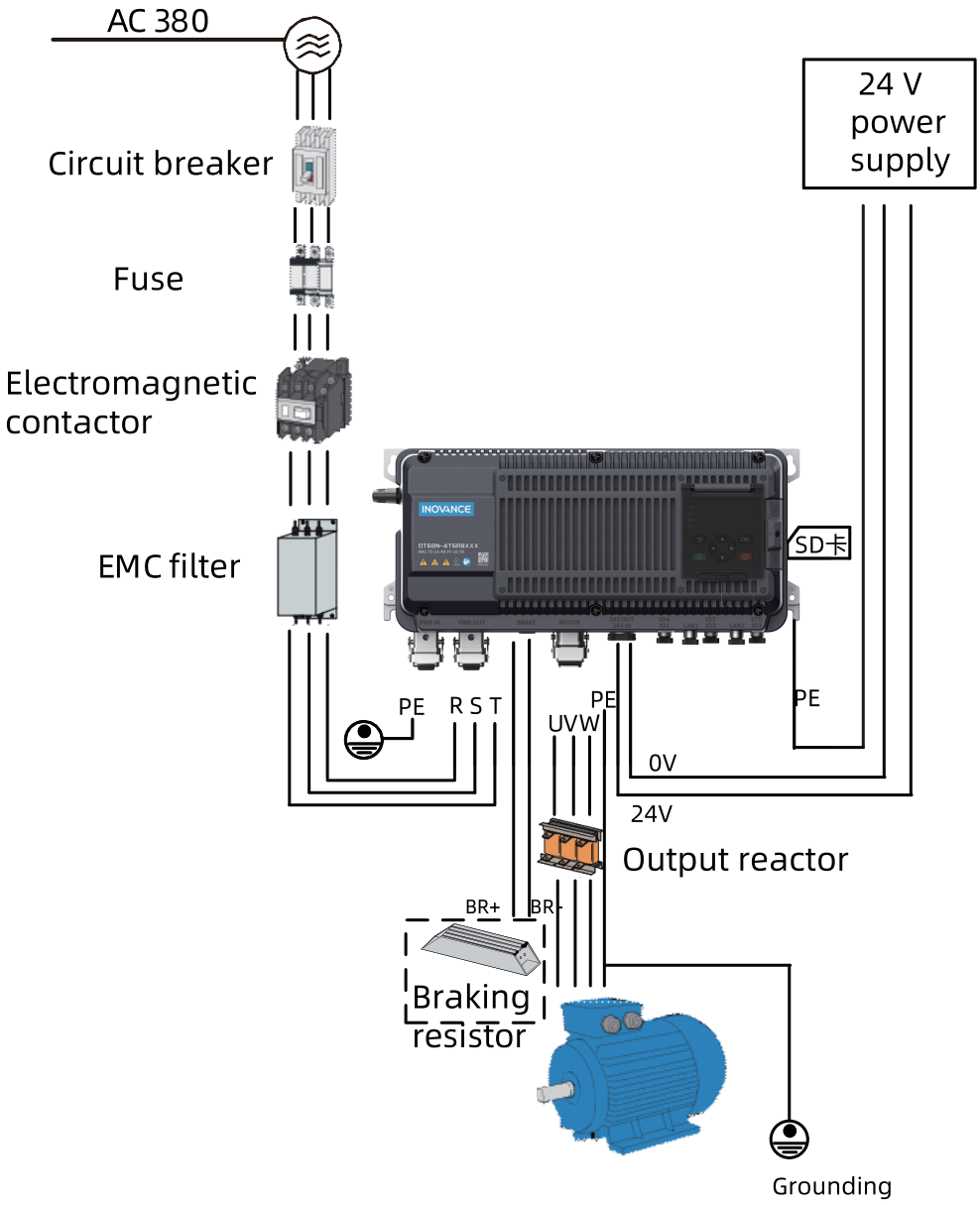


Figure 4-1 System connection

Table 4–1 Description of electrical peripherals

Name	Installation position	Function
Circuit breaker	Input side of the drive Input side of the 24 V power supply	Installed between the power supply and input side of the drive. Short circuit breaker: Cuts off the power supply when overcurrent occurs on downstream devices to prevent accidents. Residual current device (RCD): The drive may generate high-frequency leakage current during operation. To prevent electric shock which may cause a fire, select a proper RCD based on actual applications.
Contactor	Input side of the drive Input side of the 24 V power supply	Used to power on or off the drive. Do not use the contactor to power on or off the drive frequently (ON/OFF interval must be at least one hour) or use it to directly start the drive.
Fuse	Input side of the drive Input side of the 24 V power supply	Provides protection in case of short circuit to protect downstream semiconductors.
Braking Resistor	Input side of the drive	Supports external braking resistor. When using an external braking resistor, set the jumper to connect the external braking resistor and set A4-06 to 1 for external braking resistors. Consume the regenerative energy through the braking resistor.
Output reactor (ferrite ring and clamp)	Output side of the drive	When installed on the input side, the ferrite ring can be used to suppress the noise in the input power supply system of the drive. When installed on the output side, the ferrite ring can be used to suppress interference generated by the drive to external devices and reduce the bearing current.
	Signal cable	Improves the anti-interference performance of signals.
Motor	Output side of the drive	Select an applicable motor.

4.2 Electrical Wiring Diagram

Wiring for a bus-type drive

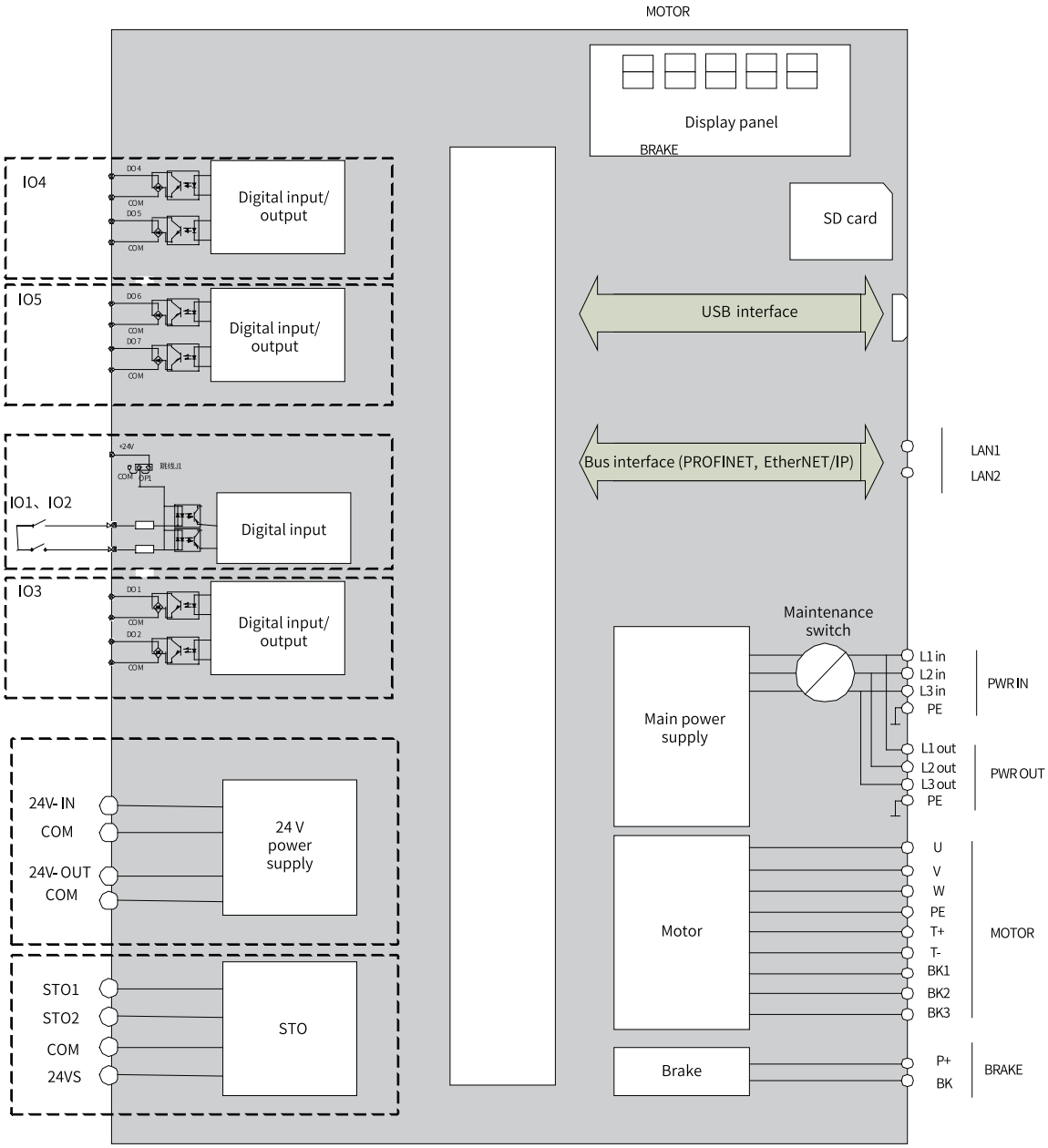


Figure 4-2 Wiring for a bus-type drive

Caution

- Signal interference may cause malfunction, so keep signal cables at least 10 cm away from power cables.
- Do not drop cuttings into the drive during wiring. Failure to comply may result in errors, faults, and malfunction.
- Keep the drive clean. Do not drop cuttings or dust into the drive while drilling mounting holes.

4.3 Grounding Requirements

Observe the following requirements to ensure a proper grounding of the drive.

Caution

1. Ground the grounding terminal to prevent electric shock. Observe related national or regional regulations during grounding.
2. To prevent electric shocks, ensure that the protective grounding conductor meets the technical specifications and local safety standards, and shorten the grounding cable length as much as possible.
3. In any case, the cross-sectional area of each protective grounding conductor that does not form part of the power cable or cable jacket cannot be less than 2.5 mm^2.
4. The leakage current of a single drive does not exceed 3.5 mA AC or 10 mA DC. You only need to configure one protective grounding conductor with the same specifications as the phase cable.
5. If the leakage current exceeds 3.5 mA, use the protective grounding conductor with the cross-sectional area of at least 10 mm^2 according to EN 61800-5-1, or connect with two protective grounding conductors of the same specifications.
6. Observe the grounding requirements of all the devices as improper grounding can lead to malfunction.

4.4 Requirements for Compatibility with Power Grids

Grid systems compatible

According to IEC 60364-1-2005 standard, this series of drives do not support delta-connected grids and are suitable for the following grid systems:

- TN
- TT
- IT

The meanings of the letters for the three grid systems TN, TT, and IT are as follows:

- First letter: Indicates the relationship between the power supply and ground.
  - T: A specific live part of the power supply is directly grounded.
  - I: All live parts of the power supply are isolated from the ground, or a specific live part is grounded through a high resistance.
- Second letter: Indicates the relationship between the equipment enclosure and ground.
  - T: The equipment enclosure is directly grounded, and this grounding system is independent of the power supply grounding.
  - N: The equipment enclosure grounding is directly bonded to the power supply grounding (in AC systems, the system grounding point is the neutral point where available. In the absence of a neutral point, a specific live conductor of the power system can be used as the grounding point).

General grid requirements

Input grid voltage range: three-phase 380 V to 480 V, -15% to +10%; frequency: 50/60 Hz±5%
Overvoltage category of the grid is OVCIII and pollution degree is PD2.

Installation altitude requirements

The maximum installation altitude is 3500 m, with rated height lower than or equal to 1000 m. For altitudes above 1000 m, derate 1% for every additional 100 m. Derating is not needed for altitudes lower than 1000 m.

Requirements in special environments

See *"18.6.2 Environment-Based Derating" on page 1299* for requirements in special environments.

4.4.1 TN System

TN system: The neutral point of the power transformer is grounded (the neutral point is grounded; in the absence of the neutral point, one of the phase conductors is grounded). Protective grounding is applied on the electrical device enclosure, and the power supply ground is bonded to the device ground. The TN system is divided into three types, TN-S, TN-C, and TN-C-S based on the connection relationship between the neutral conductor N and the protective grounding conductor PE.

- TN-S system: The neutral conductor N and the protective grounding conductor PE are separate, but these two conductors are connected only at the power supply side, as shown in the figure below.
  Models with built-in filters and models with optional external EMI filters can be used in TN-S systems.

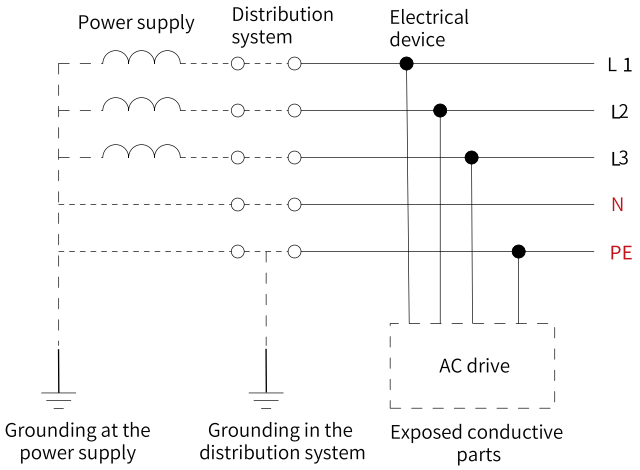


Figure 4-3 TN-S system (neutral conductor N and protective grounding conductor PE are separate)

- TN-C system: The neutral conductor N and the protective grounding conductor PE are combined into a single cable PEN, which runs throughout the entire system, as shown in the figure below. Models with built-in filters and models with optional external EMI filters can be used in TN-C systems.

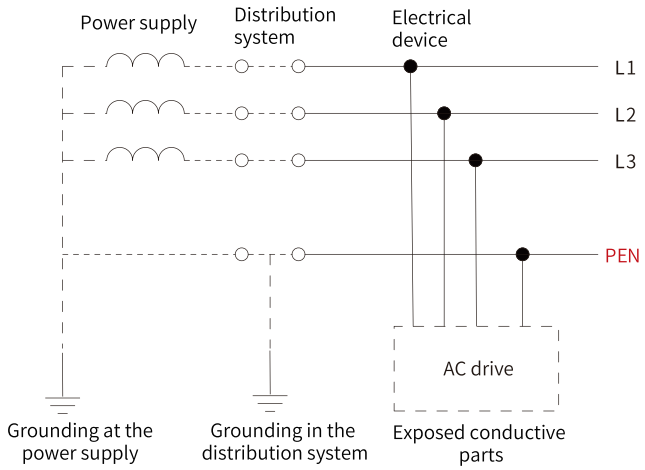


Figure 4-4 TN-C system (neutral conductor N and protective grounding conductor PE combined into a single cable PEN)

- TN-C-S system: The neutral conductor N and the protective grounding conductor PE are combined into a single cable PEN in a specific area of the system. From a designated separation point onward, they are divided into two independent conductors, N and PE, as shown in the diagram below.
  Models with built-in filters and models with optional external EMI filters can be used in TN-C-S systems.

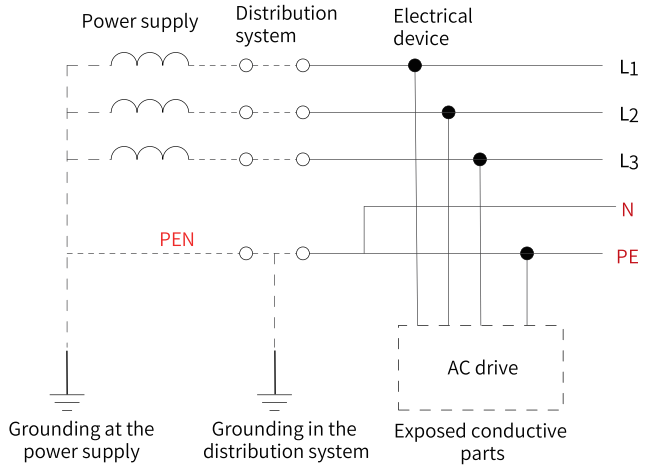


Figure 4-5 TN-C-S system (neutral conductor N and protective grounding conductor PE are separate)

  - This series of drives are applicable only to star-connected power grids. Therefore, it can be used in TN systems of star-connected power grids (where the neutral conductor N is grounded), but cannot be used in TN systems of delta-connected power grids.
  - This series of drives cannot be used in TN systems of delta-connected power grids.

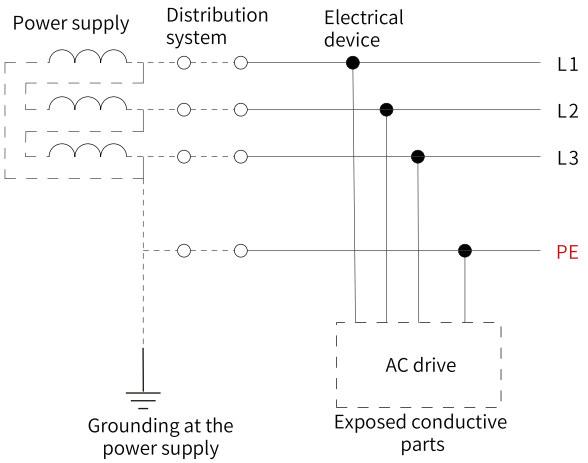


Figure 4-6 TN-S system (delta-connected power grid, with power grid grounded through one phase conductor)

Phase conductor grounding in TN system: In cases where asymmetrical grounding occurs in a TN system (phase conductor L1 grounded for example), the grounding switches for both the Y-capacitors (line-to-ground) and line-to-ground varistors of the drive must be disconnected.

4.4.2 TT System

TT system: The neutral point of the power supply transformer is grounded, and the equipment enclosure has been applied with protective grounding. However, the grounding of the power supply transformer and the grounding of the electrical equipment are independent of each other, with no electrical connection between the two grounding points. There are two types of TT systems: one with a neutral conductor N, and one without a neutral conductor N, as shown in the figure below.

- Models with built-in filters and models with optional EMI filters can be used on TT systems with a neutral conductor N.
- Models with built-in filters and models with optional EMI filters cannot be used on TT systems without a neutral conductor N. On such systems, the EMC/VDR grounding screw for the internal Y capacitor and line-to-ground varistor in the drive must be disconnected.

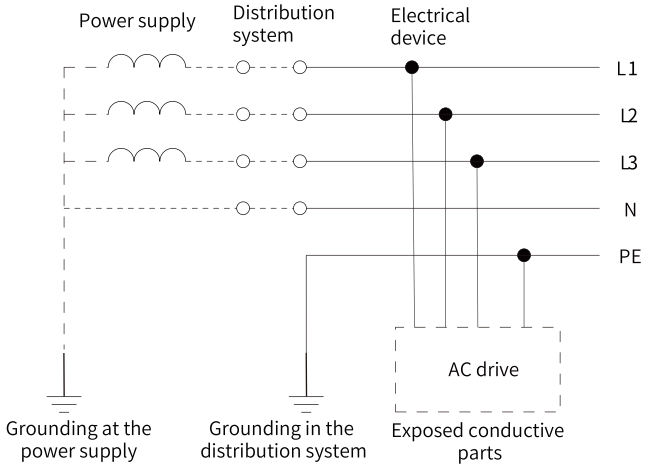


Figure 4-7 TT system (with independent neutral conductor and protective grounding conductor)

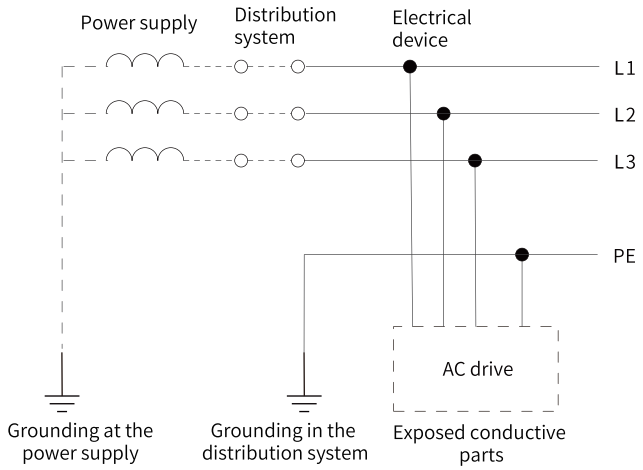


Figure 4-8 TT system (without neutral conductor but with protective grounding conductor)

4.4.3 IT System

IT system: The neutral point of the power transformer is ungrounded (or grounded through a high impedance), and protective grounding is applied on the equipment enclosure.

When the drive is installed on an IT power grid, the line-to-ground voltage of one phase may exceed the line voltage. To prevent damage to the drive, disconnect the EMC/VDR grounding screws for both the Y-capacitor (line-to-ground) and line-to-ground varistor of the drive, as shown in Figure 3-22.

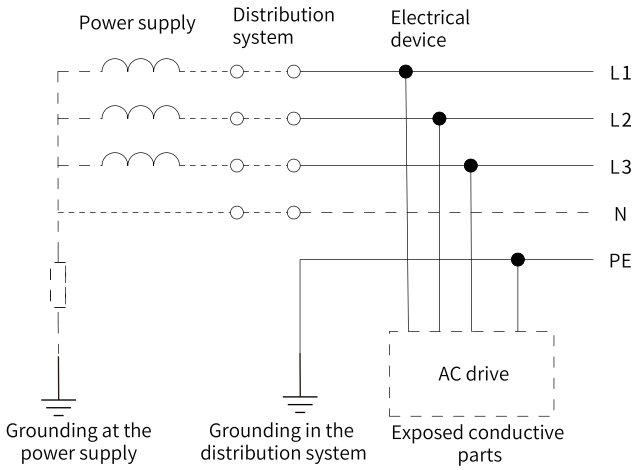


Figure 4-9 IT system (with N connector and without N conductor)

4.5 Basic Electrical Safety Precautions

4.5.1 Short Circuit Protection



An excessively high grid impedance can result in an electric shock or fire.

When the short-circuit current is excessively low, the protective device may not operate at all or may not operate in time, which may result in an electric shock or a fire.

- Ensure that the short-circuit current at the power input terminals of the drive can reach the tripping current of the protective device when short circuit or ground fault occurs between cables.
- If the short-circuit current during a ground fault is insufficient and does not reach the tripping current of the protective device, especially on a TT grid where the required short-circuit current may be extremely low, install an additional residual current device (RCD).

Note

A residual current device (RCD) is defined as a mechanical switching device or a combination thereof, capable of making, carrying, and breaking currents under normal operating conditions, and designed to open its contacts when the residual current reaches a specified value under defined conditions. Residual current devices (RCDs) are primarily used to provide protection against dangerous and potentially fatal electric shocks, as well as to protect against fire hazards caused by sustained ground fault currents.



An excessively low power grid impedance may cause electric shock or fire.

When the short-circuit current is excessively high, the protective device may be damaged due to its inability to interrupt this current, which can result in an electric shock or a fire.

Ensure that the unregulated short-circuit current at the power input terminals of drive does not exceed the breaking capacity of the protective device. Neither the power input terminals nor the cascaded power output terminals of the drive support phase sequence error detection (RST connected to PE for example). For heavy-duty version, it is recommended to use the user-defined cables of the drive. For gland version, it is recommended to use multi-color cables, with the PE pin of the internal power input terminal marked distinctly.

Causes of short circuit:

Unusual impedance reduction or insulation failure occurs between two live conductors with a high potential difference, causing electrical breakdown or arcing, which leads to a short circuit. The short-circuit current in this case is excessively high, which can easily result in device damage, grid tripping, or a fire. General causes:

- Conductive solid particles: Environments in industries such as metalworking, plastic machinery, mining, and metallurgy often contain metal shavings, carbon powder, conductive carbon fibers or similar, which can easily enter the device and cause short circuit.
- Conductive liquids: Cutting fluid from machine tools can enter the device, or water may enter the device due to inadequate protection.
- Corrosive gases: Gases containing halogen elements (such as sulfides, bromine) or ammonia can cause internal corrosion of the device, leading to arcing and short circuit.
- External short circuit: The insulation of cables after prolonged operation in high temperature can be degraded and damaged, leading to phase-to-phase arcing, phase-to-ground arcing, or ground fault of the braking resistor. The drive can provide protection against this type of short circuit generally.
- Motor insulation damage: The insulation degradation causes short circuit between winding turns or between windings and ground. The drive can provide protection against this type of short circuit generally.

In what situations must a short circuit protection device be used?

To prevent internal short circuit in the drive due to uncontrollable factors such as component failure or insulation failure, install the fuse/circuit breaker to protect the drive and input cables, preventing the drive, input cables, and adjacent devices from being damaged, which reduces the risk of fire and electric shocks.

The safe configuration diagram for fuses/circuit breakers is shown below.

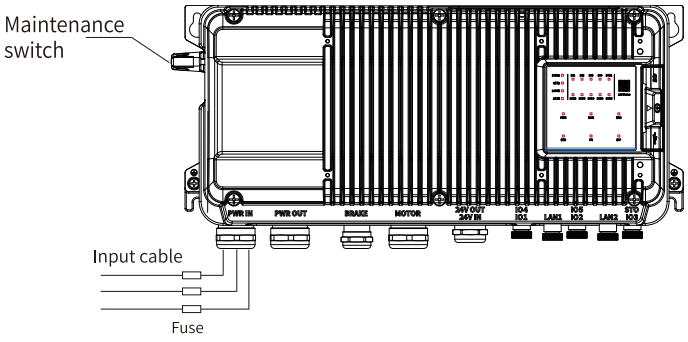


Figure 4-10 Fuse/Circuit breaker configuration

Note

Use the AC drive strictly based on the requirements in the user guide to prevent unnecessary short circuit events.

Use of aged cables and motors may result in short circuit, which can damage the device or lead to a fire.

4.5.2 Overload Protection

Warning

- Use the drive within the rated specifications. Derate the drive for use outside the specifications. Failure to comply can damage the drive.
- When one drive is used to drive multiple motors simultaneously (one-to-multiple), install a thermal relay on each motor. Failure to comply can damage the motor, or even cause a fire.

Principle of overload protection

The drive provides protective functions against drive overload and motor overload. The drive monitors key parameters such as the internal DC bus voltage, output voltage, output current, and heatsink temperature in real time, ensuring that the power semiconductor devices and other main power components inside the drive operate within the allowable range, preventing damage such as overcurrent or overtemperature of the main power components. In addition, the drive checks whether the motor is overloaded based on the rated motor parameters, actual operating state of the motor, and motor overload protection time curve, protecting the motor with different loads. When drive overload or motor overload is detected and the specified time is reached, the drive immediately stops output and reports an overload fault.

Measures to avoid overload

Normally, the drive power and motor power must meet the steady-state mechanical load requirements, with the allowable overload capacity and startup capability of the drive and motor taken into account. If the overload capacity of the drive or motor is exceeded due to excessively low power rating, user a higher power rating of the drive or motor. Common causes of overload and corresponding precautions are listed in the table below.

Common causes of overload	Precautions
The load is excessive.	Check whether the load can be reduced.
The ramp-up/down time is excessively short and the ramp-up/down frequency is excessively high.	Check whether the ramp-up/down time and the ramp-up/down frequency can be adjusted.

Common causes of overload	Precautions
Overload occurs during low-speed operation.	1. Reduce the current during low-speed operation. 2. Increase the motor speed. 3. In applications with frequent operations at low speed, user a drive with higher power rating and replace with a variable frequency motor, as demonstrated below. a. Effect of low-speed operation on the drive: During low-speed operation, temperature rise of power semiconductor devices inside the drive is intensified. Therefore, long-term operation at low speed requires derating or higher power rating. b. Effect of low-speed operation on the motor: Standard motors are typically designed for power frequency and can operate stably for long periods at rated frequency and rated speed. However, the cooling fan of a standard motor is usually shaft-mounted, so when the motor runs at low speed, the fan speed decreases, resulting in reduced cooling capacity. When using a standard motor, even if operating below the rated current, motor overload may still occur during low-speed operation (in this case, the motor is indirectly overloaded and should be derated for use). Long-term low-speed operation can damage the motor due to improper heat dissipation. In this case, it is recommended to take additional auxiliary cooling measures on the motor, use a motor with higher power rating, or use a variable frequency motor. This is because the cooling fan of a variable frequency motor usually operates on an independent power supply, unaffected by motor speed, which can ensure continuous cooling of the motor.
Overload occurs due to motor demagnetization.	Over-excitation operation of the motor or improper control parameter settings may lead to motor demagnetization (magnetic saturation) and increased losses. Adjust related parameters properly.
Overload occurs due to improper parameter settings	For example, the V/f curve setting does not match the motor characteristics. Improper parameter setting can cause motor control oscillation and trigger an overload fault. Adjust the related parameters.
Overload occurs due to excessively long motor cables and excessively high carrier frequency.	Due to leakage current, in certain harsh load conditions, the drive overload fault may be triggered. Select the appropriate motor cable length and carrier frequency derating requirements according to the model specifications. When the cable length is excessively long, install an output AC reactor. If the load requirement is still not met when the carrier frequency is derated, use a drive with higher power rating.
Overload occurs when multiple motors are driven by one drive.	When one drive is used to control one motor, the drive can protect the motor against overload. However, when one drive is used to drive multiple motors simultaneously (one-to-multiple), the current detected by the drive is the total output current instead of the actual current of each motor. In this case, the drive cannot effectively protect the motor against overload. Therefore, install a thermal relay between the drive and motor, so that the motor power supply can be disconnected by the thermal relay upon motor overload.

4.6 Main Circuit Connection

4.6.1 Descriptions of Main Circuit Terminals

The main circuit terminals of the drive adopt spring clamp terminals. The following is the layout diagram of the main circuit terminals.

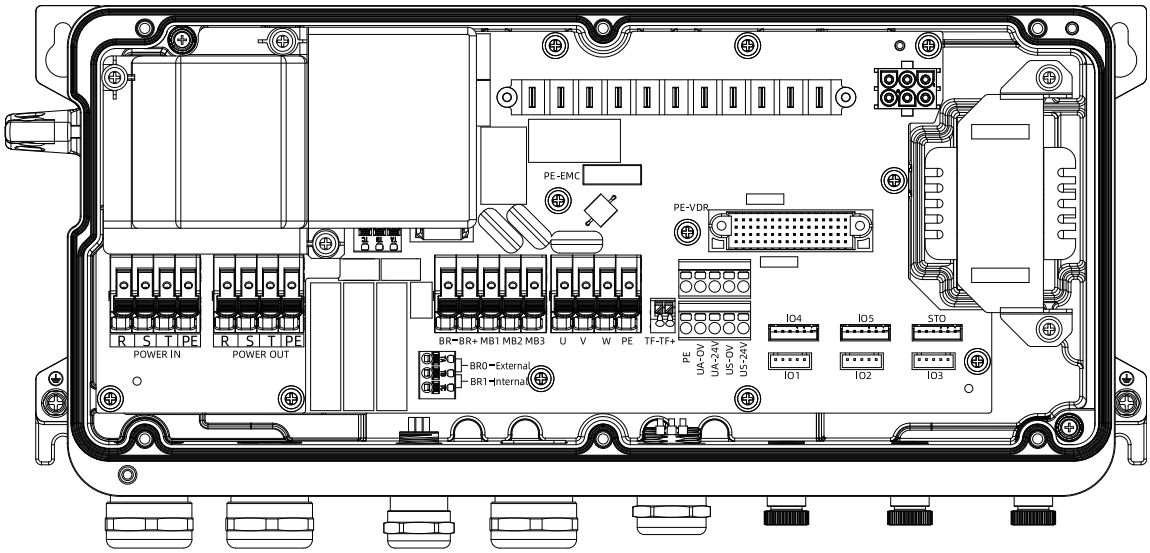


Figure 4-11 Overall layout diagram of main circuit terminals for gland version

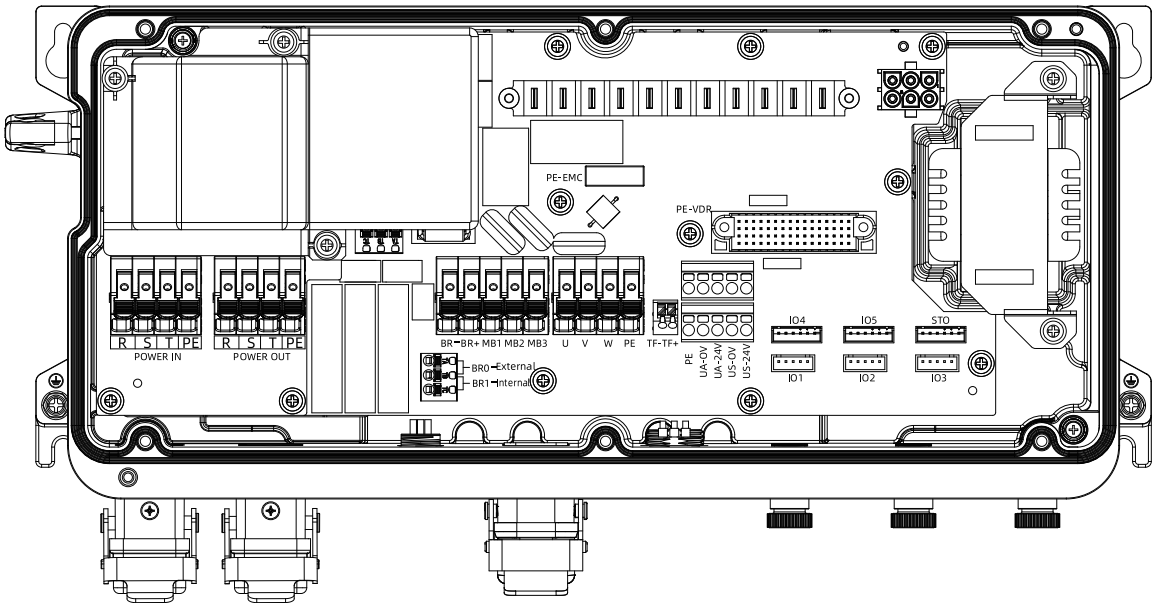


Figure 4-12 Overall layout diagram of main circuit terminals for heavy-duty version

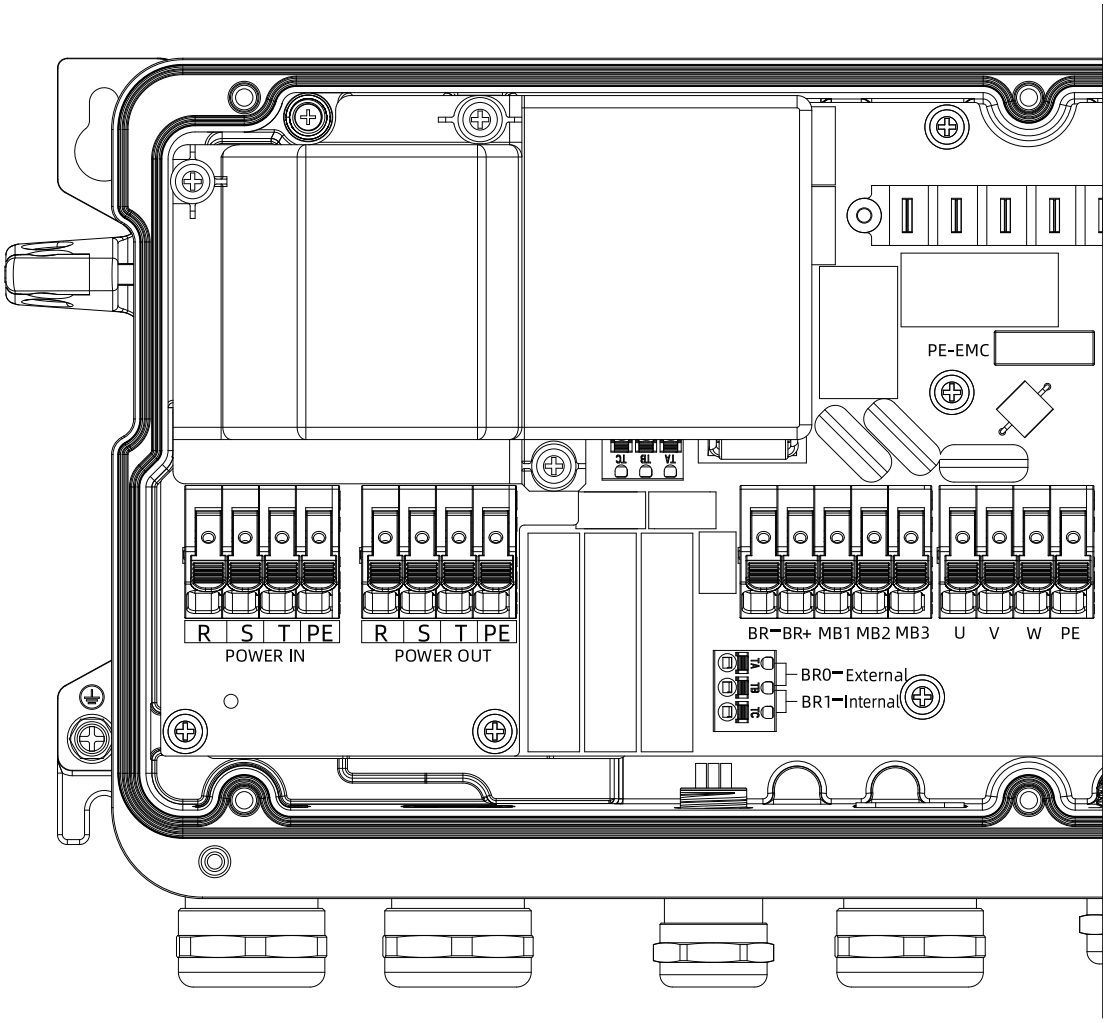


Figure 4-13 Layout of main circuit terminals of T1 models (0.37 kW to 2.2 kW)

Table 4–2 Descriptions of main circuit terminals

Mark	Name	Function
R, S, T, PE	Three-phase power cascaded output terminals	Connected to the three-phase AC input power supply.
BR-, BR+	Terminals for connecting external braking resistor	Connected to the braking resistor.
U, V, W, PE	Output terminal	Connected to a three-phase motor.
PE ⏚	Enclosure grounding	Used for protective grounding
BR0, BR1	External/Internal braking resistor selection jumper	Used to select an internal (default) or external braking resistor, as shown in *"18.7.1 Braking Resistor" on page 1299*.
MB1, MB2, MB3	Motor brake output terminal	380 V to 480 V three-phase motor brake (MB1, MB2), applicable to models with suffix B1; 180 VDC motor brake (MB1, MB2, MB3), applicable to models with suffix B0

Connecting to the power supply of the production line in daisy chain mode

The drive is designed to allow daisy-chain power supply configuration for multiple drives.

The following diagram shows the method for daisy-chaining multiple drives.

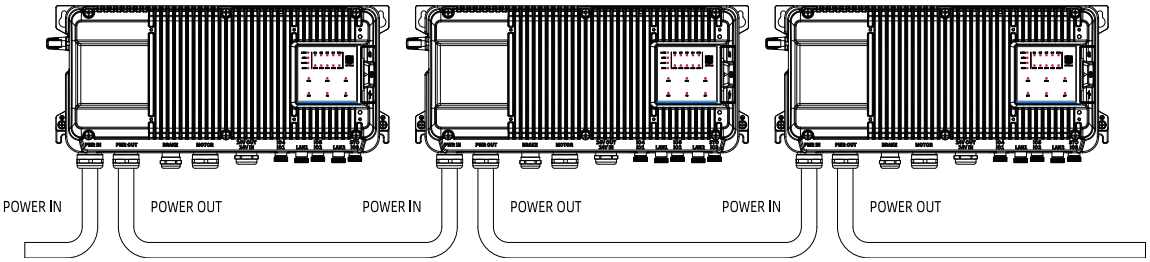
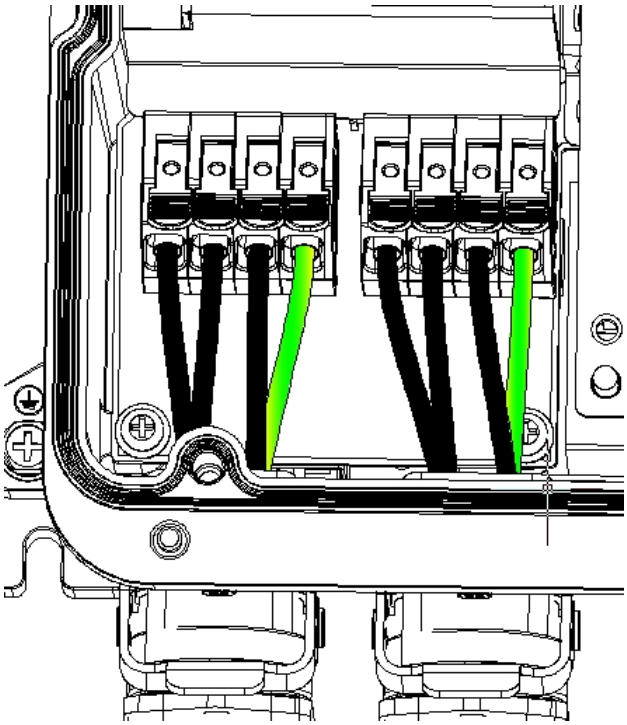


Figure 4-14 Daisy chain wiring of main power input terminals R/S/T

Wiring-type line power supply terminals

The following figure shows an example of wiring connection for the gland version.



The following table describes the function of main circuit terminals.

Note

Do not use screws when installing the main circuit terminals. Install the crimping handle with care. During installation, make sure the crimping handle is crimped in place, which means the cables cannot be pulled out easily.

The following figure shows the dimensions of main circuit terminals.

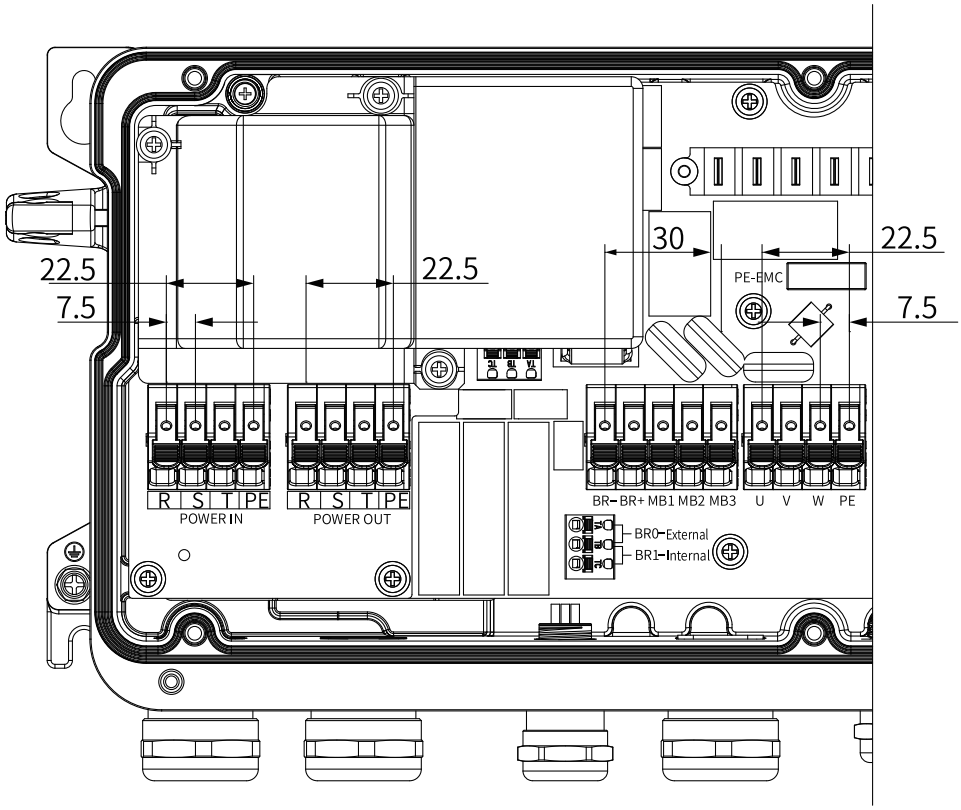


Figure 4-15 Main circuit terminal dimensions (mm)

More information on protective devices

The input side of the connector and drive can be protected with a fuse. Recommended fuse mode: I x 80% > (I1 + I2 + ... + lN), which means 80% of the total current > sum of the currents required by all devices.

Further information

If daisy chain connection is not used, cover unused connectors with the optional connector cap kit according to the IP rating requirement of the system.

4.6.2 Connecting Main Circuit Terminals To the Power Supply, Motor, and Braking Resistor

Wiring requirements for main circuit terminals

- The input power cables and output motor cables of the drive can generate strong electromagnetic interference. When these cables are routed in parallel with control circuit cables for a long distance, electromagnetic coupling can be generated, which affects normal operation of the drive. Therefore, keep a separation distance of at least 30 cm between main circuit cables and signal cables.
- Common main circuit cables include input R/S/T cables, output U/V/W cables and brake cables. Signal cables include I/O signal cables and communication cables. Cable ducts must be connected and grounded properly. Aluminum cable trays ensure equipment equipotential

bonding. The filter, drive, and motor must be properly bonded to the system (machine or device). All conductive metal contact surfaces at these bonding interfaces must achieve full surface contact, and the mounting areas must be applied with spray coating.

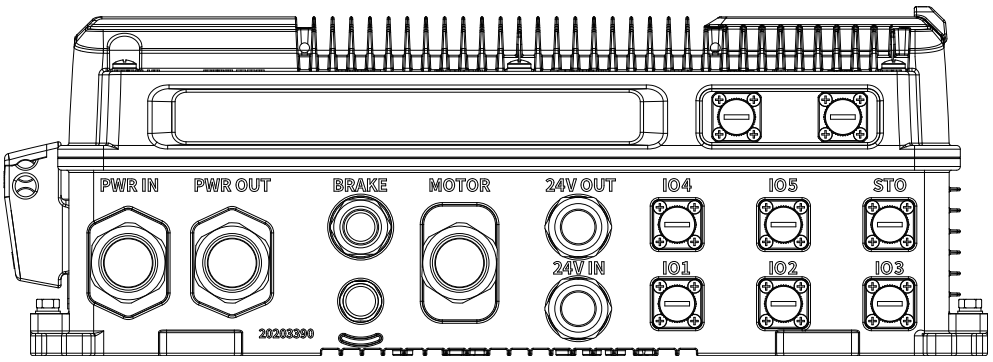


Figure 4-16 Wiring panel for gland version

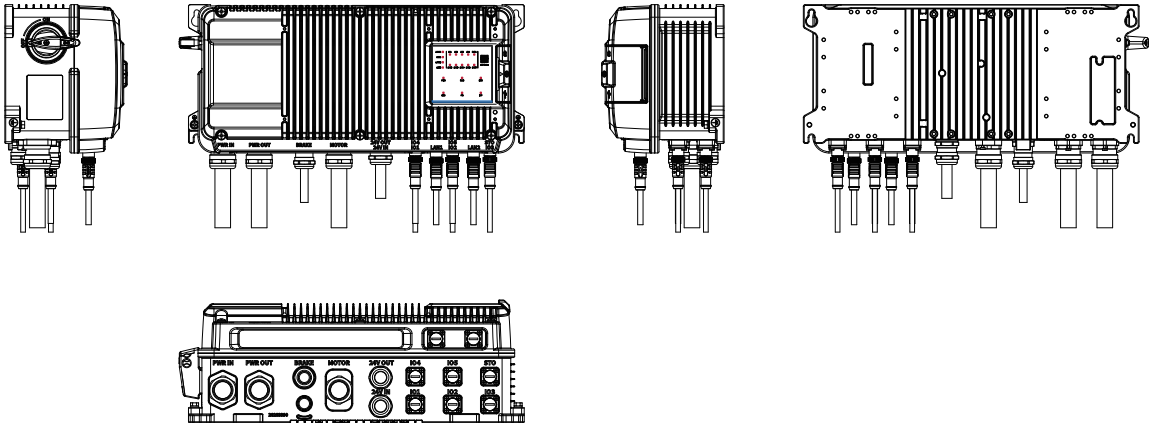


Figure 4-17 Wiring for gland version

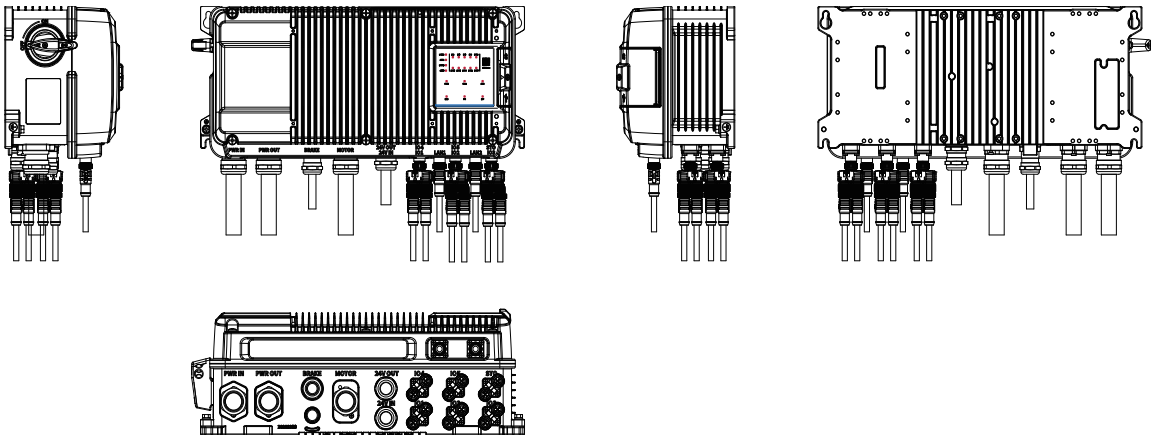


Figure 4-18 Wiring for gland version (with optional cable entry head)

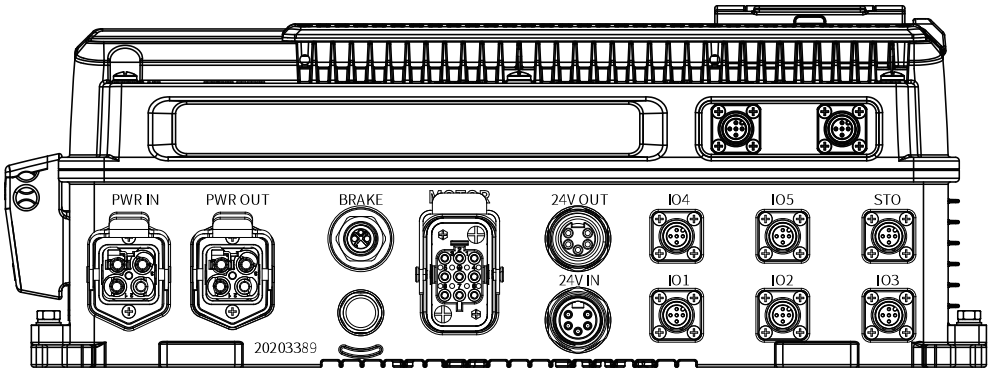


Figure 4-19 Wiring panel for heavy-duty version

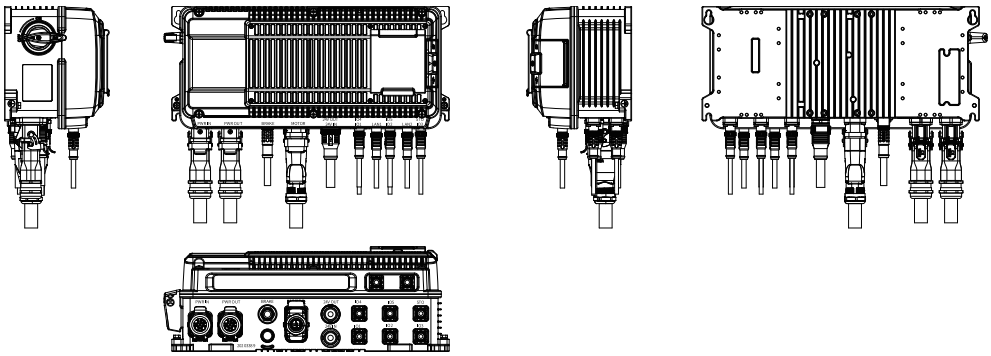


Figure 4-20 Wiring for heavy-duty version

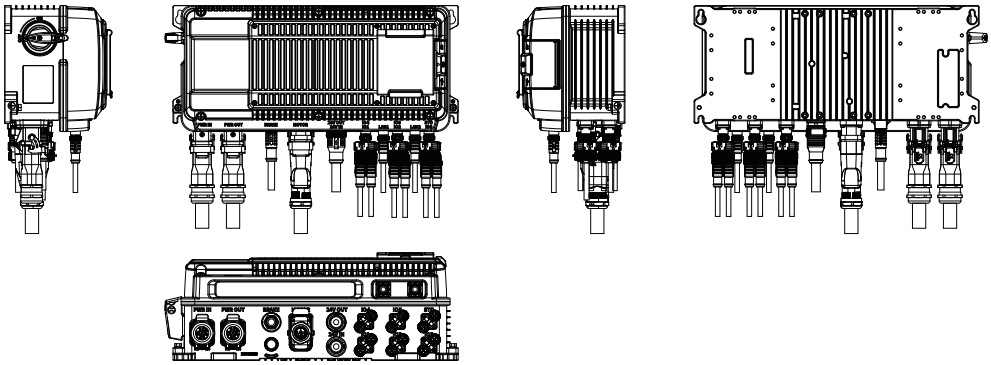


Figure 4-21 Wiring for heavy-duty version (with optional cable entry head)

Wiring in an IT system

In an IT grid system, disconnect the PE-VDR selective grounding screw. Failure to comply can damage the drive, as shown below.

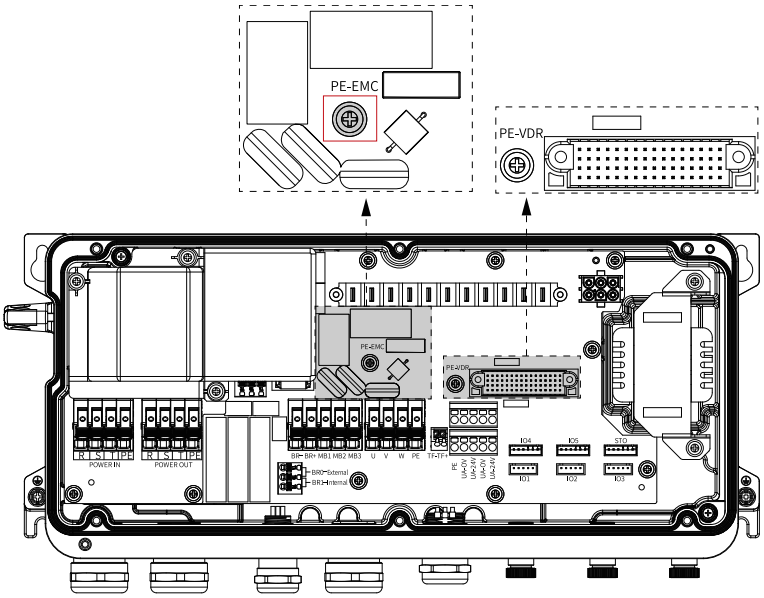


Figure 4-22 Disconnecting the PE-VDR selective grounding screw

Cable shield requirements on the motor side

It is recommended to use shielded cables as motor output cables, with the shield drain wire crimped to the PE terminal.

Keep the drain wire of the motor cable shield as short as possible, with its width not shorter than 1/5 of its length. See Figure 3-23 for the motor cable shield drain wire.

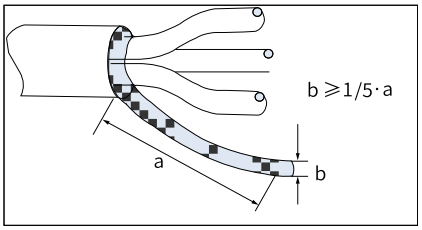


Figure 4-23 Drain wire of the motor cable shield

4.6.3 Requirements for Protective Grounding Cables

Observe the following requirements to ensure a proper grounding of the drive.

CAUTION

- To prevent electric shock, ground the grounding terminal properly. Observe related national or regional regulations during grounding.
- To prevent electric shock, ensure the protective grounding conductor complies with technical specifications and local safety standards. Keep the length of the grounding cable as short as possible. If the current leakage of the drive exceeds 3.5 mA or 10 mA, use a protective grounding copper conductor with a cross-sectional area of at least 10 mm^2 according to standard IEC/EN61800-5-1, or use two protective grounding conductors of the same specifications.

CAUTION

To comply with EMC standards, ground the neutral point of the power supply. When the neutral point is ungrounded or grounded through a high resistance, a risk of electric shock can be incurred if the selective grounding screw of the EMC filter is not removed.



- When multiple devices are used, ground all the devices. Incorrect grounding can result in misoperation of devices.
- For products with VDR/EMC selective grounding screws, in basic insulation testing, disconnect the VDR selective grounding screw prior to dielectric strength test. In reinforced insulation testing, disconnect the VDR and EMC selective grounding screws prior to dielectric strength test. Failure to comply may result in test failure.



The dimensions of the grounding cable must comply with the electrical device technical standards. Keep the length of the grounding cable as short as possible. Failure to comply can lead to unstable potential in the grounding terminals away from the grounding point due to leakage current, resulting in an electric shock.



Do not share the grounding cable with other devices (such as welding machines or high-current electrical devices). Improper grounding of the device can lead to faults due to electrical interference of the drive or device.



For use of multiple drives, observe all the grounding instructions for the drive. Improper grounding of the device can lead to malfunction of the drive and the device.

Purpose of grounding

Typically, circuits are insulated by insulating materials and enclosed within a housing. However, insulating materials are not capable of preventing leakage current entirely, a minimal residual current will inherently flow into the enclosure. The purpose of grounding is to prevent electric shock caused by current leakage during direct touch with the electrical device enclosure.

The drive can generate strong interference during operation. Proper grounding can mitigate electromagnetic interference emissions from the drive.

Grounding requirements

- The protective grounding conductor must be a green-and-yellow cable comprised of copper conductors. Do not connect the protective grounding conductor to a switching device (such as a circuit breaker) in series.
- Ground the grounding terminal properly. Improper grounding can result in device malfunction or damage.
- The grounding terminal cannot be shared with the neutral terminal (N) of the power supply.
- It is recommended to install the drive on a conductive metal surface. Ensure the whole conductive bottom of the drive is bonded properly to the mounting face.

- Tighten the grounding screw with specified tightening torque to prevent the protective grounding conductor from being secured improperly.

Grounding method

The following three grounding methods are used generally.

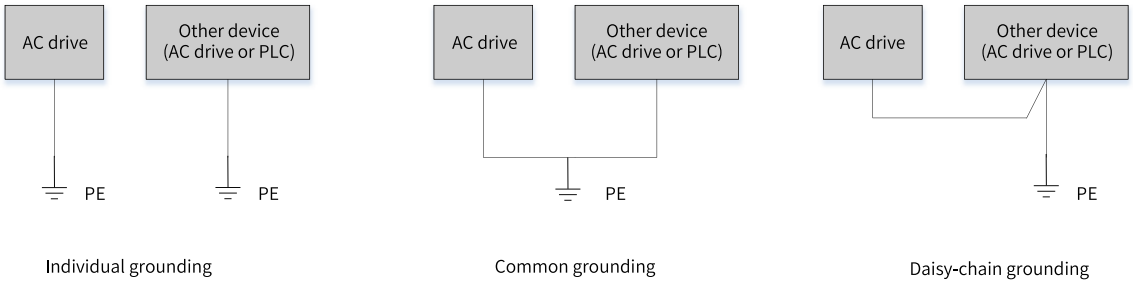


Figure 4-24 Grounding diagram

- Separate grounding: The drive and other devices are connected to the protective ground separately, which is the optimal grounding method recommended.
- Common grounding: The grounds of the drive and other devices are connected to the same protective ground, which is an acceptable grounding method.
- Series grounding: The grounding cables of other devices are connected to the grounding point of a grounded drive, or the ground of the drive is connected to the grounding point of other grounded devices. This method can easily incur common ground impedance interference, which is not recommended.

4.7 Control Circuit Connection

4.7.1 Control Circuit Terminals

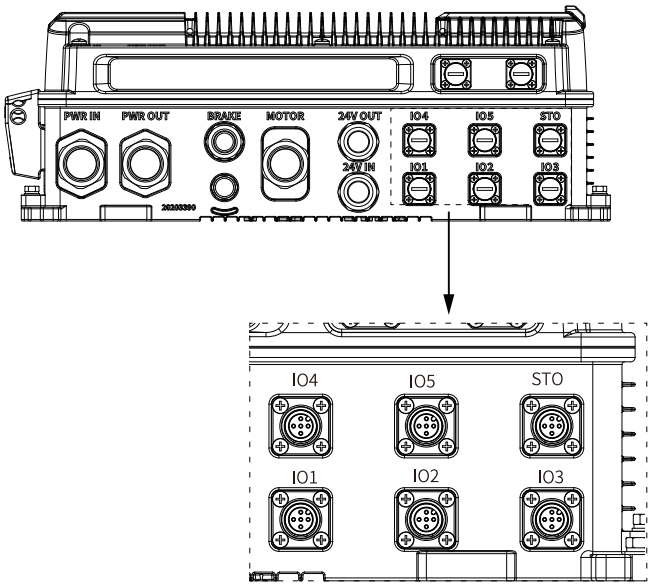


Figure 4-25 Layout of external panel for control terminals of gland version

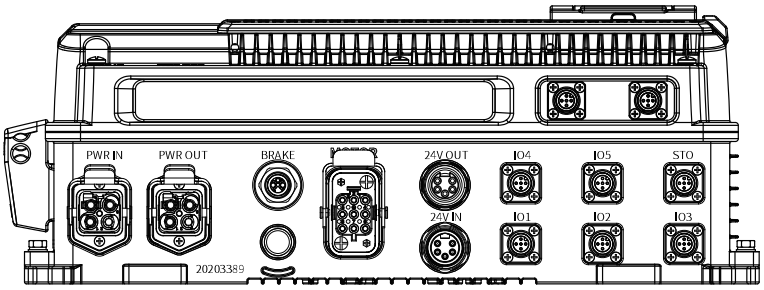


Figure 4-26 Layout of external panel for control terminals of heavy-duty quick connector version



Figure 4-27 Operating panel of gland version



Figure 4-28 Operating panel of heavy-duty quick connector version

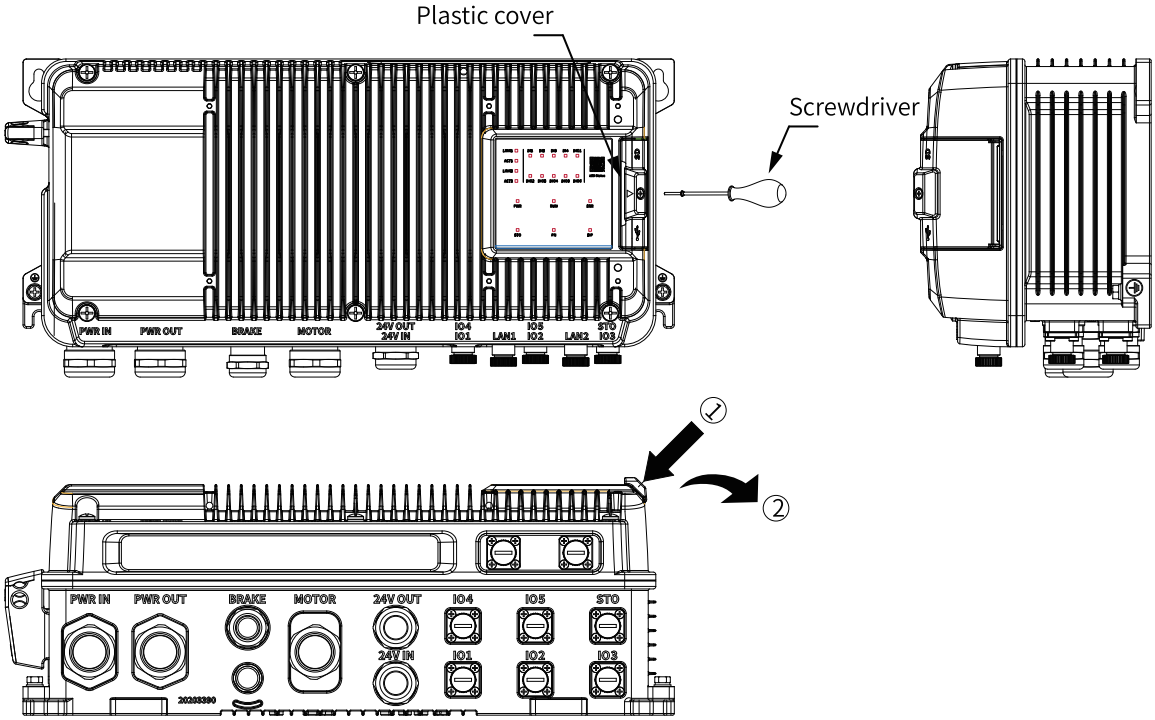


Figure 4-29 Operation control terminal open

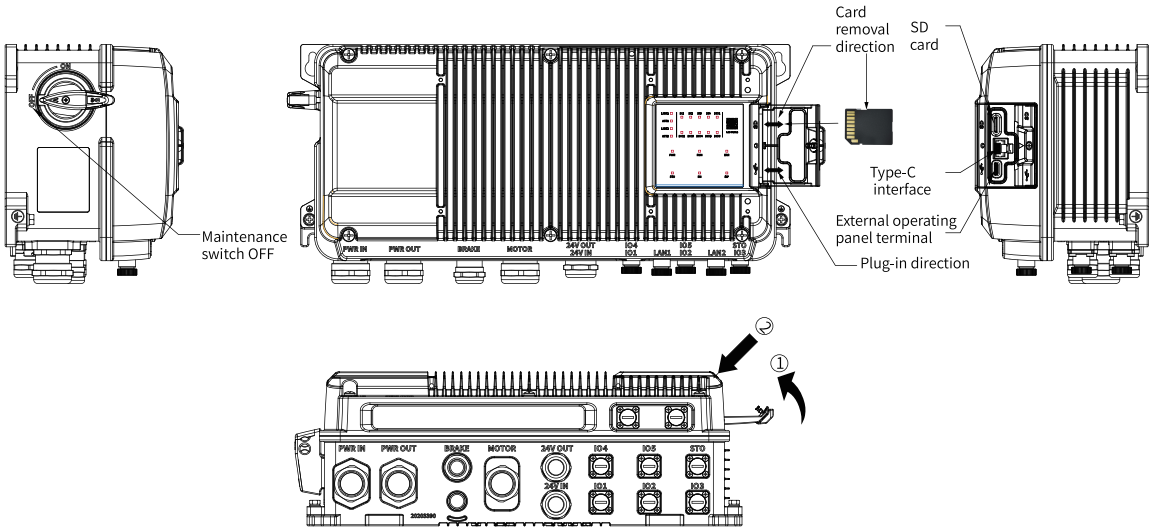


Figure 4-30 Operation control terminal closed

No.	Name	Mark	Function	
1	EtherNet communication	LAN1	Used for PROFINET or EtherNet/IP communication, which can be switched through internal parameters.	
2		LAN2		
3	EtherNet indicator	Link-IN	Used to indicate changes during communication. Link-IN/ACT-IN indicator corresponds to LAN1, Link-OUT/ACT-OUT indicator corresponds to LAN2.	
		ACT-IN		
		Link-OUT		
		ACT-OUT		
4	Digital input	IO1	DI1/COM	Optocoupler isolation, supports unipolar input load mode only (active high): • Input impedance: 3.5 kΩ • Maximum input frequency: 100 Hz • Operating voltage range: 15 V to 30 V; invalid voltage < 5 V; valid range: 15 V
			DI2/COM	
5		IO2	DI3/COM	
			DI4/COM	

<table>
<tr><th>No.</th><th>Name</th><th>Mark</th><th colspan="3">Function</th></tr>
<tr><td>6</td><td rowspan="6">Digital input/ output</td><td rowspan="2">IO3</td><td>DIO1</td><td>DI5/COM, 24V/DO1</td><td rowspan="5">DI:
Optocoupler isolation, supports unipolar input sink mode only (DI input pulled down to COM):
• Input impedance: 3.5 kΩ
• Maximum input frequency: 100 Hz
• Operating voltage range: 15 V to 30 V; invalid voltage < 5 V; valid range: 15 V
DO:
Internal isolation: uses high-side load switch and supports source output only:
• Output load: 0.5 A/point
• Maximum input frequency: 100 Hz
• Protection against output overcurrent, overtemperature, and short circuit</td></tr>
<tr><td>7</td><td>DIO2</td><td>DI6/COM, 24V/DO2</td></tr>
<tr><td>8</td><td rowspan="2">IO4</td><td>DIO3</td><td>DI7/COM, 24V/DO3</td></tr>
<tr><td>9</td><td>DIO4</td><td>DI8/COM, 24V/DO4</td></tr>
<tr><td>10</td><td rowspan="2">IO5</td><td>DIO5</td><td>DI9/COM, 24V/DO5</td></tr>
<tr><td>11</td><td>DIO6</td><td>DI10/COM, 24V/DO6</td></tr>
<tr><td>12</td><td>Functional safety</td><td>STO</td><td colspan="3">Standard STO terminal that not connected by default (Connect this terminal properly before use.)</td></tr>
<tr><td>13</td><td>USB port</td><td>Type-C</td><td colspan="3">Supports connection to software tool and software upgrade only (power supply not supported) through a shielded USB cable</td></tr>
<tr><td>14</td><td>SOP20 external operating panel terminal</td><td>CN1</td><td colspan="3">Supports connection only to Inovance SOP-20 LCD operating panel, which can be used as a relay to connect to the software tool for commissioning.</td></tr>
<tr><td>15</td><td>SD card</td><td>SD</td><td colspan="3">Used for copy operations, which can be performed at stop. The minimum capacity is higher than 512 M, and the maximum capacity is lower than 32 G.</td></tr>
</table>

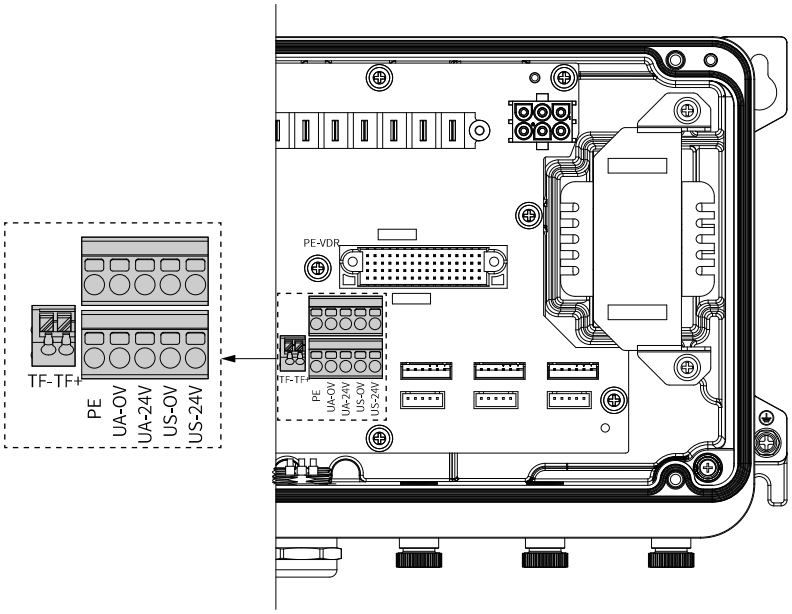


Figure 4-31 Schematic of internal terminals in the control circuit

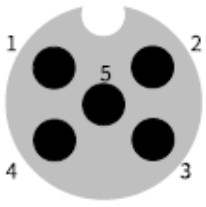
Table 4–3 Description of control circuit terminals

External terminal	Type	Type of information transmitted	Mark	Name	Function
CN1	5.0 mm x 5P-PCB terminal block	24 V external power supply	US_24V	Power supply input	CN1 is connected to external 24VIN, and CN2 is connected to external 24VOUT. The internal CN1 and CN2 are daisy-chained, with a maximum overcurrent capacity of 10 A.
			US_0V	Power supply GND	
CN2			UA_24V	Power supply	
			UA_0V	Power supply GND	
			PE	Reference GND	
CN9	3.5 mm x 2P-PCB terminal block	Temperature sensor input	TF-/TF+	-	Supports PT100, PT1000, KEY84, and PTC130 (three-core and single-core): • PT100: -40℃ to +200℃, accuracy ±5℃ • PT1000: -40℃ to +200℃, accuracy ±5℃ • KTY84: -40℃ to +200℃, accuracy ±10℃ • PTC130 (single-core): 120℃ to 140℃, accuracy ±15℃ • PTC130 (three-core): 120℃ to 140℃, accuracy ±15℃

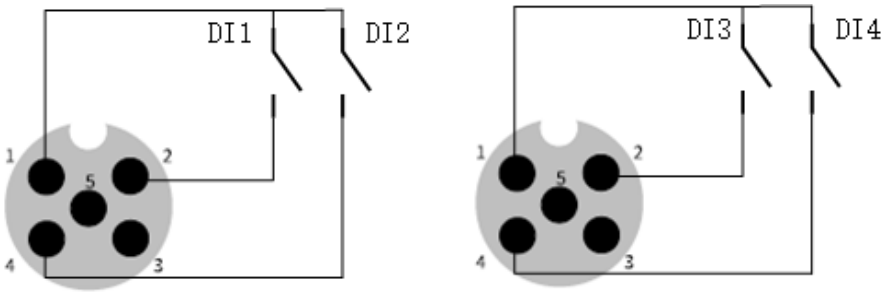
4.7.2 Wiring of I/O Terminals

Wiring of the DIs

The digital input of the distributed drive only supports source-type logic input (active high), in which IO1 and IO2 only support DI, while IO3, IO4, and IO5 support DIO. Switchover between DI and DO functions can be achieved through parameters E0-59/E0-60. The following shows the pin assignment.

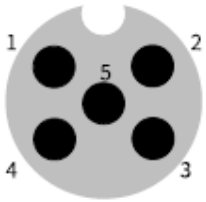
DI function				
Assignment	Pin	Function	Description	Cable color coding
	1	24 V	+24 V power supply (Unswitched_ 24V)	Brown
	2	DI1	1st digital input	Black
	3	COM	+24 V power supply reference ground (COM)	Blue
	4	DI2	1st digital input	White
	5	NC	Not connected	-

The DIs of the distributed drive are designed based on IEC-61131-2-2017 standard, and DI can only be set to sink mode to prevent incorrect external wiring. The following shows schematic for connecting four external switches to four DIs.

Function	DI - Digital input			
Connection mode	M12 A-coded, 5-pin female terminal			
Wiring diagram				
I/O type	Assignment			
	Pin	IO1	IO2	IO3 to IO5
10DI	1	US_24V	US_24V	US_24V
	2	DI1	DI3	DI5/7/9
	3	COM	COM	COM
	4	DI2	DI4	DI6/8/10
	5	NC	NC	NC

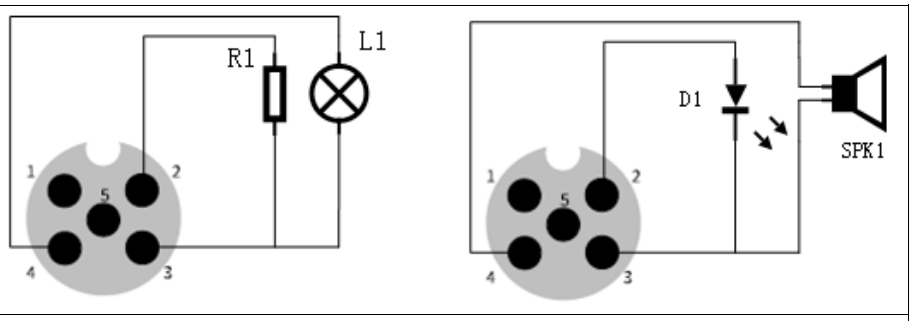
Wiring of the DOs

To allow high-current output, DOs of the distributed drive are supplied from the CN1 and CN2. The power supply UA_24V/UA_0V is dedicated to DOs. To support DI expansion, all DOs are set to DI mode by default. Therefore, you need to switch to DO mode through parameters for using the DOs. The distributed drive supports a total of 6 DOs, which are defined on the IO3 to IO5 interfaces as follows.

DO function				
Assignment	Pin	Function	Description	Cable color coding
	1	L+	+24 V power supply (Switched_24V)	Brown
	2	DO1	1st digital output	Black
	3	L-	+24 V power supply reference ground (COM)	Blue
	4	DO2	1st digital output	White
	5	NC	Not connected	-

The DOs of the distributed drive are designed based on IEC-61131-2-2017 standard, and DOs can only be set to source mode to prevent incorrect external wiring. Additionally, each DO supports overload and short circuit protection. Parameters in the software tool can display the real-time status of DO output. The following shows the schematic for connecting four external switches to four DOs.

Function	DO - Digital output
Connection mode	M12 A-coded, 5-pin female terminal

Wiring diagram				
I/O type	Assignment			
	Pin	IO3	IO4	IO5
6DO	1	UA_24V	UA_24V	UA_24V
	2	DO1	DO3	DO5
	3	COM	COM	COM
	4	DO2	DO4	DO6
	5	NC	NC	NC

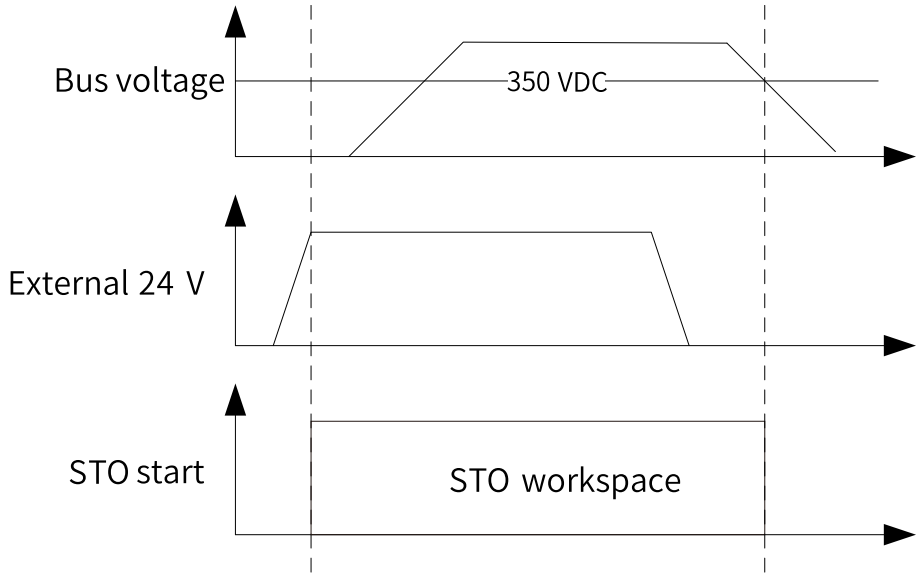
When IO3 to IO5 are set to the DO output mode, the output status of each DO can be read through parameters. If overload, short circuit, and overtemperature occurs on the DO, a fault can be reported. See the DO software sections for actual operations.

DO can drive capacitive loads. When the external device is short-circuited or overloaded, the DO stops output. Rectify the fault cause timely as prolonged short circuit can trigger overtemperature fault of the DO integrated circuit.

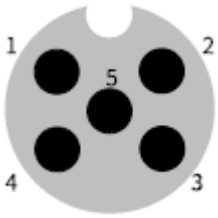
4.7.3 Wiring of STO Terminals

This series of drives are equipped with the STO function as standard. When the STO function is enabled, the PWM drive signals of the motor is cut off by the drive to stop motor torque output. The STO function of the drive complies with IEC61800-5-2 standard, with the corresponding functional safety certificate (IEC 61800-5-2: SIL3, EN ISO 13849-1: PL e/Cat3) obtained. For further information about the STO function of the drive, contact Inovance. When using the STO function of this drive in a safety-related system or device, the company, individual, or responsible party establishing the safety-related system or device must conduct a risk assessment to ensure the safety integrity level of the system or device meets the standard requirements. During risk assessment, all relevant safety factors must always be considered to ensure compliance with safety standard requirements.

The distributed drive supports an external 24V DC power supply. Upon system energization, the STO function starts. The operational zones of the STO are defined as follows.



Assignment of STO terminals:

Function: STO				
Assignment	Pin	Function	Description	Cable color coding
	1	24VS	STO power supply on the user end (maximum output capability: 24 V/0.16 mA/ 25℃)	Brown
	2	STO1	Safety input channel 1	White
	3	COM	STO power reference GND	Blue
	4	SOT2	Safety input channel 2	Black
	5	NC	Not connected	-

The following wiring methods are available for the input side of STO.

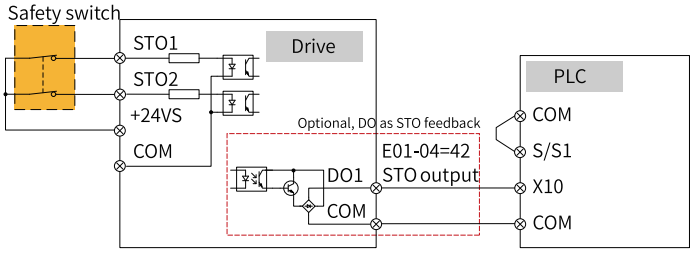


Figure 4-32 STO wiring diagram (internal 24 V)

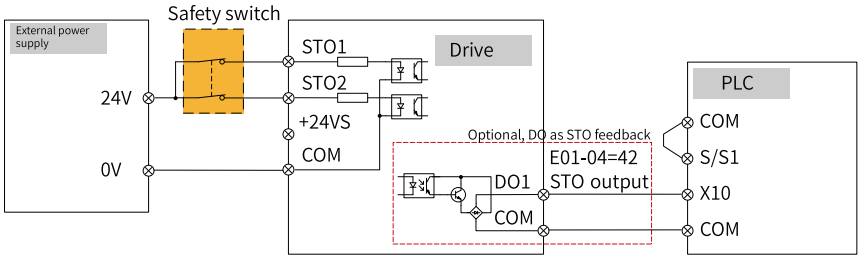


Figure 4-33 STO wiring diagram (external 24 V)

Figure 4-34 External control PNP output used as STO input

EMC requirements for STO wiring:

- Ensure that the cable between the drive and safety switch does not exceed 30 m.
- It is recommended to use double-shielded or single-shielded multi-pair cables and crimp the STO cable shield to the grounding bracket to enhance the STO cable resistance to electromagnetic interference.

4.7.4 Wiring of the 24 V Power Supply

Description of terminals

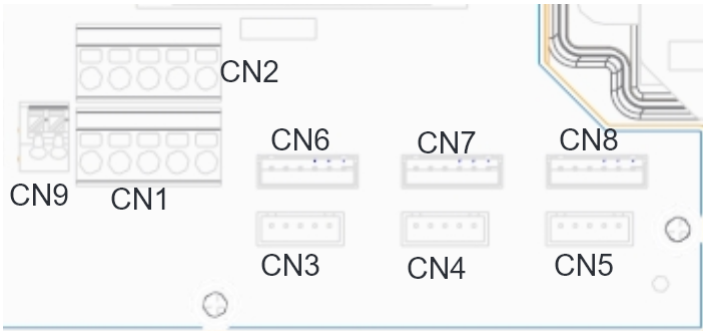
The 24V wiring method differs between the gland version and the heavy-duty quick connector version.

The heavy-duty quick connector version is wired through the enclosure terminal. The internal pin assignment of the quick connector is as follows.

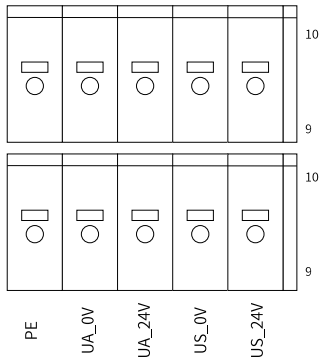
Table 4–4 Description of 24 V terminal of heavy-duty quick connector version

24 V (IN), 5-pin, male	24 V (OUT), 5-pin, female	Pin	Assignment	Description	External wiring color
		1	US-0V	24 V power negative - US	Black
		2	UA-0V	24 V power negative - UA	Blue
		3	PE	Grounding	Green-and-yellow
		4	US-24V	24 V power positive - US	Brown
		5	UA-24V	24 V power positive - UA	White

Gland:



The sequence of CN1 and CN2 from right to left is:

Function: Gland version - Wiring of 24 V power supply			
Assignment	Pin (from right to left)	Function	Description
	1	US_24V	DI and 24 V power supply, also capable of powering up the system
	2	US_0V	DI and 24 V power supply reference ground
	3	UA_24V	Dedicated +24 V power supply for DO (Switched_24V)
	4	UA_0V	DO power supply reference ground
	5	PE	System reference ground, which is connected to the drive enclosure

Connected in daisy chain to the 24 V power supply

24 V power supply can be used to power up multiple drives in daisy chain mode.

The following figure illustrates the method of daisy chain connection for multiple converters.

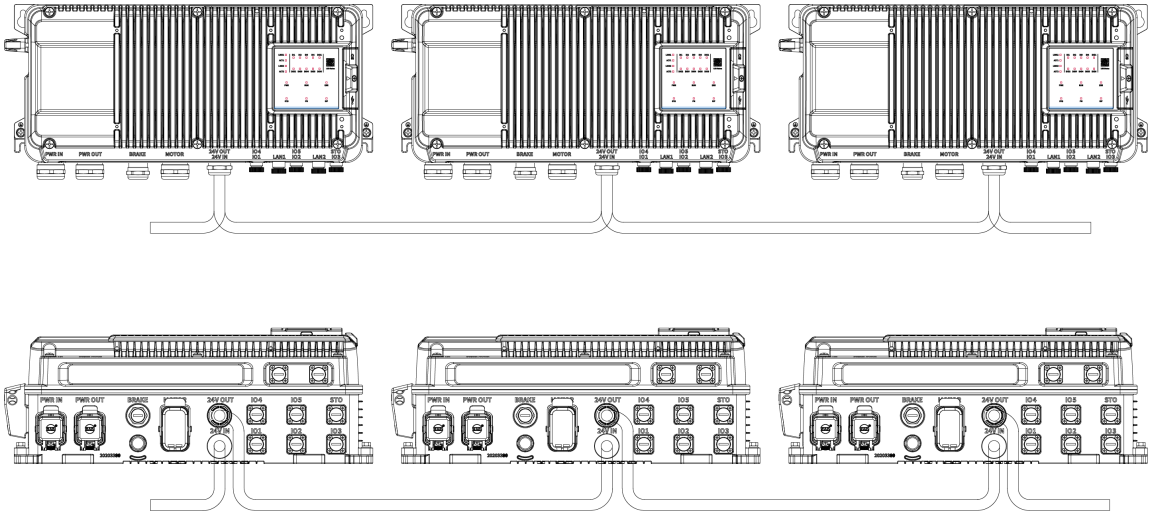
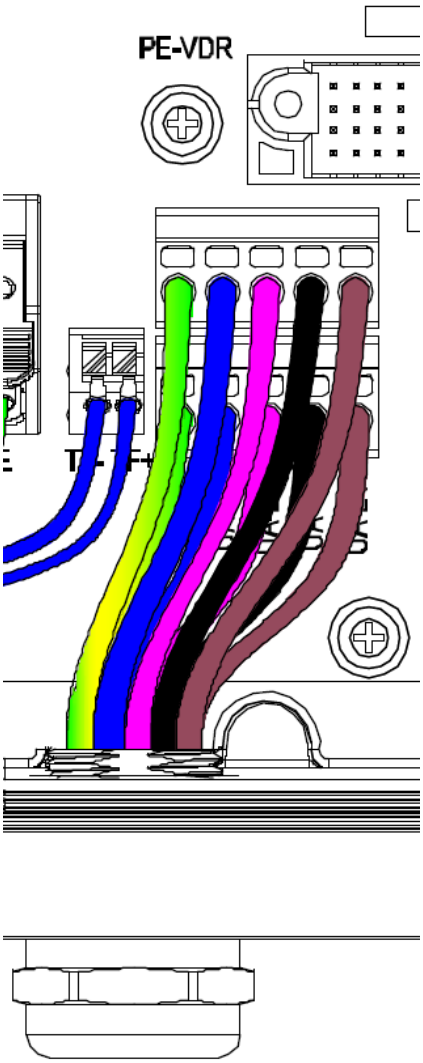


Figure 4-35 Wiring of input 24 V daisy chain

Wiring of external 24 V power supply terminal

This figure shows wiring of the 24 V power supply terminal in daisy chain connection.



Maximum current limit of daisy chain connection

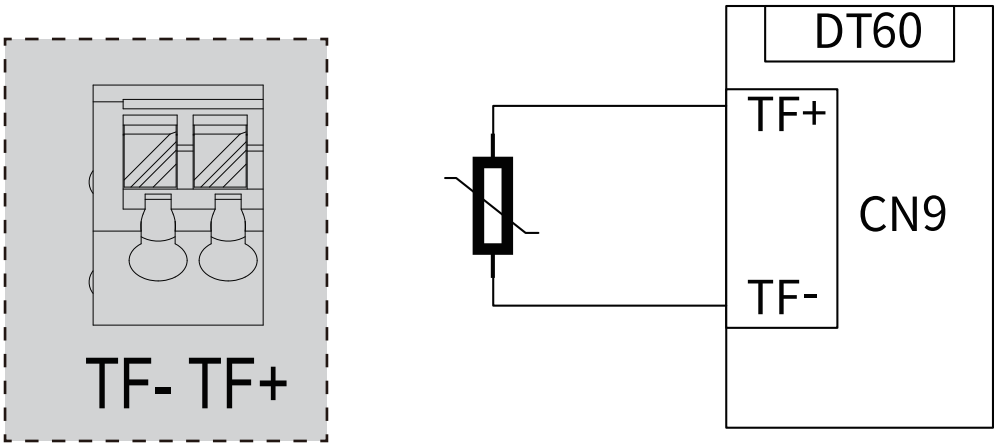
The maximum allowable quantity depends on the maximum current limit in daisy chain connection. The following table shows the relationship between the maximum current limit of the cable cross-sectional area and the ambient air temperature.

IEC cable		UL cable	
Gland version	Connector version	Gland version	Connector version
18 A + 18 A @ 2.5 mm^2, 40 °C	9 A + 9 A @ 2.5 mm^2, 40 °C	18 A + 18 A@14AWG, 40 °C	9A + 9 A@14AWG, 40°C
15 A + 15 A @ 2.5 mm^2, 50 °C	7 A + 7 A @ 2.5 mm^2, 50 °C	15 A + 15 A@14AWG, 50 °C	7A +7A@14AWG, 50 °C

If daisy chain connection is not used, cover unused connectors with the optional connector cap kit according to the IP rating requirement of the system. For information about the connector cap kit, see *"3.5 Installation Accessories" on page 49*.

4.7.5 Wiring of Motor Temperature Sensor

As shown in Table 3-4 in section 3.7.1, terminal CN9 can be connected to a motor temperature sensor to monitor motor operating temperature. This terminal can only be used for connecting two-wire temperature sensors.

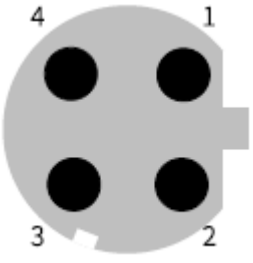


Note

In the current design, when a PT100 temperature sensor is connected to the drive signal terminals, the cable impedance of the sensor increases proportionally with the length of the motor cable, which can affect the temperature sampling accuracy greatly, so PT100 is not suitable for long drive cables.

4.8 Wiring of Communication

The distributed drive is compatible with PROFINET and EtherNet/IP communication, which can be selected through parameters. An external M12 terminal is used to meet both communication and waterproof requirements. You can purchase dedicated cables as needed. Definition of the communication interfaces are as follows.

Function	EtherNet/IP interface PROFINET interface		
Connection mode	M12 D-coded, 4-pin female terminal		
Wiring diagram			
Assignment	No.	LAN1	LAN2
	1	TD1+	TD2+
	2	RD1+	RD2+
	3	TD1-	TD2-
	4	RD1-	RD2-

4.8.1 Wiring of PROFINET Communication

Use shielded CaT 5e or Cat 6e twisted pair cables as PROFINET bus, without distinction between straight-through and crossover cables, with a maximum single cable length of 100 m. PROFINET network supports three basic topologies: bus, star, and ring.

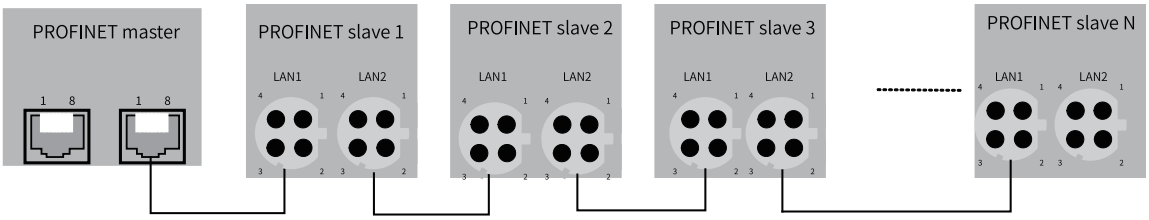


Figure 4-36 Bus connection method

In bus connection, the shielded CaT 5e EtherNet cable is routed out from PROFINET master to any EtherNet port of the drive, and then routed out from another EtherNet port to connect the next drive.

PROFINET does not distinguish between IN and OUT ports. Any network port can serve as the port connected to the master. In general applications, the master does not check the specific network connection. However, if specific ports are configured in the topology, the connection must follow the sequence specified in the topology diagram. Otherwise, an error can be reported by the master.

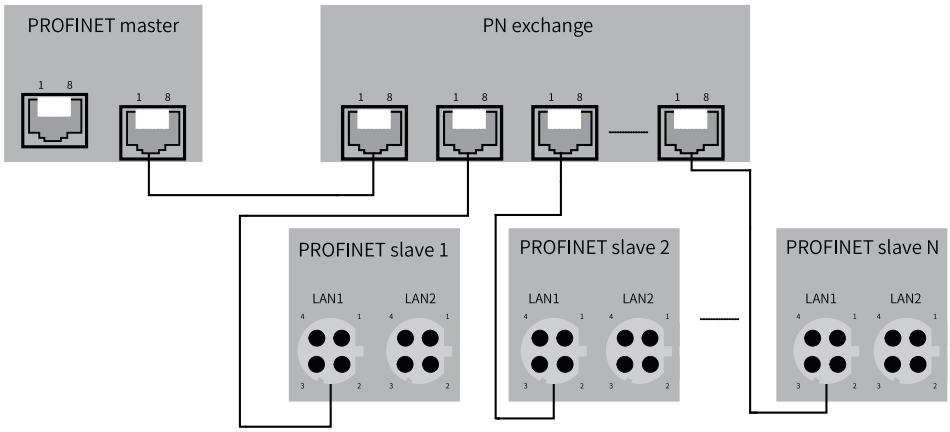


Figure 4-37 Star connection

In star connection, the master and slaves (drives) are connected together through an EtherNet switch. It is recommended to use a PROFINET EtherNet switch due to high latency and weak interference resistance of regular EtherNet switches.

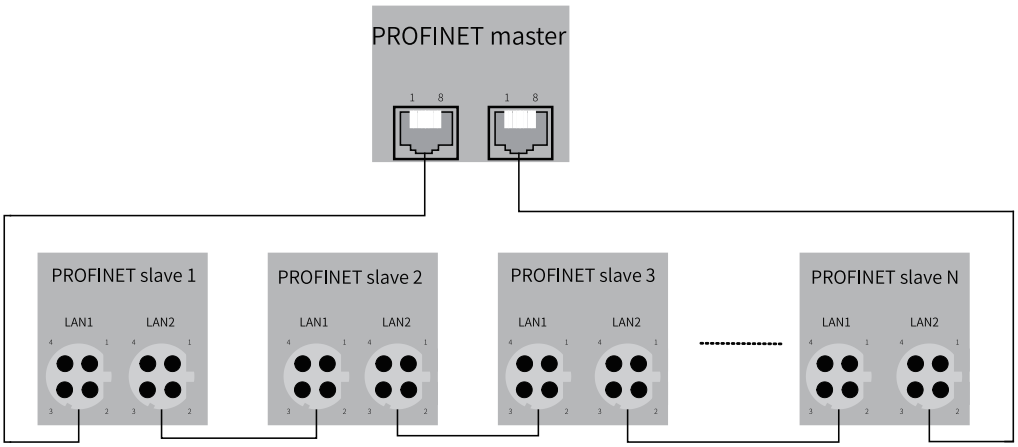


Figure 4-38 Ring connection

The ring connection is similar to bus connection, with difference lies in that the spare network port of the last drive is connected to the spare port of the master, and the master needs to be configured as MRP manager in the ring connection, so that drives in all the ring network are MRP clients (MRP does not require the actual topological view to be downloaded).

Bus and star topologies can be combined to form complex topologies such as tree networks.

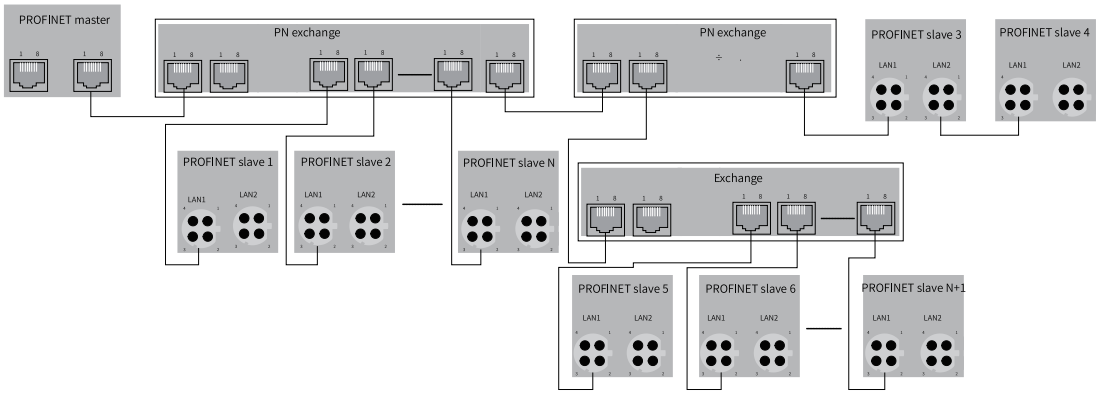


Figure 4-39 Tree network

4.8.2 Wiring of EtherNet/IP

EtherNet/IP requires shielded twisted pair cables of Cat5e (or higher) that complies with the TIA/EIA-568-B standard, with each cable shorter than 100 m.

EtherNet/IP supports bus, star, ring, and tree topologies, as shown in the following diagram.

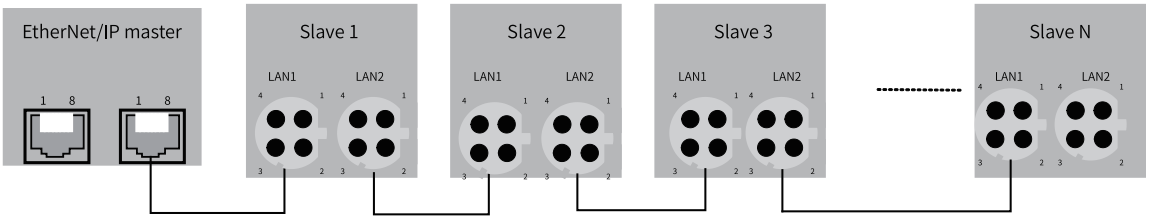


Figure 4-40 Bus topology

For wiring with bus topology, the cable is first routed out from the master to any M12 communication port of the first device, then routed out from another M12 communication terminal to the next device, and so on sequentially.

Bus topology features easy wiring and low cost, but if an upstream device fails, all devices downstream of the fault point cannot communicate.

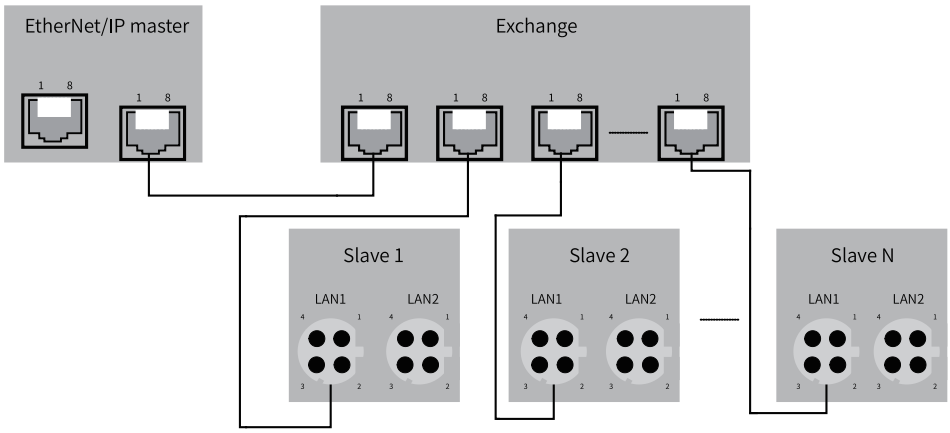


Figure 4-41 Star topology

For wiring with star topology, the cable is first routed out from the master to a network switch, then connected to each device through the switch.

Compared to bus topology, star topology requires an additional switch. A single device failure does not affect communication of other devices, but if the switch fails, communication for all devices is affected.

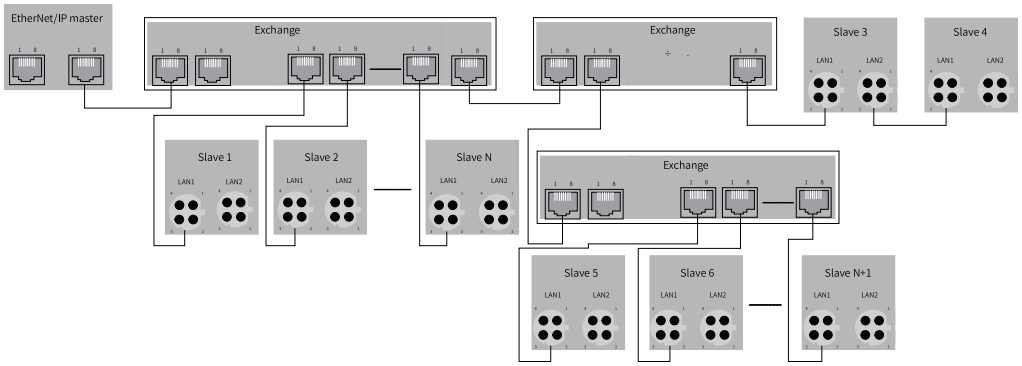


Figure 4-42 Tree topology

Tree topology combines star and bus topologies, allowing flexible layout on-site, but also inherits the drawbacks of both topologies. When a node in the network fails, all devices connected to that node cannot communicate normally.

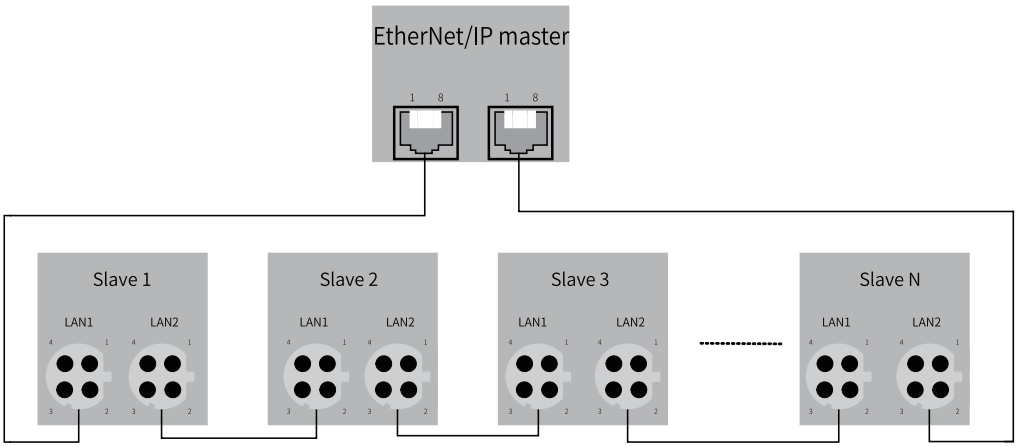


Figure 4-43 Ring topology

Ring topology is a derivative of bus topology. The difference from bus topology is that the cable from the last device is routed back to another terminal on the master. This topology inherits the advantages of the bus topology, and a single node fault within the topology does not affect the entire topology.

CAUTION

Ring topology requires the master to support and enable DLR management function, or the topology must include a DLR manager; otherwise, network storms can occur (broadcast data frames are continuously forwarded without being discarded in the network, causing the amount of data transmitted in the network to increase indefinitely, eventually blocking the entire network), leading to complete failure of the entire topology.

4.9 Cable Routing

The following cables are used for the drive.

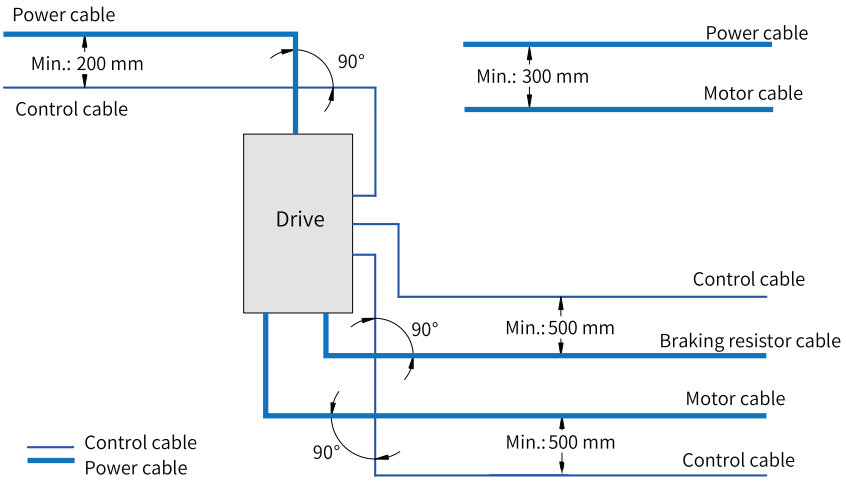
- Input/Output (grounding) cables
- Brake cable
- Signal cable

For detailed cable selection information, see *" Cable" on page 1302*.

Routing requirements:

- Routing signal cables and power cables through different routes
  Signal cables and high-current cables (power input cables, inverter output cables, braking resistor cables) must be routed through difference routes with a separation distance of at least 50 cm. The above requirements must also be followed for wiring inside the control cabinet.
- Motor cables
  Use shielded cables as motor cables. Minimize the distance between the cabinet module and the motor. Route the motor cable independently of other cables, and avoid long-distance parallel routing of the motor cables and other cables to reduce electromagnetic interference caused by rapid changes in the output voltage of the drive.
- Control cables and power supply cables

If the control cables and power supply cables must be cross-connected, make them be cross-connected at 90 degrees, preventing interference caused by parallel routing.



Routing recommendations

- **Routing disturbing cables and sensitive cables**
  Route cables that transmit different types of signals through different routes. Separate the disturbing cables from sensitive cables by a distance of at least 20 cm. If these two types of cables must be cross-connected, make them be cross-connected at 90 degrees to avoid interference, as shown in the following figure.

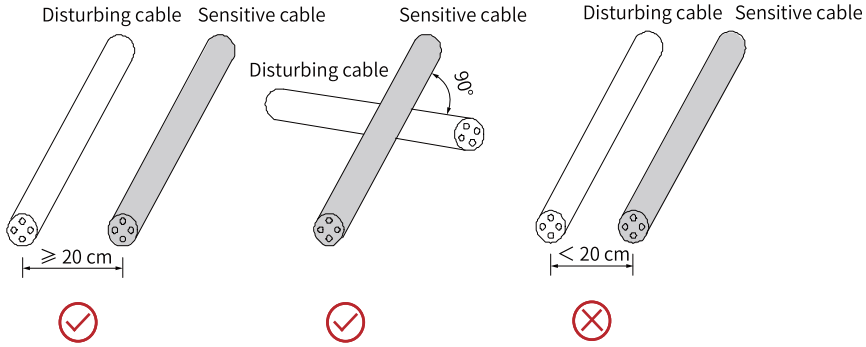


Figure 4-44 Routing disturbing cables and sensitive cables

- **Routing cables that transmit different types of signals**
  Route cables that transmit different types of signals through different routes and separate them with equipotential signal cables. When routing cables that transmit the same type of signals, lay equipotential signal cables at the outer layer and lay equipotential signal cables as many as possible in the middle, as shown in the following figure.

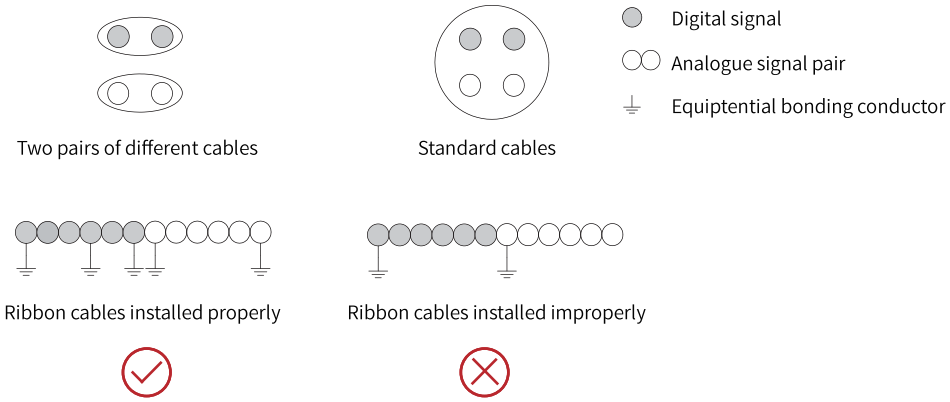


Figure 4-45 Routing different types of signal cables

- **Routing multi-conductor cables**
  For multi-conductor cables, it is recommended that one cable transmits one type of signals. If one cable is used to transmit different types of signals, use the cable with conductors shielded, as shown in the following figure.

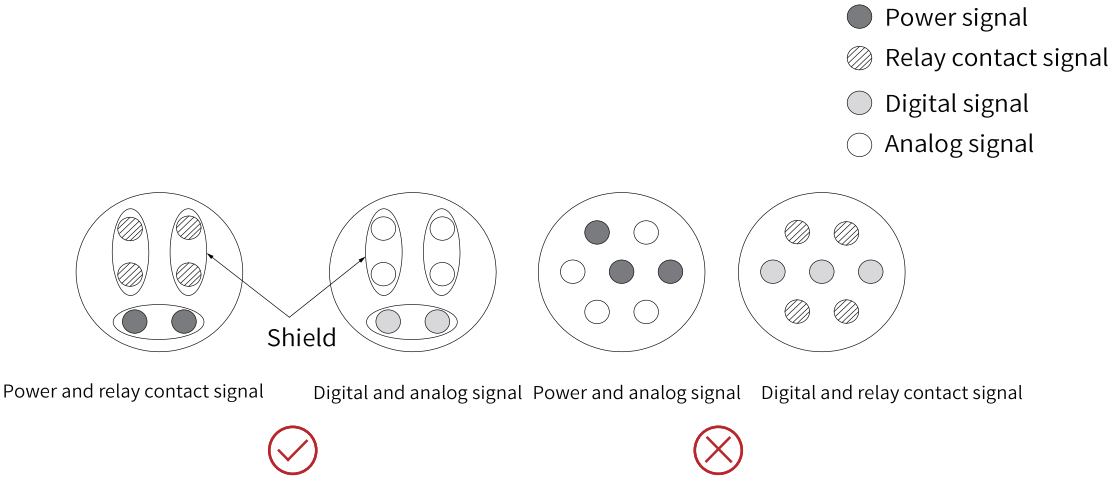


Figure 4-46 Routing multi-conductor cables

If certain conductors in a multi-conductor cable are reserved or unused, connect these conductors to the equipotential bonding point, as shown below.

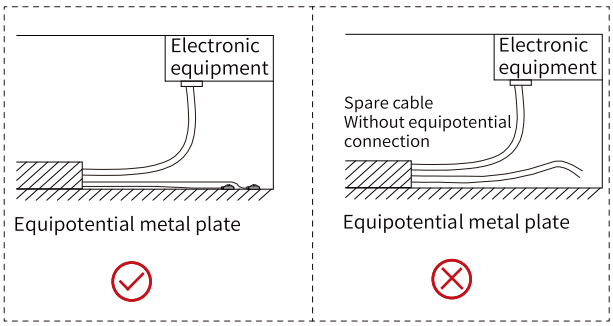


Figure 4-47 Handling of unused conductors in a multi-conductor cable

- **Requirements on the wiring loop area**
  For cables that transmit low-level sensor signals and shared cables that transmit relay signals, lay them close to each other to avoid a large loop area. Use twisted pair cables for analog signals. Lay digital signal cables close to each other.

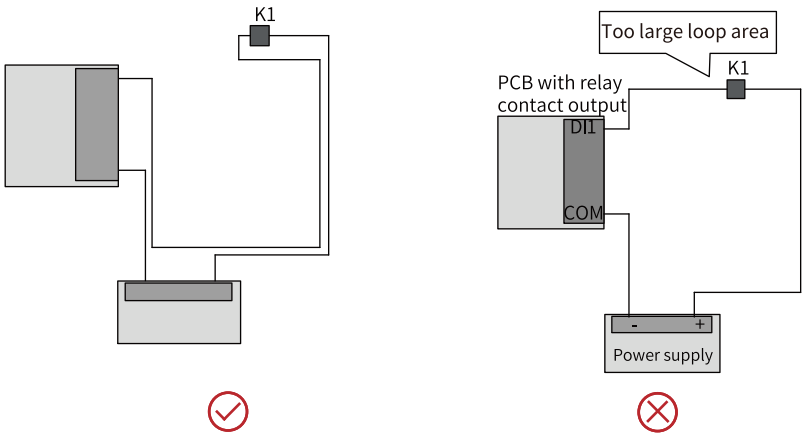


Figure 4-48 Recommended wiring loop area

- **Laying multiple types of cables**

  For cables of different types, route the cables along the equipotential metal plate. To enhance the internal EMC performance, separate different types of cables or separate cables with metal separators (recommended) in the same metal (zinc-iron or stainless steel) duct, as shown below.

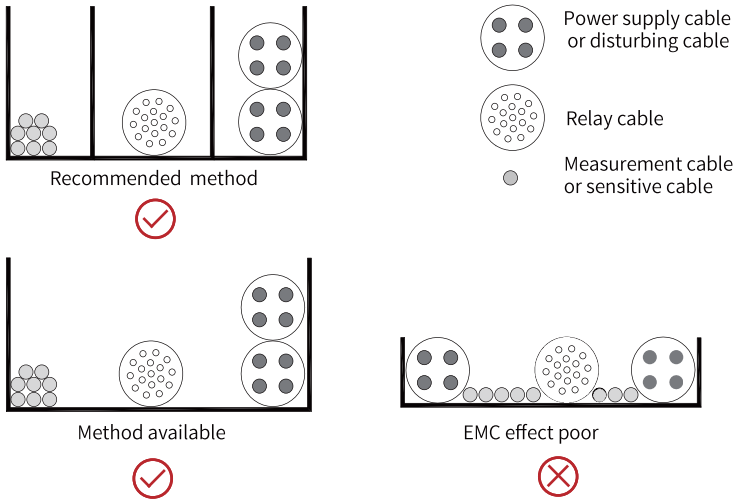
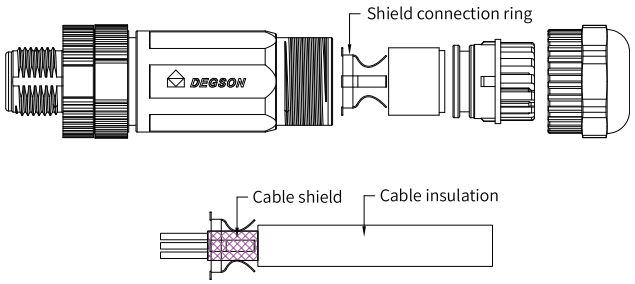


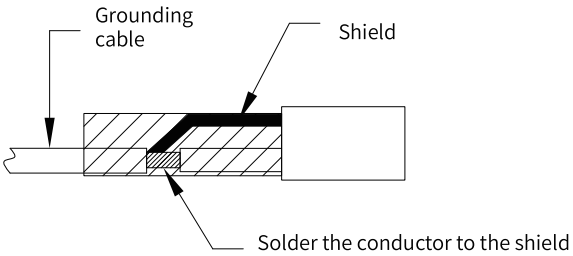
Figure 4-49 Laying multiple types of cables

- **Requirements on handing of shielded cables**

  Both I/O and communication connectors are shielded. The cable shield is wrapped with copper foil and connected to the shield ring of the conductor to allow continuous shielding, as shown below.



  If the motor connector needs to be connected to the shield, solder the shield to the grounding conductor, as shown below.


Grounding
cable
Shield
Solder the conductor to the shield

5 Connecting the Drive

5.1 Cable Preparation

5.1.1 I/O Cables

5.1.1.1 Gland Version

Recommended cable specification: UL2586-12AWGx4C+TAB OD: 14 mm to 17 mm

See the following diagram for design dimensions of cable connection part.

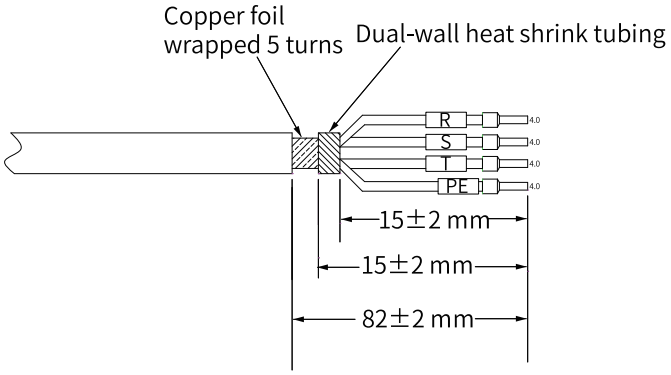


Figure 5-1 Input/Output cable (gland version)

5.1.1.2 Heavy-duty Quick Connector Version

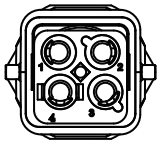
Output heavy-duty connector

Recommended cable specification: UL2586-12AWGx4C+TAB OD: 14 mm to 16 mm

The BOM for the output heavy-duty connector is shown in the following table.

Description	Model	Manufacturer	Quantity for One Drive
Enclosure	H3A-TE-2B-M25	WAIN	1
Housing insert	HQ-003/0-FC	WAIN	1
Male terminal	CCSF-4.0	WAIN	4
PG gland	WNA-M25(D9-16)	WAIN	1

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	R	3-phase output R
	2	S	3-phase output S
	3	T	3-phase output T
	4	PE	Output grounded

See the finished cable below.

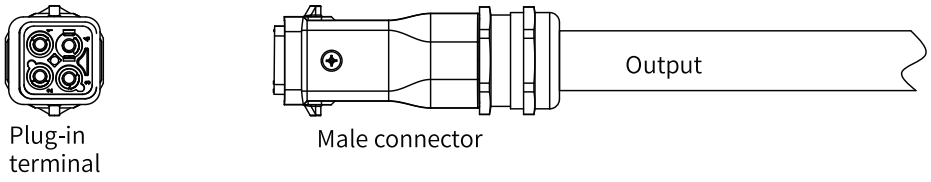


Figure 5-2 Output cable for heavy-duty quick connector version

Input heavy-duty connector

Recommended cable specification: UL2586-12AWGx4C+TAB OD: 14 mm to 16 mm

The BOM for the input heavy-duty connector is shown in the following table.

Description	Model	Manufacturer	Quantity for One Drive
Enclosure	H3A-TE-2B-M25	WAIN	1
Housing insert	HQ-003/0-MC	WAIN	1
Female terminal	CCSM-4.0	WAIN	4
PG gland	WNA-M25(D9-16)	WAIN	1

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	R	3-Phase Input R
	2	S	3-Phase Input S
	3	T	3-Phase Input T
	4	PE	Used for input grounding.

Reference drawing of finished cable

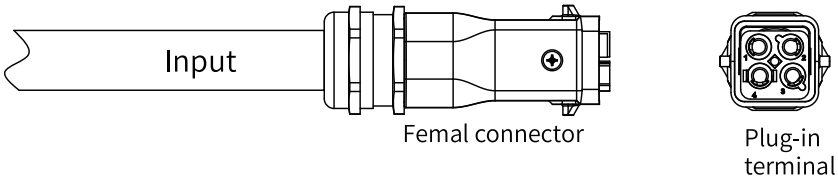


Figure 5-3 Input cable for heavy-duty quick connector version

5.1.2 Braking Cable

5.1.2.1 Gland Version

Recommended cable specification: UL2586-16AWGx2C OD: 7 mm to 10 mm

See the following diagram for design dimensions of cable connection part.

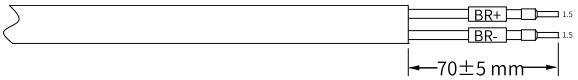


Figure 5-4 Braking cable (gland version)

5.1.2.2 Heavy-duty Quick-Connector Version

Recommended cable specification: UL2586-16AWGx2C OD: 7 mm to 10 mm

Cable selection: DT60N-CAB-X.0-8 finished product (X represents cable length; DT60N-CAB-5.0-8 indicates a 5-meter cable.)

Note: There is no separate connector assembly.

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	BR+	Braking resistor +
	2	PE	Standby
	3	BR-	Braking resistor -

Reference drawing of finished cable

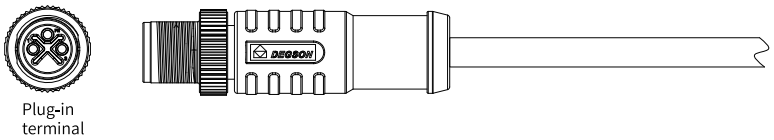


Figure 5-5 Braking cable (connector version)

5.1.3 Motor Output Cable

5.1.3.1 Gland Version

Recommended cable specification: UL2586-14AWGx4C+18AWGx4C+TAB OD: 14 mm to 17 mm

See the following diagram for design dimensions of cable connection part.

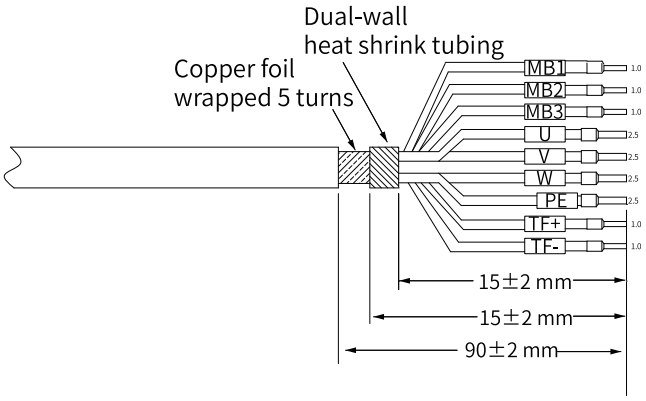


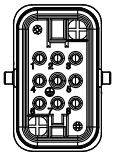
Figure 5-6 Motor output cable (gland version)

5.1.3.2 Heavy-duty Quick Connector Version

Recommended cable specification: UL2586-14AWGx4C+18AWGx4C+TAB OD: 14 mm to 17 mm

Heavy-duty connector - model: HQ-008-MC-TEH - brand: WAIN

Assignment of connector pins is shown in the following table.

Assign-ment	Pin	Function	Description
	1	U	Motor phase U
	2	MB2	Motor brake 2
	3	W	Motor phase W
	4	MB1	Motor brake 1
	PE	PE	Grounding
	5	TF+	Motor temperature detection +
	6	MB3	Motor brake 3
	7	V	Motor phase V
	8	TF-	Motor temperature detection -

See the finished cable below.

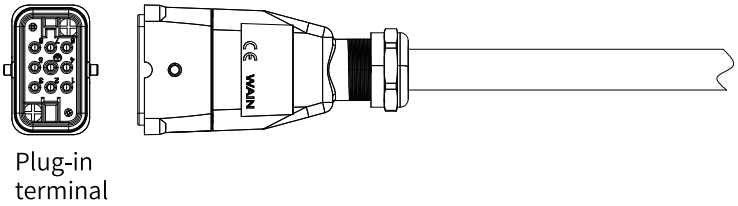


Figure 5-7 Motor output cable (heavy-duty quick connector version)

5.1.4 24 V I/O Cable

5.1.4.1 Gland Version

Recommended cable specification: UL2586-14AWGx5C OD: 7 mm to 10 mm

See the following diagram for design dimensions of cable connection part.

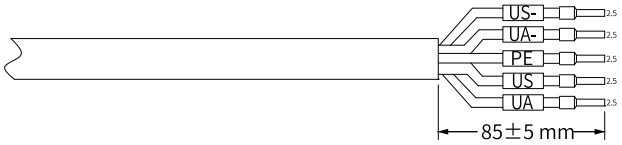


Figure 5-8 24 V input/output cable (gland version)

5.1.4.2 Heavy-duty Quick Connector Version

Input connector

Recommended cable specification: UL2586-14AWGx5C OD: 7 mm to 10 mm

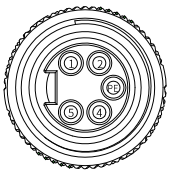
Parallel cable selection: DT60N-CAB-X.0-10 (X represents cable length. DT60N-CAB-5.0-10 represents a 5-meter cable)

Note: There is no separate connector assembly.

24 V input cable selection: DT60N-CAB-X.0-12 (X represents cable length. DT60N-CAB-5.0-12 represents a 5-meter cable)

Note: There is no separate connector assembly.

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	US-0V	DI and 24 V power supply reference ground
	2	US-0V	DO power supply reference ground
	3	PE	System reference ground, which is connected to the drive enclosure
	4	US_24V	DI and 24 V power supply, also capable of powering up the system
	5	UA-24V	Dedicated +24 V power supply for DO (Switched_24 V)

See the finished cable below.

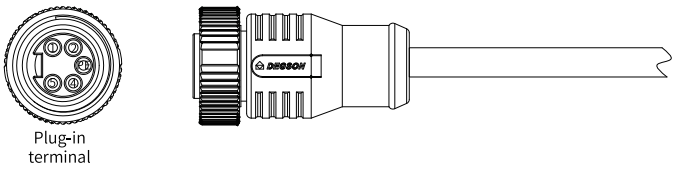


Figure 5-9 24 V input cable with connector

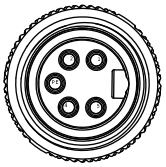
Output connector

Recommended cable specification: UL2586-14AWGx5C OD: 7 mm to 10 mm

Parallel cable selection: DT60N-CAB-X.0-10 (X represents cable length. DT60N-CAB-5.0-10 represents a 5-meter cable)

Note: There is no separate connector assembly.

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	US-0V	DI and 24 V power supply reference ground
	2	US-0V	DO power supply reference ground
	3	PE	System reference ground, which is connected to the drive enclosure
	4	US_24V	DI and 24 V power supply, also capable of powering up the system
	5	UA-24V	Dedicated +24 V power supply for DO (Switched_ 24 V)

See the finished cable below.

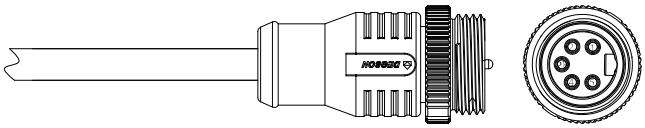


Figure 5-10 24 V output cable with connector

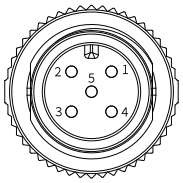
5.1.5 I/O and STO (IO1-IO5/STO) Cables

Recommended cable specification: UL2517-22AWGx5C-AB

See the table below for assembly connector selection.

Description	Model	Manufacturer	Cable outer diameter range (mm)
Non-shielded straight plastic connector	PA-M12A-05P-MM-SL7001-00AH	DEGSON	4.5 to 6
Non-shielded bent plastic connector	PA-M12A-05P-MM-SR7001-00AH	DEGSON	6 to 7.5
Shielded straight metal connector	PASH-M12A-05P-MM-SL7001-00AH	DEGSON	4.5 to 6
Shielded straight metal connector	PASH-M12A-05P-MM-SL7002-00AH	DEGSON	6 to 7.5
Shielded bent metal connector	PASH-M12A-05P-MM-SR7001-00AH	DEGSON	4.5 to 6
Shielded bent metal connector	PASH-M12A-05P-MM-SR7002-00AH	DEGSON	6 to 7.5

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	24 V	24 V power supply (+)
	2	DI/O or STO1	Digital output or STO channel 1
	3	COM	24 V reference ground
	4	DI/O or STO2	Digital output or STO channel 2
	5	Standby	Standby

See the finished cable below.

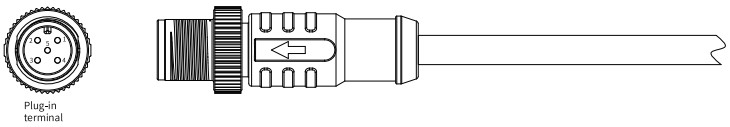


Figure 5-11 IO and STO cables (IO1 to IO5/STO)

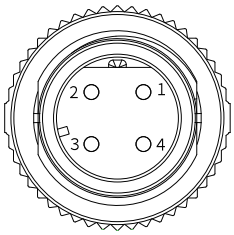
5.1.6 LAN Communication Cable

Recommended cable specification: CAT5E-FTP-4Px24AWG

See the table below for assembly connector selection.

Description	Model	Manufacturer	Cable outer diameter range (mm)
Non-shielded straight plastic connector	PA-M12D-04P-MM-SL7001-00AH	DEGSON	4.5 to 6
Non-shielded bent plastic connector	PA-M12D-04P-MM-SR7001-00AH	DEGSON	6 to 7.5
Shielded straight metal connector	PASH-M12D-04P-MM-SL7001-00AH	DEGSON	4.5 to 6
Shielded straight metal connector	PASH-M12D-04P-MM-SL7002-00AH	DEGSON	6 to 7.5
Shielded bent metal connector	PASH-M12D-04P-MM-SR7001-00AH	DEGSON	4.5 to 6
Shielded bent metal connector	PASH-M12D-04P-MM-SR7002-00AH	DEGSON	6 to 7.5

Assignment of connector pins is shown in the following table.

Assignment	Pin	Function	Description
	1	TD+OUT	TD+ Input/Output
	2	RD+OUT	RD+ Input/Output
	3	TD-OUT	TD- Input/Output
	4	RD-OUT	RD- Input/Output

See the finished cable below.

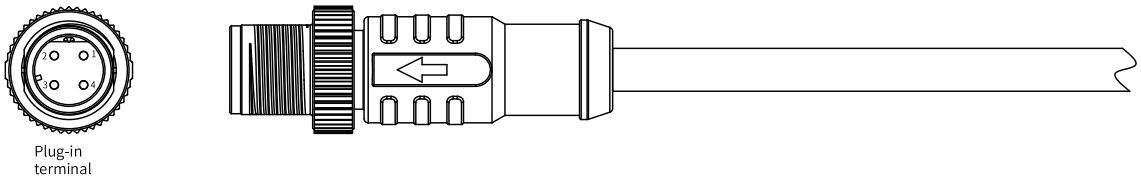


Figure 5-12 LAN communication cable

Note

The total length of the power cables and control cables is customized according to customer requirements.

Insulated terminals are recommended for power terminals to ensure safety compliance.

It is recommended to use pin-type crimped terminals as the control terminals before connecting to the connector to ensure reliability.

5.2 Pre-wiring Inspection

Check the following items before wiring.

Table 5–1 Pre-wiring checklist

No.	Item
1	Cables used during wiring comply with the requirements on the cross-sectional area and the shield.
2	The equipment and the drive are grounded properly.

No.	Item
3	Proper electrostatic discharge (ESD) procedures are followed and antistatic wrist straps are worn.
4	A multimeter meeting the requirements is available.

5.3 Connecting Cables

Before connecting the cables, ensure that the input power supply has been disconnected.

Connecting the cable with gland

The following show how to connect the cable with gland.

1. Disassemble the drive module in the direction indicated by the arrow, as shown below.

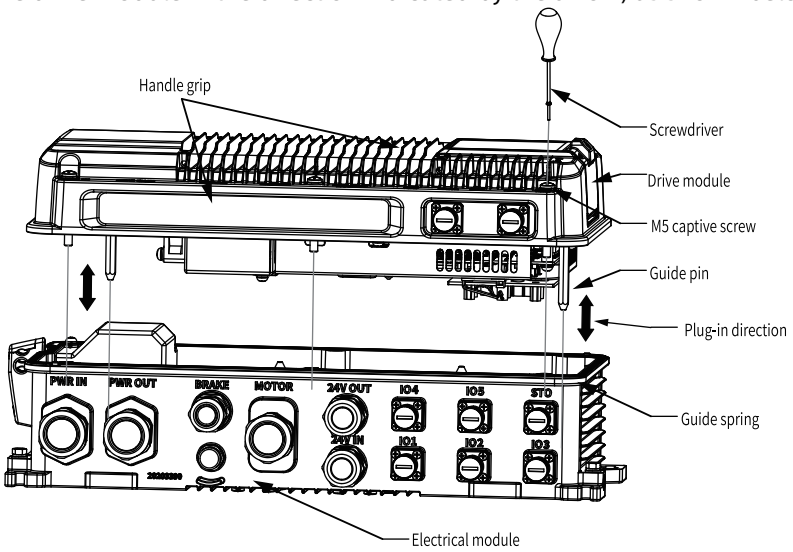


Figure 5-13 Disassembling the drive module

2. Connect the 380 V power cables (R, S, T, PE), 24 V power cables (24V+, 24V-), and output motor cables (U, V, W, PE) of the drive in sequence, and if an external braking resistor is used, also connect the braking resistor cable (BR-, BR+) through screw-less method, as shown below.

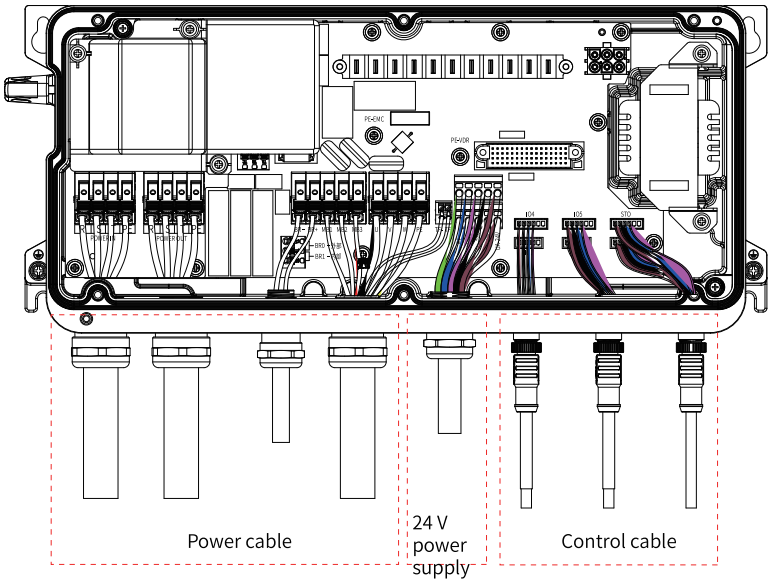


Figure 5-14 Cable connection diagram

3. Re-install the drive module to the electrical module in the same procedure for disassembly, but in the reverse order. Tighten the cover screws with the tightening torque recommended in *"3.4.3 Installation Direction" on page 48*.

5.4 Post-wiring Inspection

After wiring is done, check the following items and tick compliant items.

Table 5–2 Post-wiring checklist

No.	Item	Compliance
1	Power input cables are connected to R, S, and T terminals.	☐
2	Motor input cables are connected to the U, V, and W terminals.	☐
3	The cross-sectional area of the main circuit cables meet the requirements.	☐
4	The heat-shrink tubing has been applied to the copper barrel of the main circuit lug and cable conductors, with the tubing fully covering all exposed conductors.	☐
5	The motor output cable does not exceed 50 m. Otherwise, the carrier frequency needs to be reduced through F0-15.	☐
6	The grounding cable is connected properly.	☐
7	The output terminals and control cable terminals are connected properly.	☐
8	The braking resistor and braking unit with proper resistance are wired properly.	☐
9	The control circuit signal cables are shielded twisted pair cables.	☐
10	Control circuit cables and main circuit cables are routed through different routes.	☐
11	There are no screws, gaskets, or exposed cables left inside the product.	☐

6 Commissioning Tools

6.1 List of Commissioning Tools

Three types of commissioning tools are supported: the built-in local operating panel of the drive, the external operating panel SOP-20, and the iFA Drive commissioning software.

Table 6–1 Commissioning tool list

Tool type	Function	Application scenario	Remarks
Operating panel	The local operating panel is the standard operating panel of the drive. • Provides functions such as status and data display, parameter setting, fault information prompts, and start/stop control. • Installed on the drive by default.	Applicable to simple commissioning of an individual drive.	Standard
External operating panel	The external operating panel SOP-20 is an optional operating panel for the drive. • Provides functions such as status and data display, parameter setting, fault information prompts, and start/stop control. • Connected to the iFA Drive commissioning software through relay mode. • Supports parameter copy and software upgrade functions. • Connected to the drive through an external network cable.	Applicable to commissioning of one or multiple drives.	Option
iFA Drive commissioning software	iFA Drive commissioning software is independently developed by Inovance with full proprietary intellectual property rights. It supports commissioning, fault diagnosis, and operation status monitoring of the drive. Products supported by iFA drive include AC drives, servo systems, and electro-hydraulic servo systems.	Applicable to complex commissioning with a PC.	Option

6.2 Display and Operation

6.2.1 Overview

The standard operating panel for the heavy-duty quick connector version adopts the LED+key structure, with the following functions provided.

- Parameter display: The LED displays parameters, monitoring data, and fault codes. The indicators indicate the current status and the unit of parameters.
- Parameter setting: In each level of menu, the data bit you are operating on will flash. You can use the UP and DOWN keys to increase or decrease numerical values, and switch between the bits through the left and right keys.
- Status monitoring: In the stop or operation state of the drive, the operating panel displays the status information of the drive based on parameter settings (A6-03 to A6-05).

The operating panel for the gland version adopts the LED structure, which provides functions including power indication, DI, DO, communication, and fault status display.

6.2.2 Components

The operating panel is shown in the following figure, including the status display area, parameter display area, and key area.

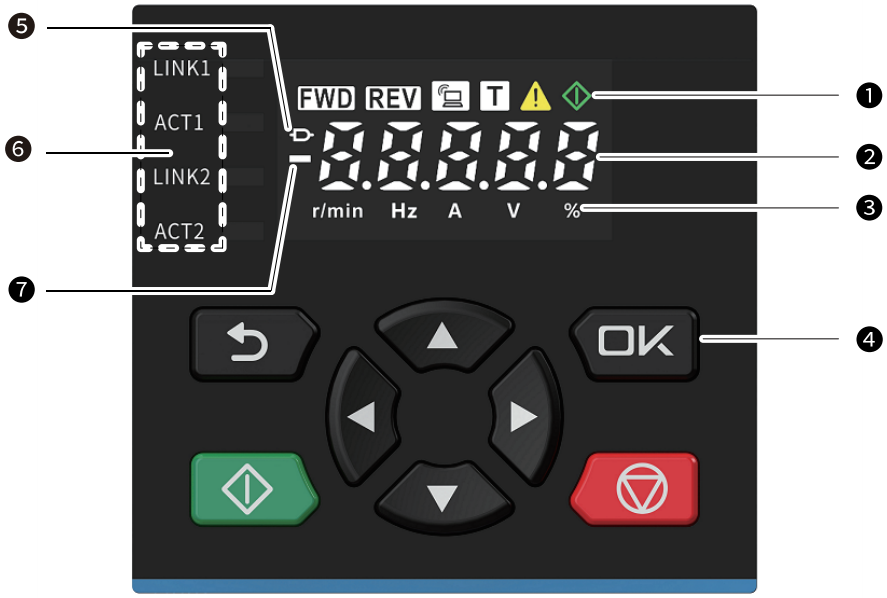


Figure 6-1 Operating panel

Table 6–2 Panel description

No.	Name	Description
①	Status display area	Displays the operation state of the drive. For details, see *"Table 6-3 Description of status bar" on page 105*.
②	Parameter display	Displays parameters of the drive. For details, see *"6.2.3 Display on the Operating Panel" on page 106*.
③	Unit display area	Displays the unit of the currently displayed data.
④	Key area	For details, see *"Table 6-4 Description of keys" on page 105*.
⑤	Connector sign	Steady ON: Indicates that the parameters accessed currently are connector parameters.
⑥	Communication status indicator	Displays the connection state of EtherNet/IP or PROFINET.
⑦	Minus sign	Steady ON: Indicates that the current parameter value is negative or reverse direction applies.

Table 6–3 Description of status bar

Symbol	Name	Function	Status
FWD	Forward (FWD)	Forward run	Steady ON: Indicates that the speed reference direction or the operating direction of the drive is forward.
REV	Reverse (REV)	Reverse run	Steady ON: Indicates that the speed reference direction or the operating direction of the drive is reverse.
	Local/Remote	Local/remote connection mode	Steady OFF: Local (operating panel) control Steady ON: Terminal control Flashing: Communication control Flashing quickly: User-defined control
T	Torque control	Torque control mode	Steady OFF: Speed control mode Steady ON: Torque control mode
	Alarm	Alarm state	Steady ON: A fault or an alarm occurs.
	Operation	Operation state	Steady OFF: The drive does not run. Steady ON: The drive is running.
	Minus sign	Value sign	Steady ON: Indicates that the current parameter value is negative or the direction is reverse.
	Connector	Connector sign	Steady ON: Indicates that the parameters accessed currently are connector parameters.

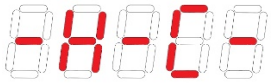
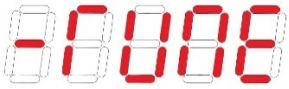
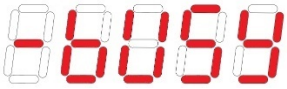
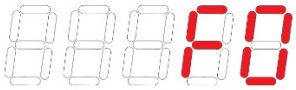
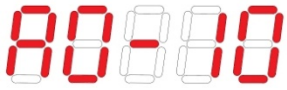
Table 6–4 Description of keys

Key	Name	Function
	Menu/Back	• Used to return to the previous page or undo the operation. • Menu switchover • Holding down this key enters the multi-function menu.
	Enter	• Used to enter the setting page or confirm the settings.
	UP	• Used to increase the parameter value you are operating on.
	DOWN	• Used to decrease the parameter value you are operating on.
	Shift	• Used to switch monitored values in the monitoring page. • Used to switch data bits in the parameter page. • Used to switch basic menus, user menus, and calibrate menus and fault log menus in multi-function menu page. • Used to switch fault log in fault log menu.
	Run	• Used for start operations in operating panel control mode.
	Stop key	• Used for stop operations in the operation state. • Used for reset operations in the fault/alarm state.

6.2.3 Display on the Operating Panel

The main display area of the operating panel consists of five 8-segment LEDs, which display various monitoring data such as the set frequency and output frequency, as well as the current operating state of the AC drive.

Table 6–5 Description of the displayed contents

Type	Keypad display	Definition
Status display		Initializing
		The drive is in the auto-tuning state.
		Busy
		The drive is in the self-test state.
		In SD card parameter copy state (from SD card to drive)
		In SD card parameter read state (from drive to SD card)
Parameter display		Parameter group F0
		A0-10
Connector display		Connector is L2202.
Parameter value display		Parameter value is 321.5 (decimal).
		Parameter value is 0x000E (hexadecimal).

Type	Keypad display	Definition
Fault Display		Fault code E027.1
		Alarm code A028.1
		Minor fault code L028.3
		Prompt code N028.2

6.2.4 Viewing and Setting Parameters

The operating panel adopts a three-level menu to perform operations such as parameter setting. The three levels of menus are shown below.

- Level-1 menu: Parameter group
- Level-2: Parameter
- Level-3: Parameter value

After entering each level of the menu, when the displayed bit flashes, you can press  and  to change the value of this bit. You can also switch to other data bits through  and  .

In the level-3 menu, if the parameter is displayed without flashing bits, this parameter cannot be modified. This may be caused by the following reasons.

- This parameter is a read-only parameter such as the product model, detection value, and operation log.
- This parameter can be changed only after the drive stops.

You can return to the level-2 menu from level-3 menu by pressing  or  . The difference between these two keys is as follows.

- After you press  , the drive saves the parameter value and returns to the level-2 menu and shifts to the next parameter automatically.
- After you press  , the drive returns to the previous level menu corresponding to this parameter, without saving the current parameter value.

The following shows how to set b5-01 [Digital reference of main frequency] to 30.00 Hz through the operating panel.

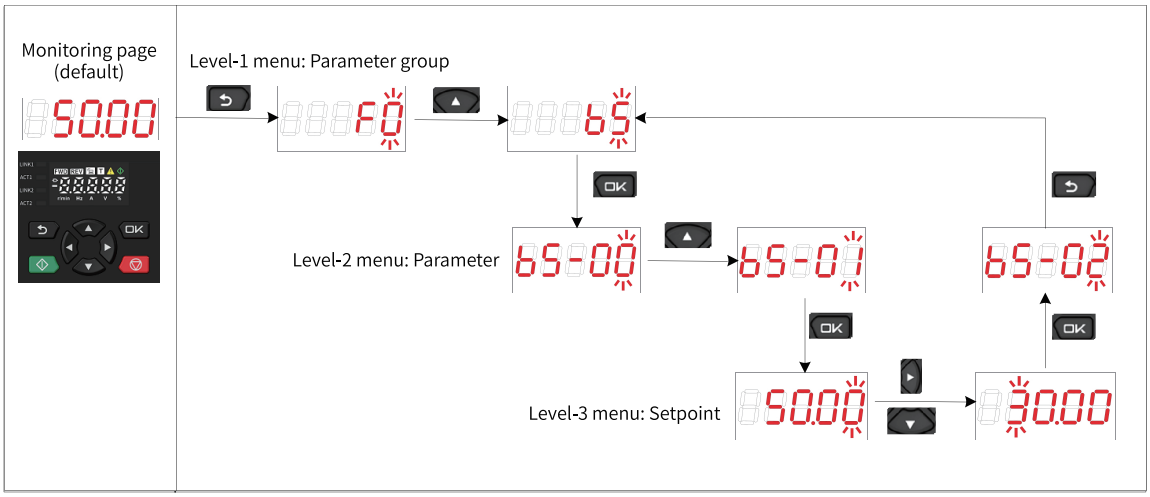


Figure 6-2 Parameter setting procedure

6.2.5 Status Monitoring

The operating panel provides a monitoring page that displays status information of the drive in the stop or operation state.

In the stop or operation state, the operating panel displays the status information of the drive according to the parameter settings (A6-03 to A6-05).

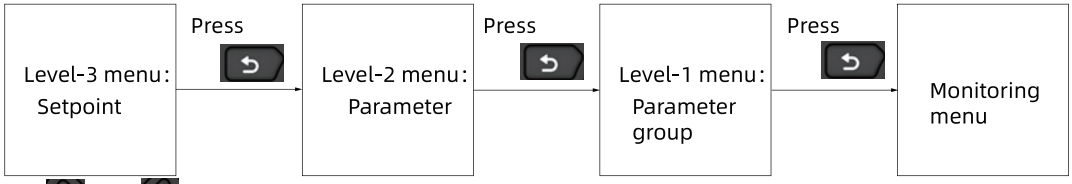
6.2.5.1 Viewing Monitoring Parameters in Stop State

When the drive is in stop state, two default parameters are displayed: set frequency (Hz) and bus voltage (V). You can select monitoring parameters in stop state through A6-05 [Parameter displayed on the LED operating panel at stop].

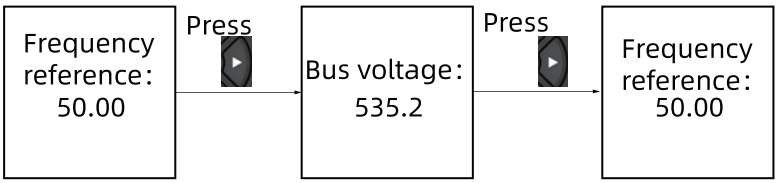
Procedure

1. Enter the monitoring page.
   The monitoring page is displayed by default. If 50.00 is displayed without flashing, it indicates the monitoring page at stop, where 50.00 represents the set frequency in the stop state.

   For example, if the level-3 menu (parameter value) is displayed, you can press  to return to the monitoring page.



2. Press  and  to switch monitoring parameters and view other states.
   By default, the displayed value 50.00 represents the set frequency.



The unit of the current monitoring parameter can be viewed in the unit display area of the operating panel. See the operating panel in *"6.2.2 Components" on page 104*.

3. To modify the default monitoring parameters in the stop state, adjust the corresponding bit in A6-05 [Parameters displayed on the LED operating panel at stop].
   If the bit is set to 1, the parameter can be displayed on the monitoring page of the operating panel. If the bit is set to 0, the parameter cannot be displayed on the monitoring page of the operating panel. For details, see *" Setting Monitoring parameters Displayed on the Operation Panel" on page 732*.

Related parameters

Table 6–6 Monitoring parameter selection in stop state

Param.	Name	Default value	Value range
A6-05	Parameter displayed on LED operating panel at stop	0x0033	bit0: Set frequency (Hz) bit1: Bus voltage (V) bit2: DI input status bit3: DO output status bit9: PLC phase bit11: PID reference bit14: Free mapping 0 bit15: Free mapping 1 Bit values are shown below. 0: Not displayed 1: Displayed

Note

This parameter is an extended parameter, which can accessed only when A0-10 [Current system parameter access level] is set to a non-zero value.

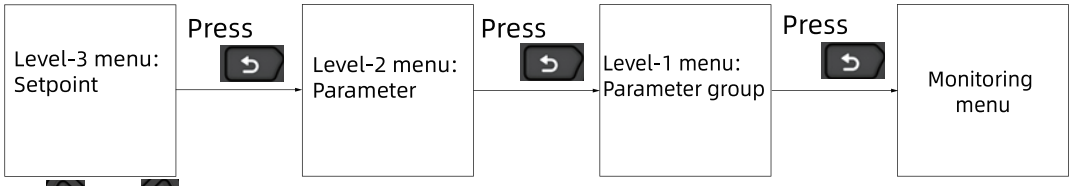
6.2.5.2 Viewing Monitoring Parameters during Operation

When the drive is in the operation state, five default monitoring parameters are provided: operating frequency (Hz), set frequency (Hz), bus voltage (V), output voltage (V), and output current (A). You can select monitoring parameters in the operation state through A6-03 [Parameter 1 displayed on the LED operating panel during operation] and A6-04 [Parameter 2 displayed on the LED operating panel during operation].

Procedure

1. If the status display area  on the operating panel is highlighted, it indicates that the drive is in the operation state.
2. Enter the monitoring page.
   The monitoring page is displayed by default. If 50.00 is displayed without flashing, it indicates the monitoring page during operation, where 50.00 represents the current operating frequency.

   For example, if the level-3 menu (parameter value) is displayed, you can press  to return to the monitoring page.



3. Press  and  to switch monitoring parameters and view other states.
   By default, the displayed value 50.00 represents the operating frequency.

   The unit of the current monitoring parameter can be viewed in the unit display area on the operating panel.

4. To modify the default monitoring parameters during operation, adjust the corresponding bit in A6-03 [Parameter 1 displayed on the LED operating panel during operation] and A6-04 [Parameter 2 displayed on the LED operating panel during operation].
   If the bit is set to 1, the parameter can be displayed on the monitoring page of the operating panel. If the bit is set to 0, the parameter cannot be displayed on the monitoring page of the operating panel.

Related parameters

Table 6–7 Monitoring parameter selection in operation state

Param.	Name	Default value	Value range
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	bit0: Operating frequency (Hz) bit1: Set frequency (Hz) bit2: Bus voltage (V) bit3: Output voltage (V) bit4: Output current (A) bit5: Output power (kW) bit6: Output torque (%) bit7: DI input status bit8: DO output status bit9 to bit13: Reserved bit14: Load speed bit15: PID reference Bit values are shown below. 0: Not displayed 1: Displayed
A6-04	Parameter 2 displayed on LED operating panel during operation	0x0	bit0: PID feedback bit1: PLC stage bit2: Reserved bit3: Operating frequency 2 (Hz) bit4: Remaining operating time bit5: Reserved bit6: Free mapping 0 bit7: Free mapping 1 bit8: Motor speed bit9: Current power-on time (min) bit10: Current operating time (min) bit11: Reserved bit12: Reference set through communication bit13: Encoder feedback speed bit14: Main frequency X bit15: Auxiliary frequency Y Bit values are shown below. 0: Not displayed 1: Displayed

Note

This parameter is an extended parameter, which can be accessed only when A0-10 is set to a non-zero value.

6.3 Operating Panel for Gland Version

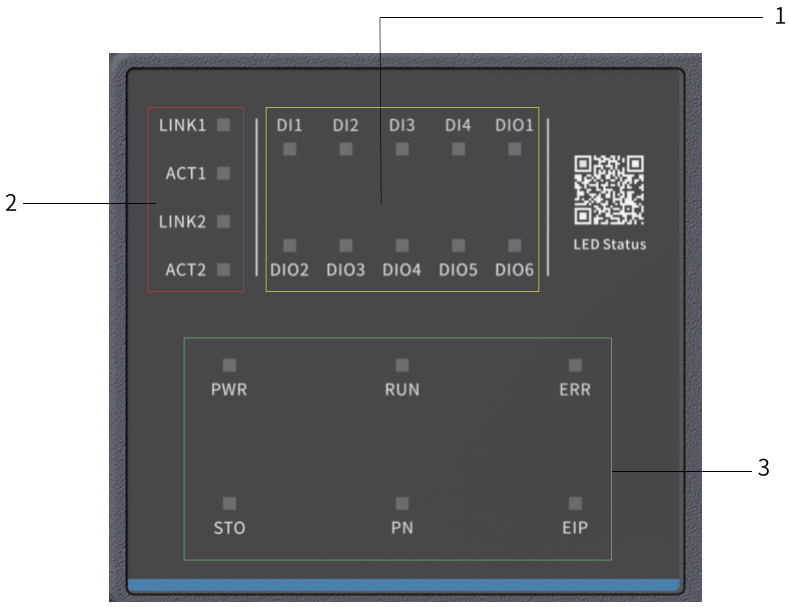


Figure 6-3 Operating panel for the gland version

Table 6–8 Panel description

No.	Name	Description
1	DI/DO status indicator	Displays the current input and output status of DI/DO.
2	Communication status indicator	Displays the current connection status of EtherNet/IP or PROFINET.
3	System operation indicator	Displays the current system status.

Table 6–9 Status description

Symbol	Function	LED color	Status
DI1	DI1 status indicator	Green	ON: DI1 has signal input. OFF: DI1 has no signal input.
DI2	DI2 status indicator	Green	ON: DI2 has signal input. OFF: DI2 has no signal input.
DI3	DI3 status indicator	Green	ON: DI3 has signal input. OFF: DI3 has no signal input.
DI4	DI4 status indicator	Green	ON: DI4 has signal input. OFF: DI4 has no signal input.

Symbol	Function	LED color	Status
DIO1	DI5 status indicator	Green	ON: DI5 has signal input. OFF: DI5 has no signal input.
	DO1 status indicator	Blue	ON: DO1 has signal input. OFF: DO1 has no signal input.
DIO2	DI6 status indicator	Green	ON: DI6 has signal input. OFF: DI6 has no signal input.
	DO2 status indicator	Blue	ON: DO2 has signal input. OFF: DO2 has no signal input.
DIO1	DI7 status indicator	Green	ON: DI7 has signal input. OFF: DI7 has no signal input.
	DO3 status indicator	Blue	ON: DO3 has signal input. OFF: DO3 has no signal input.
DIO1	DI8 status indicator	Green	ON: DI8 has signal input. OFF: DI8 has no signal input.
	DO4 status indicator	Blue	ON: DO4 has signal input. OFF: DO4 has no signal input.
DIO1	DI9 status indicator	Green	ON: DI9 has signal input. OFF: DI9 has no signal input.
	DO5 status indicator	Blue	ON: DO5 has signal input. OFF: DO5 has no signal input.
DIO1	DI10 status indicator	Green	ON: DI10 has signal input. OFF: DI10 has no signal input.
	DO6 status indicator	Blue	ON: DO6 has signal input. OFF: DO6 has no signal input.
Link1	LAN1 EtherNet connection indicator	Green	ON: LAN1 connected successfully
ACT1		Green	OFF: LAN1 not connected
Link2	LAN2 EtherNet connection indicator	Green	ON: LAN2 connected successfully
ACT2		Green	OFF: LAN2 not connected
PWR	Power supply indicator	Green	ON: Bus voltage of the drive greater than 350 V OFF: Bus voltage of the drive lower than 350 V

Symbol	Function	LED color	Status
RUN	Operation indicator	Green	ON: Drive running OFF: Drive stopped
ERR	Fault indicator	Red	ON: A fault occurred on the drive. OFF: No fault occurred on the drive.
STO	STO operation indicator	Green	ON: STO terminal connected properly OFF: STO terminal not connected
	STO fault indicator	Red	ON: An STO fault occurred on the drive. OFF: No STO fault occurred on the drive.
PN	PROFINET indicator	Green	ON: PROFINET communication protocol used for the drive; OFF: PROFINET communication protocol not used for the drive
EIP	EtherNet/IP indicator	Green	ON: EtherNet/IP communication protocol used for the drive OFF: EtherNet/IP communication protocol not used for the drive

6.4 External LCD Operating Panel

6.4.1 External LCD Operating Panel

The external LCD operating panel (SOP-20-810) is a new-generation commissioning tool for the drive. It comes with a wide power supply range and supports multiple buses, parameter setting, status monitoring, simple oscilloscope, parameter copy, fault analysis, program download, and USB relay functions for single-drive/multi-drive systems.

6.4.2 Appearance and Page

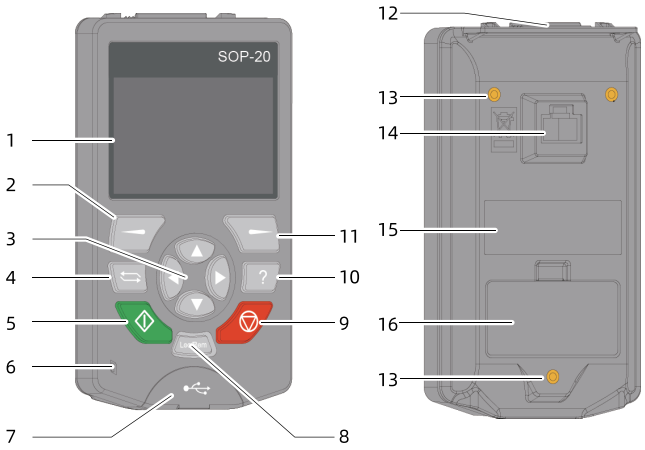


Figure 6-4 Appearance of the external LCD operating panel

Table 6–10 Description of the external LCD operating panel

No.	Name	No.	Name
1	Display	9	Stop/Reset key
2	Left soft key	10	Help key
3	Direction keys	11	Right soft key
4	SHIFT key	12	Snap-fit joint
5	Run	13	Fixing screw
6	Status indicator	14	RJ45 port
7	USB port	15	Product nameplate
8	Loc/Rem key	16	Battery cover

Table 6–11 Description of keys

Key	Name	Description
	Left soft key	Used to execute the function displayed at the left corner of the screen.
	Right soft key	Used to execute the function displayed at the right corner of the screen.
	SHIFT key	Used to quickly enter the device list page. In some interfaces where operations cannot be interrupted, the quick model switchover function is disabled and this key is invalid.
	Direction keys	The UP and DOWN keys are used to select options in a displayed menu and list, scroll up and down a text page, and adjust a value (such as setting time, entering a password, or changing a parameter value). The left and right keys are used to move the cursor left and right.
	Help key	Click the Help button to enter the help page. The help page contains explanatory information related to the current page.
	Run	Used to start the drive in the local control mode.
	STOP key	Used to stop the drive in the local control mode. When the drive is faulty, the stop key is used to reset the drive.
	Loc/Rem key	Used to switch between the control panel (local) and the remote connection (remote).

Main page display

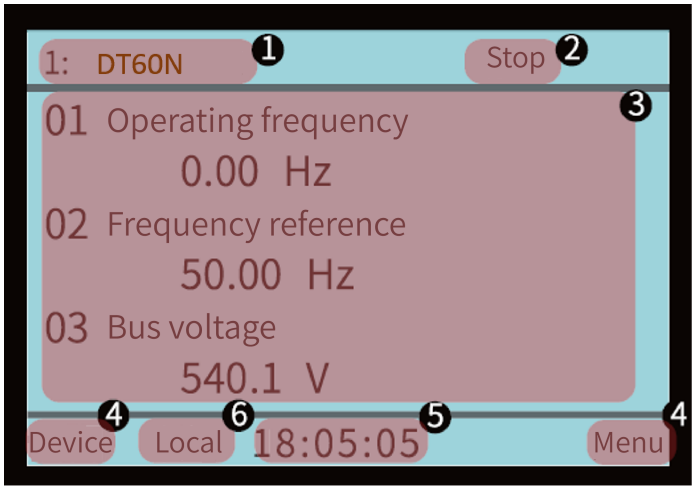


Figure 6-5 Main page of the external LCD operating panel

- ❶ Current device equipment information: The number in the front is the station No. The description followed is the device name.
- ❷ Device status and fault information: Displays the operating status of the current device. When a fault occurs on the device, fault information flashes on the display, and the operating status is no longer displayed.
- ❸ Content area: Displays actual content in this area. The content varies with different views. The preceding example is a homepage view.
- ❹ Soft key selection: Displays the soft key function in the given context.
- ❺ Clock: Displays the current time.
- ❻ Control position (inverter unit):
  - Loc: Local control by the external LCD operating panel is enabled.
  - Rem: Remote control by I/O terminal or bus is enabled.
  - _: This function is unavailable on the device.

6.4.3 Wiring

For commissioning purpose, connect the RJ45 port on the back of the external LCD keyboard to the RJ45 port on the operating panel side of the drive through a standard network cable. Ports on the drive are shown below.

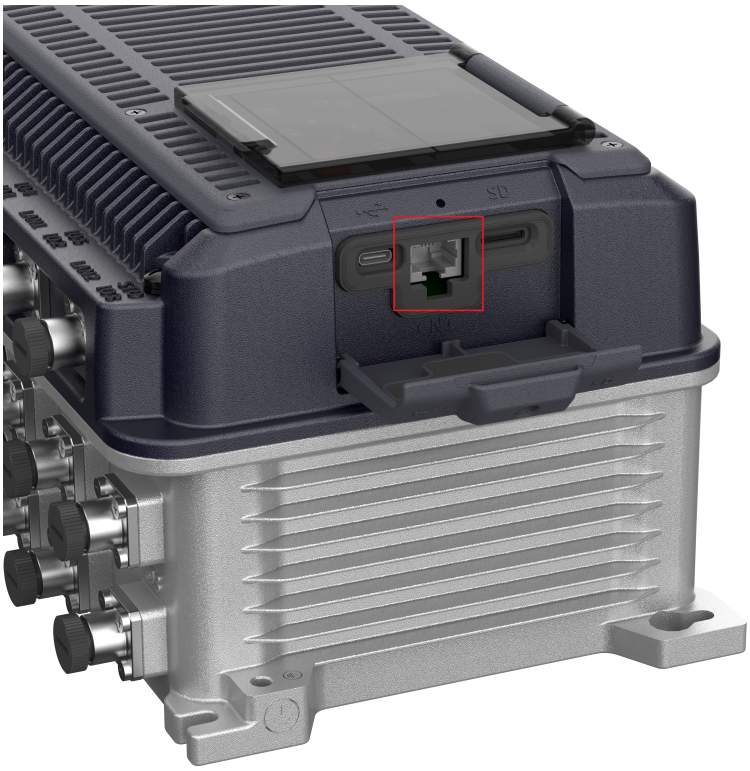


Figure 6-6 Connection between the LCD operating panel and drive

6.4.4 Status View

After the external LCD operating panel is wired, the status information of the current drive is displayed on the main page, as shown in the following figure. Press  and  to view more status information.

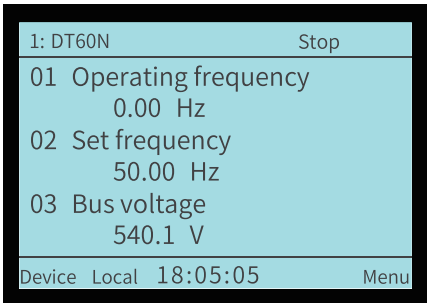


Figure 6-7 Status view

Press  to enter the device list page. Press  and  to move the cursor. Select the target device, then press  to enter the device status information page.

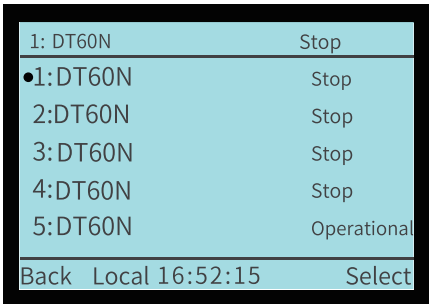


Figure 6-8 Device list

6.4.5 Parameter Setting

Press  in the main page to enter the parameter setting page, as shown below.

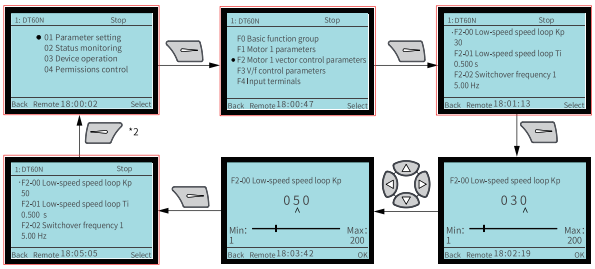


Figure 6-9 Parameter setting

Note

To set parameters of other devices, press  on a page with  to directly enter the device list page.

6.4.6 Jog Function

The motor jog function can be triggered through the RUN and STOP keys on the operating panel only in the local control mode.

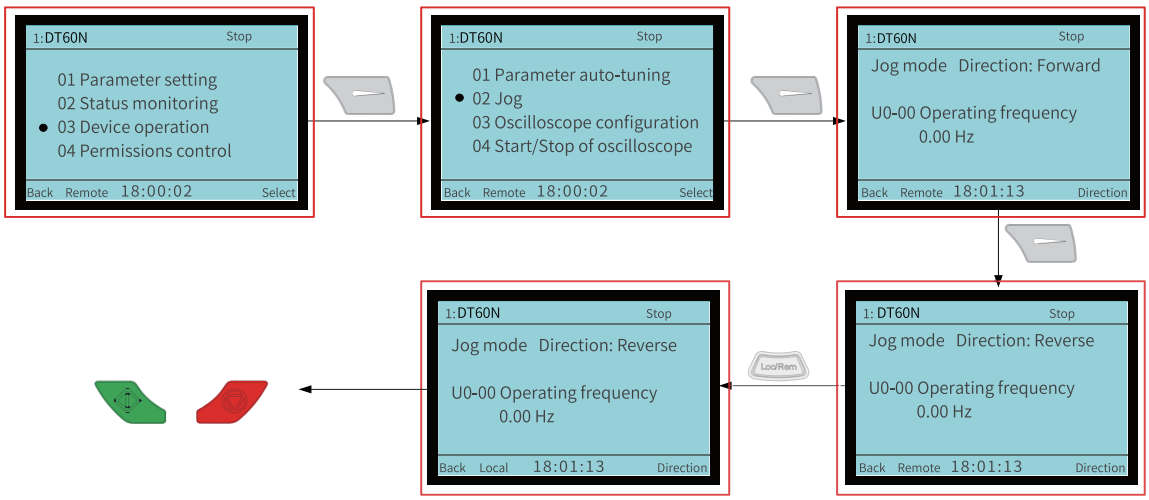


Figure 6-10 Jogging

Caution

To set the jogging function of other devices, press [ ] on a page with [ ] to directly enter the device list page and select the device.

6.4.7 Parameter Copy

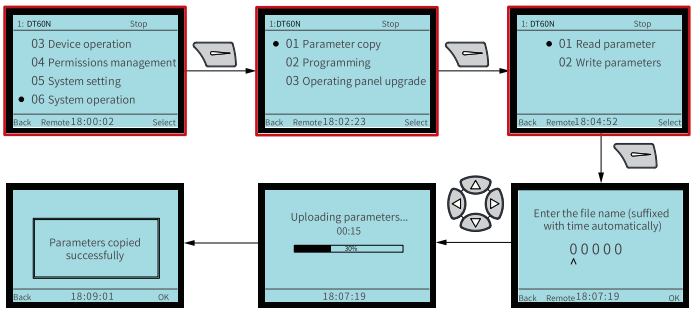
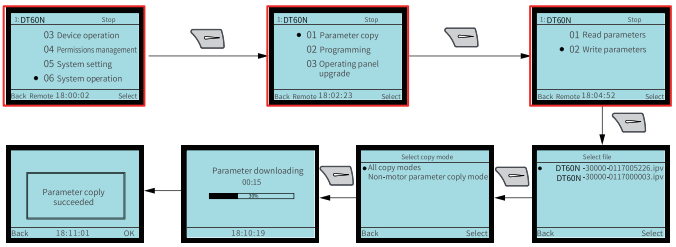


Figure 6-11 Parameter uploading



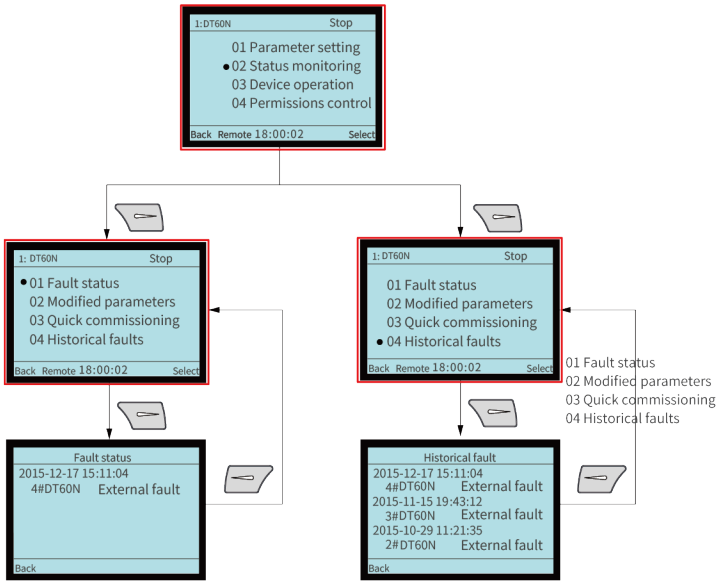


Figure 6-12 Parameter downloading

Caution

To perform parameter copy or programming on other devices, press on a page with to directly enter the device list page and select the device.

6.4.8 Fault Query

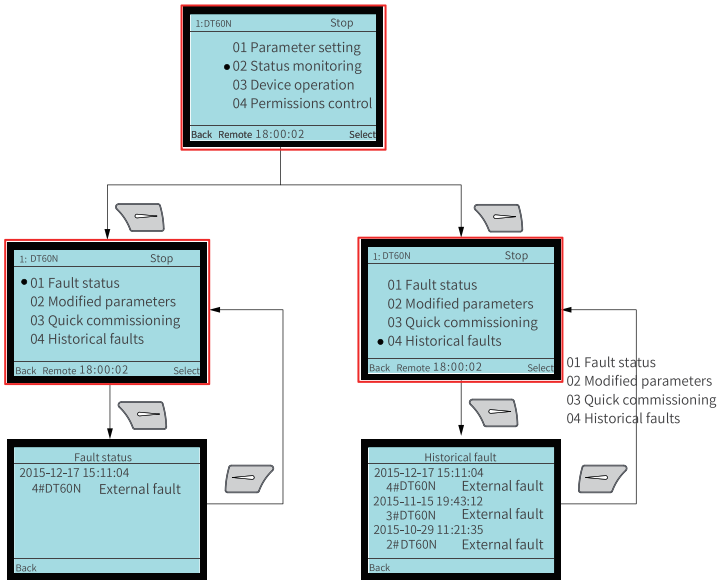


Figure 6-13 Fault query diagram

Caution

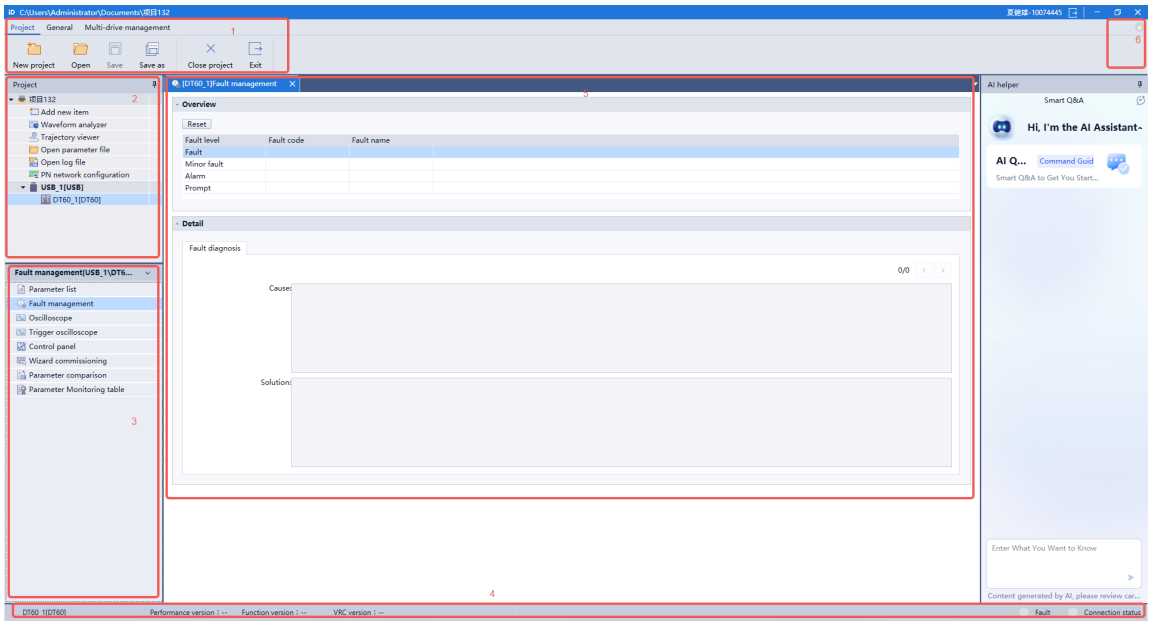
- The fault state page displays the active fault information list. The historical fault page displays the historical fault information list.
- To check faults of other devices, press on a page with to directly enter the deivce list page and select the device.

6.5 iFA Commissioning Software

6.5.1 Software Pages

6.5.1.1 Main Page

The page is divided into 5 function areas, providing access to commonly used functions. Each function area provides users with abundant information and functions.



No.	Function area	Introduction
①	Toolbar	Includes projects, general functions, multi-drive management, and control panel.
②	Project tree	The project tree is the entrance for displaying and operating all project data, showing nodes in tree and table formats. The following tasks can be performed in the project tree.
③	Workspace	Provides general functions and device-specific functions.
④	Status bar	Displays drive operating status.
⑤	Function operation area	Displays function information.
⑥	Page style switchover	The status bar locates at the bottom of the main page and supports switchover between multiple styles.

6.5.1.2 Toolbar

After the main page is opened, the toolbar remains visible, providing common operations such as "Project," "General," "Multi-drive management," and "Control panel."

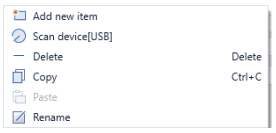
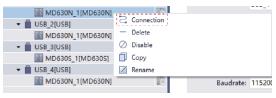
The following table shows the toolbar categories and their corresponding icon descriptions.

Toolbar categories	Icon	Definition	Description
Item		New	Create and open a new project by entering the required information.
		Open	Select and open the target project from existing local projects.
		Save	Save the current open project data, which is in working state, to the original project path.
		Save as	Save the current commissioning project to a user-defined local location.
		OFF	Close the current commissioning project.
		Exit	Exit the current commissioning project.
General		General	General software configuration
		Check for updates	Used to view iFA Drive software version information and provide software version upgrade function.
		Waveform analyzer	Used to view waveform data exported from oscilloscope and black box for offline analysis.

Toolbar categories	Icon	Definition	Description
		Trajectory viewer	Used to view historical data exported from "Motion trajectory and simulation" for offline analysis.
		Opening parameter file	Used for offline viewing and editing of encrypted parameter files in the form of .dat.
		Opening log file	Open drive event log files (drive logs) in format of ".InoDeviceLogList" and ".InoDeviceLogList".
Multi-drive manage-ment		Importing parameter file	Used to import multi-drive parameter files and download them to the drive.
		Exporting parameter file	Used to export selected parameter files and save them as files.
		Editing parameter file	Open parameter files. Parameter values in the files can be edited.
		Parameter copy	Export parameters from devices in the network and import them to applicable device selected.
		Compare	Select a recipe file and compare it with the networked device. Parameters with different values will be listed.
Control panel		Emergency stop	Used for executing emergency stop on the selected device in the current project tree.
		Exit emergency stop	Used to exit the emergency stop state of the selected device in the current project tree.
		Software reset	Used to perform a software reset on the selected device in the current project tree.

6.5.1.3 Project Tree

The project tree is the entrance for displaying and operating all project data, showing nodes in tree and table formats. The following tasks can be performed in the project tree.

Illustration	Icon	Definition	Description
		Adding a new item	Add a new item.
		Scanning device [xxx]	Scan the property of existing devices. xxx represents the corresponding link. For example: Scan device [USB].
		Delete	Delete an existing link.
		Copy	Copy a link.
		Paste	Paste the copied device to the link.
		Rename	Rename an existing link.
		Connect	Link an existing device.
		Delete	Delete an existing device.
		Disable	Disable an existing device.
		Copy	Copy an existing device.
		Rename	Rename an added device.
		Calling device	Call an existing device.

Delete device

For deleting drives or USB nodes, do as follows: right-click on the node, then click the "Delete" in the pop-up menu.

Note: The delete operation is cascading, which means any child devices under the device will also be deleted. The corresponding link node must be switched to offline mode before deletion.

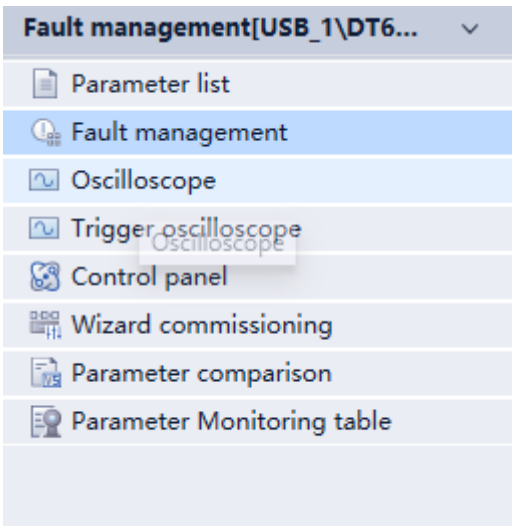
Edit the content within a node in the workspace, and the detailed view will be refreshed accordingly.

6.5.1.4 Workspace

The workspace has two layout modes: list mode and tile mode. List mode is used by default, and you can switch between modes using the "  " button in the upper-right corner of the workspace.

The software tool automatically loads and displays the functions supported by the connected device. The following diagram takes SV680N as an example.

Table 6–12 Layout mode selection

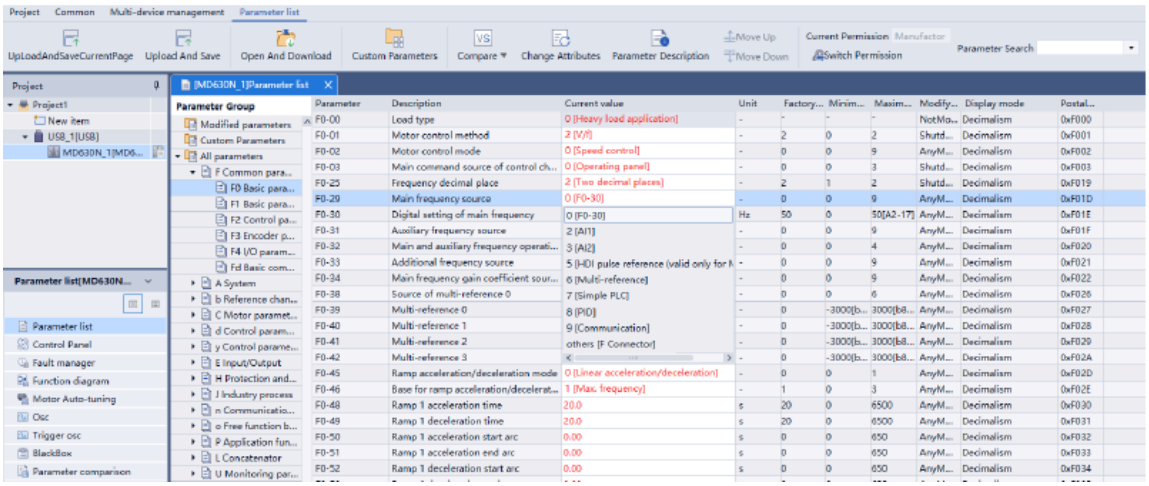
Icon	Definition	Layout preview
	Tile mode	

6.5.1.5 Function Operation Area

After you double-click on a certain function, all the information of this function are displayed in the function operation area.

After double-clicking on a function in the workspace, the corresponding detailed operation form expands on the right side.

The following takes "SV680N parameter list" function as an example.



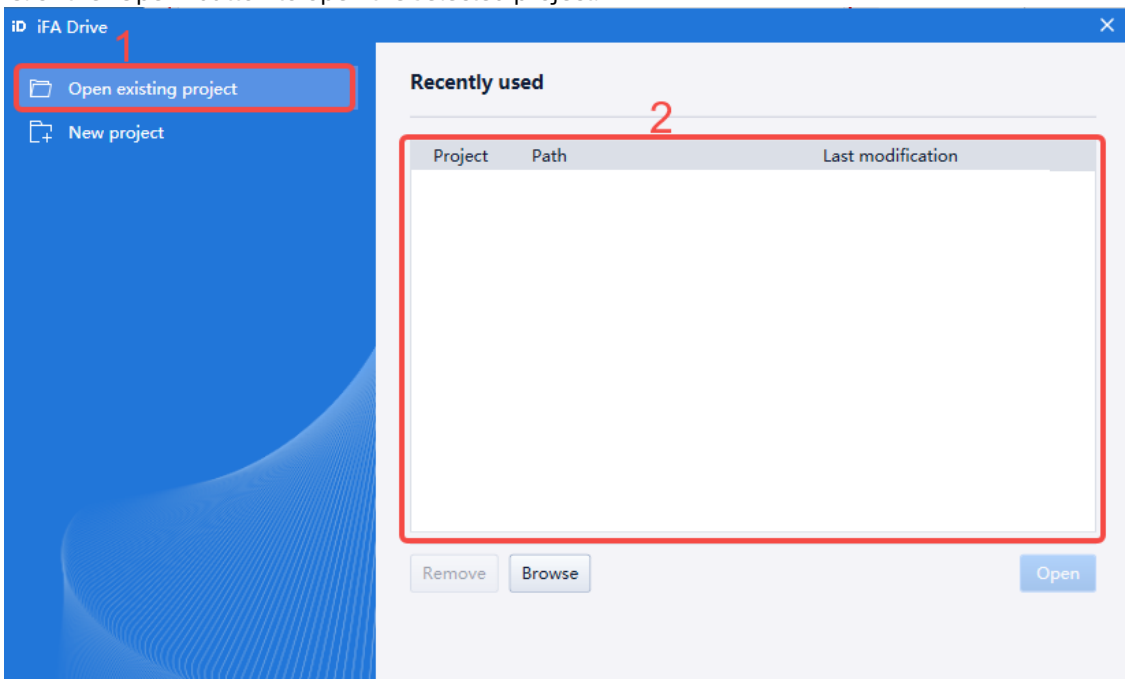
1. You can switch or close the function operation form by clicking the buttons in the title bar at the top of the workspace.
2. You can achieve grouped display of function operation forms by right-clicking the buttons in the title bar at the top of the workspace. You can adjust the distribution of each function within each group using "Move to previous group" and "Move to next group" buttons.

6.5.2 Quick Start

After launching the software, you need to enter a specified project, which can be an existing project or a newly created project.

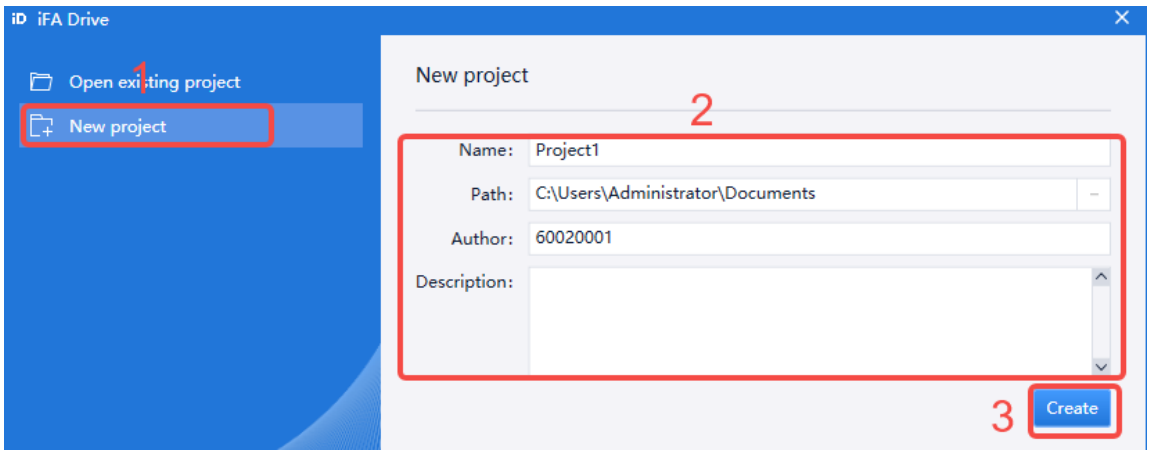
Opening an existing project

1. Click "Open existing project".
2. Select the corresponding project.
3. Click the "Open" button to open the selected project.



Creating a new project

1. Click "New project".
2. Set the "Project name," "Path" for project storage, and "Description" of the project.
3. Click "Create" finally.



6.5.2.1 Creating a Project

New project wizard

Configure the link for a proper use of the drive.

After clicking "Add new item" button on the left, the "New project wizard" window will pop up.

- Single link
  There are 5 types of links: Serial, USB, EtherNet, and PROFINET. The following shows how to configure the link through USB link.

  1. Configure the link.

     After selecting the link "USB" needed, fill in optional information such as "Link selection, baud rate, station number range", then click the "Next" button to create the corresponding link.

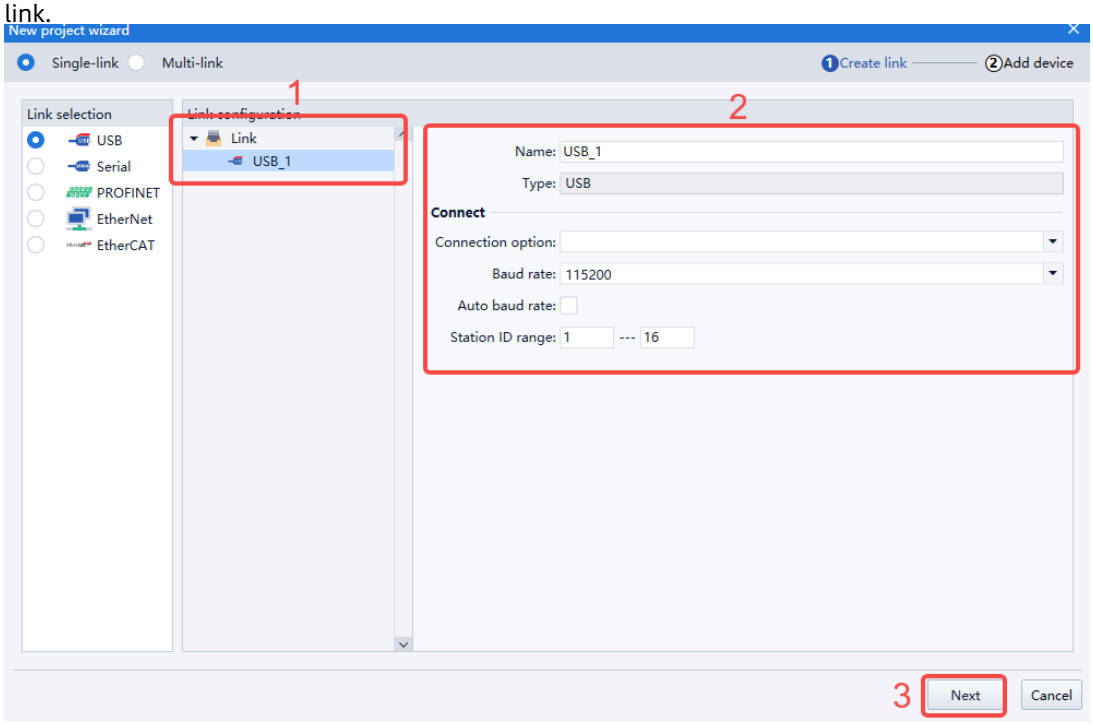


Table 6–13 Description of the USB parameter configuration page

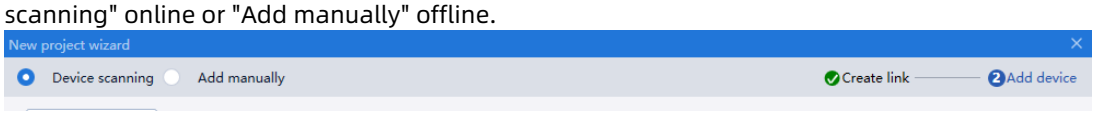
Function	Description
Name	Displays the name of the USB node, which is editable. The node name changes in real time during editing.
Type	Displays the device connection type, which is not editable.
Connection selection	Displays the identifier of the connected device, which is presented as a drop-down box. Each device is assigned with an identifier. If no device is connected, the field is empty.
Baud rate	Displays the baud rate for device communication, which is presented as a drop-down box.
Adaptive baud rate	Presented in the form of CheckBox. Check to enable automatic adaptation to different baud rates.
Station number range	Device station number, editable, range: [1, 255]

Note: Communication parameter configuration is for device scanning. Setting the correct station number range allowed connected devices to be scanned properly.

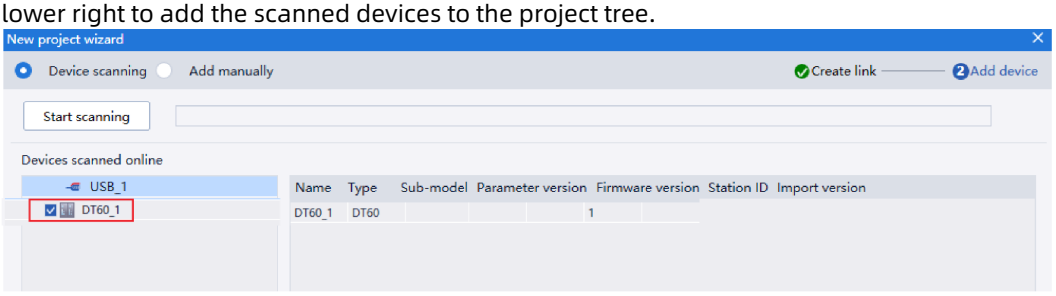
2. Add a device.

After links are added, you can start to add devices. You can add device through "Device scanning" in online mode or "Add manually" in offline mode.

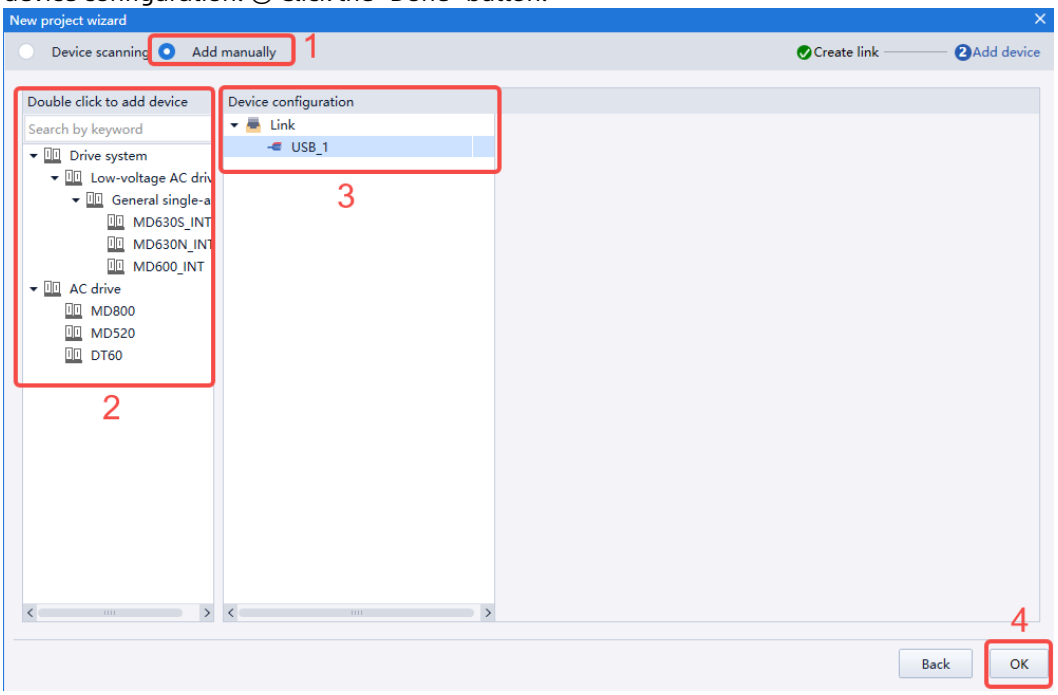
After links are added, you can start to add devices. You can add device through "Device scanning" online or "Add manually" offline.

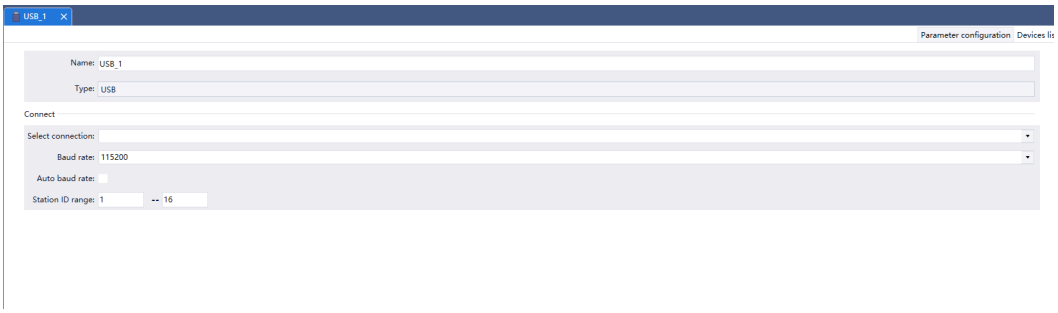


- "Device scanning" in online mode: Click the "Start scanning" button and wait for the progress bar to complete. Scanned devices are listed on the left. Click the "OK" button at the lower right to add the scanned devices to the project tree.



- "Add manually" in offline mode: ① Click the "Add manually" button. ② Select the link, then double-click the device node to be added. ③ The device node is automatically added in the device configuration. ④ Click the "Done" button.

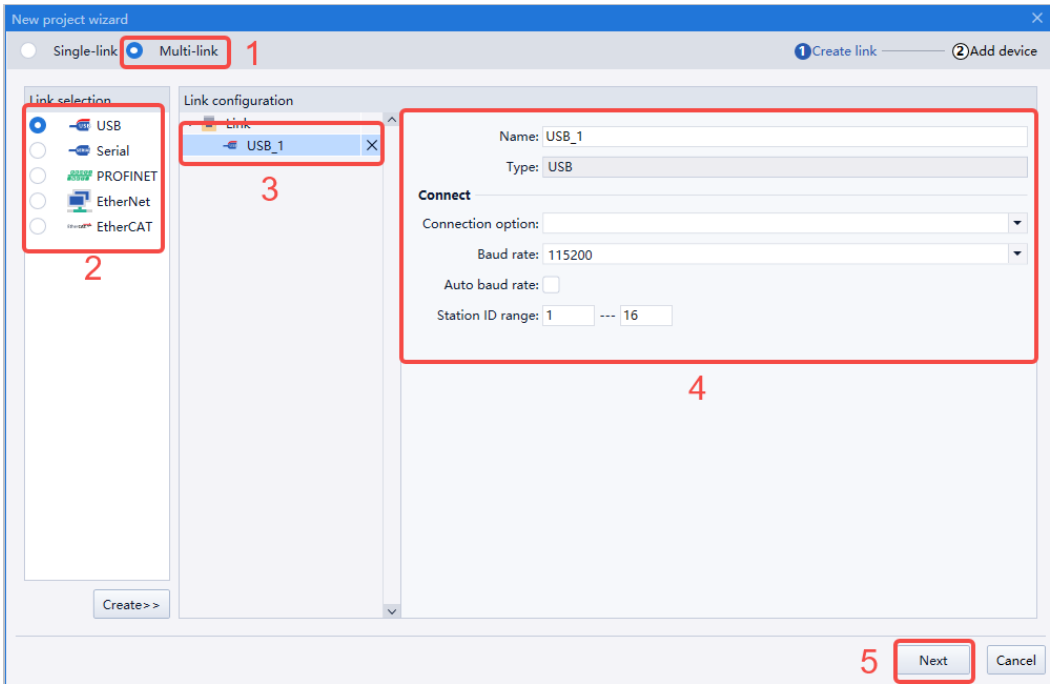




- Multiple links

  Links including Serial, USB, and PROFINET are available. The following shows how to configure the link through Serial and USB links.

  1. ① Click the "Multi-link" button. ② Select "Link". ③ Click the "Create" button. ④ The configuration page for this link can be displayed in the link configuration; ⑤ Enter the corresponding link configuration parameters. ⑥ Click the "Next" button.

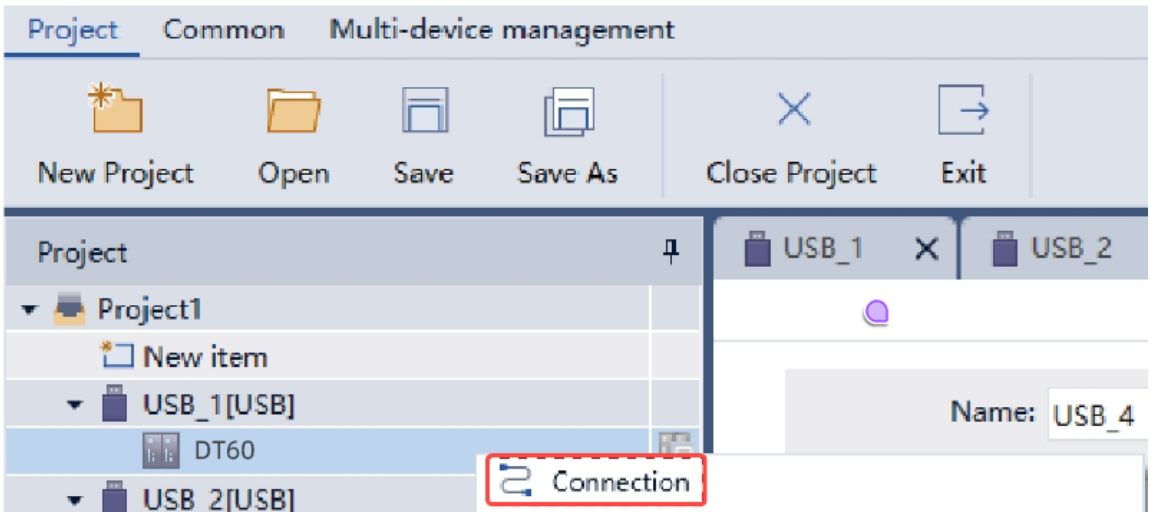


  2. Add a device. See the operation method in "Single link". The following shows the page when devices are added.

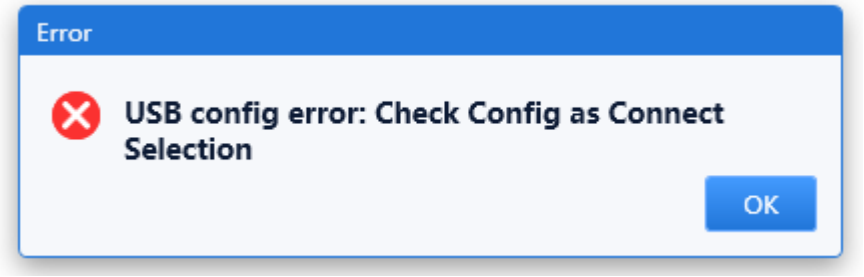


6.5.2.2 Connecting the Drive

After adding the corresponding device, click the "Connect" button. The drive can only be commissioned only after it is connected properly.



1. Scanning may fail, as shown in the figure below. This usually occurs when no device is connected or when the connection is incorrect.



6.5.3 General Functions

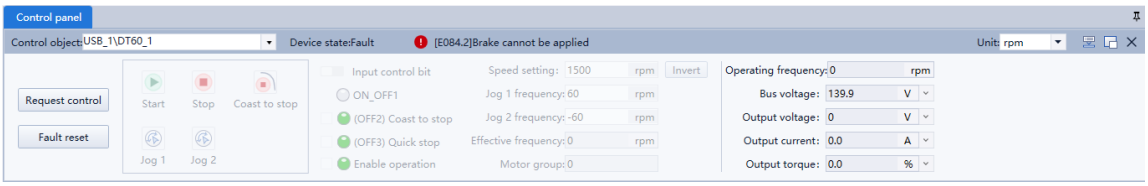
6.5.3.1 Control Panel

The control panel is used to perform trial run on the drive and monitor actual values of drive status and critical variables.

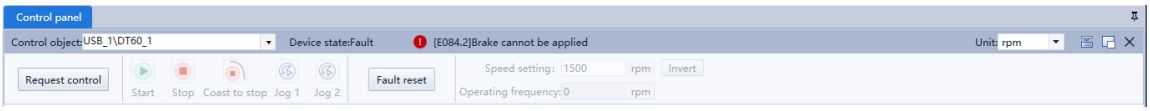
The control panel page mainly consists of control permissions, fault reset, motion control, control bit, parameter read/write, parameter monitoring, unit switchover, panel switchover, equipment status monitoring, fault information monitoring, and control object switchover.

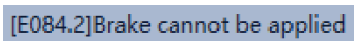
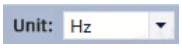
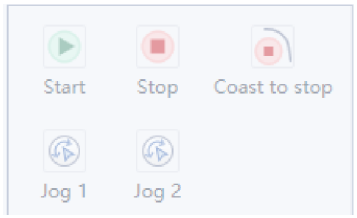
The control panel page is shown below.

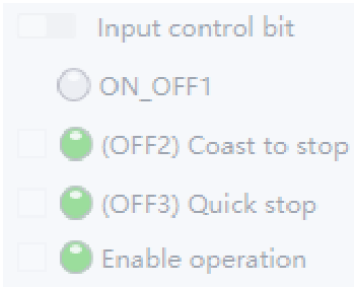
Full panel



Basic panel



Function	Icon	Description	
Control object		Function: Used to select the device to be controlled. It can control all devices under the current network link. The dropdown list displays device names. Multi-axis devices display the device name plus the corresponding parent device name. For example, the MD800 inverter is shown as: Inverter_1[MD800_1]. Rectifiers do not support this function. Note: • Name and ToolTips follow the project tree node. • Selectable only and non-editable	
Device status		Displays the current status of the device.	
Fault information		Displays information of the fault with the highest priority.	
Unit switchover		Used to switch the unit. After unit switchover, the corresponding description or unit in the parameter setting area and parameter monitoring area change accordingly, with related values converted synchronously.	
Switchover between full panel/basic panel		Used to switch the panel state.	
Switchover between floating panel and fixed panel		Used to switch the panel state.	
OFF		Used to close the control panel.	
Request control/ Release control		Used to switch between request control and release control. Note: If the control panel is not activated, this function is disabled.	
Fault reset		Used to reset faults that can be reset for all devices.	
Motion control		Used to control device motion.	
		Start	Used to start the device.
		Stop	Used to stop the device.
		Coast to stop	Used to make the device coast to stop.
		Jog 1/Jog 2	Used to control device motion in jog mode. Motion starts when this button is pressed and stops when released.
		Note: If control permissions is not acquired, this function is disabled.	

Function	Icon	Description	
Input control bit		Used to enable the control function of the control bit.	
		ON_OFF1	Start/Stop status indicator
		ON_OFF2	Stop mode control
		ON_OFF3	Stop mode control
		Operation enable	Operation enable control
		Note: If the control panel is not activated, this function is disabled.	
Parameter setting and detection		Used to read and write related parameters.	
		Frequency setting	Write upon focus loss or through Enter key.
		Invert	Used to invert the frequency reference and write it.
		Jog 1 frequency/Jog 2 frequency	Write upon focus loss or through Enter key.
		Effective frequency	Read-only
		Motor set	Read-only
		Operating frequency	Read-only
		Bus voltage/Output voltage/Output current/Output torque	Non-editable. You can select monitored items from the drop-down list.
		• Write upon focus loss or through Enter key. • Read upon focus loss.	

6.5.3.2 Parameter List

The parameter list function provides display and management of parameters, which include parameter information display, parameter upload/download, property update, parameter description, and user-defined parameter management.

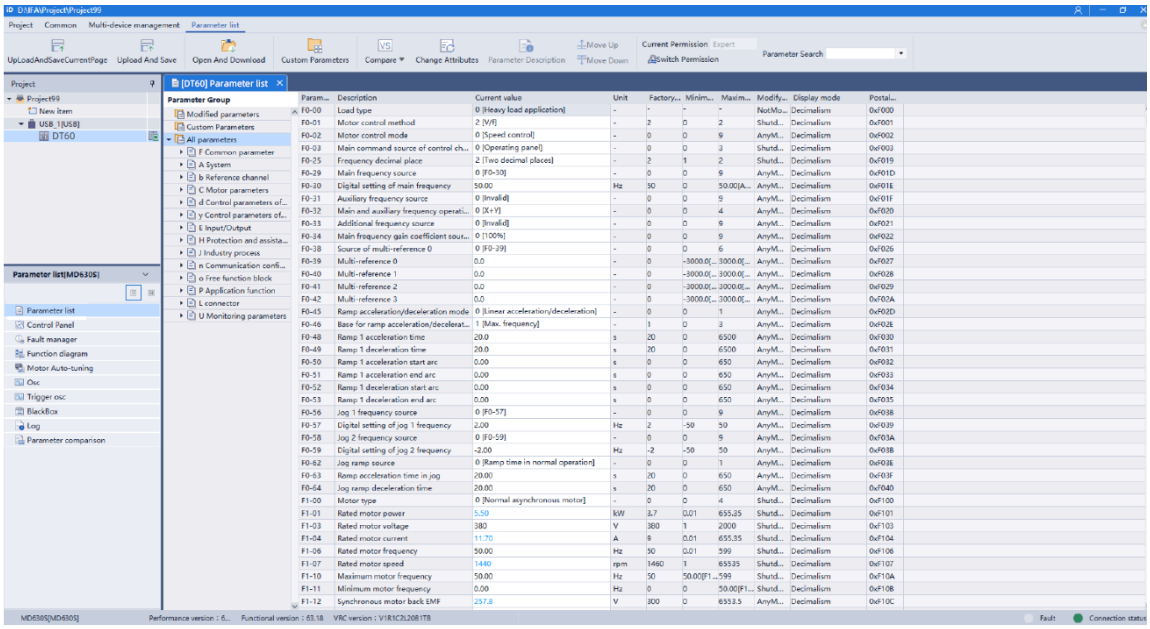
Parameter view mode

Click on the right-side parameter group node to display the corresponding parameter information. Parent nodes include all parameter information of the child nodes.

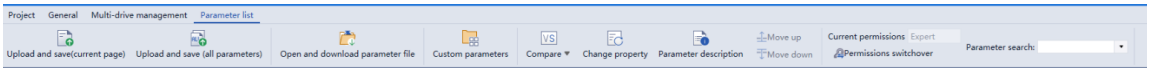
Parameters in "All parameters" and its child nodes are system default parameters.

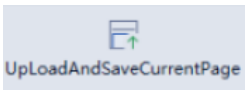
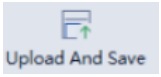
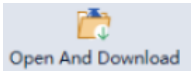
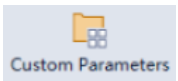
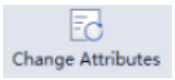
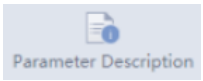
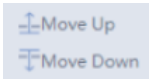
Parameters in "Modified parameters" node are those with values differ from the default values.

Parameters in user-defined parameter node are user-defined parameters.



Toolbar



Function	Icon	Description
Upload and save (all on current page)		Used to upload and save all accessible parameters in the node selected currently (retry when failed).
Upload and save		Used to upload and save all accessible parameters in the current device (retry when failed).
Open and download		Open a parameter file in .dat format and download it to the device (retry when failed).
User-defined parameters		Used to edit parameter information in the user-defined parameter group.
Change property		Used to update the property of current device. If failed, check whether property update is already in progress.
Description		Provides additional description for the parameter selected currently.
Move Up/Down		Used to move parameters within the user-defined group, supporting parameter multi-selection for batch movement.
Parameter search		Used to search for parameters in the list of parameter that can be accessed in the current node.

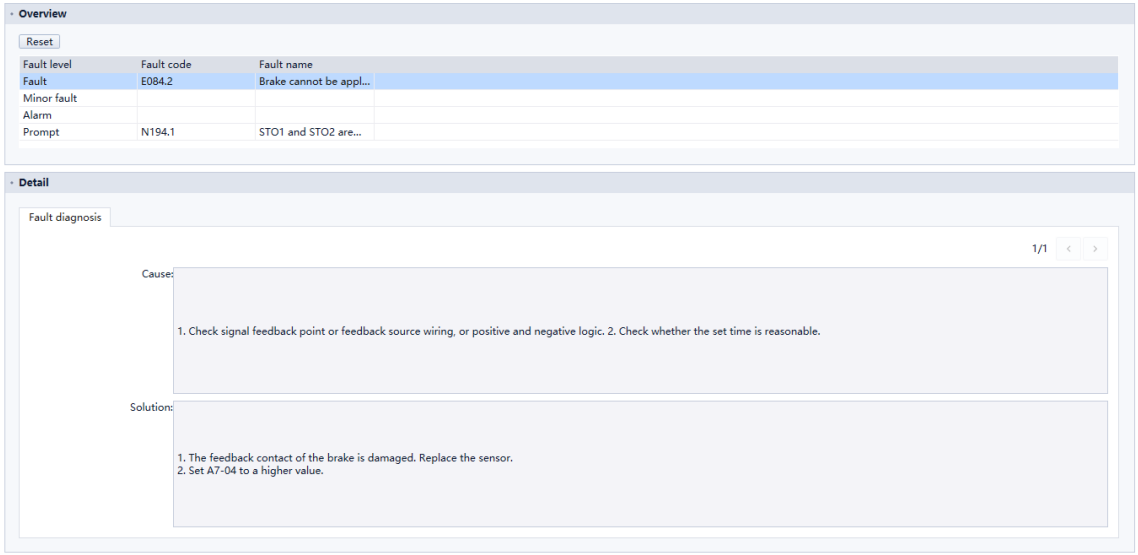
6.5.3.3 Fault Management

6.5.3.3.1 Drive Fault Management

After selecting a drive in the project tree, double-click "Fault management" page in the "Detailed view" to display detailed information about the current faults and their solutions. The fault management page mainly consists of the following two parts.

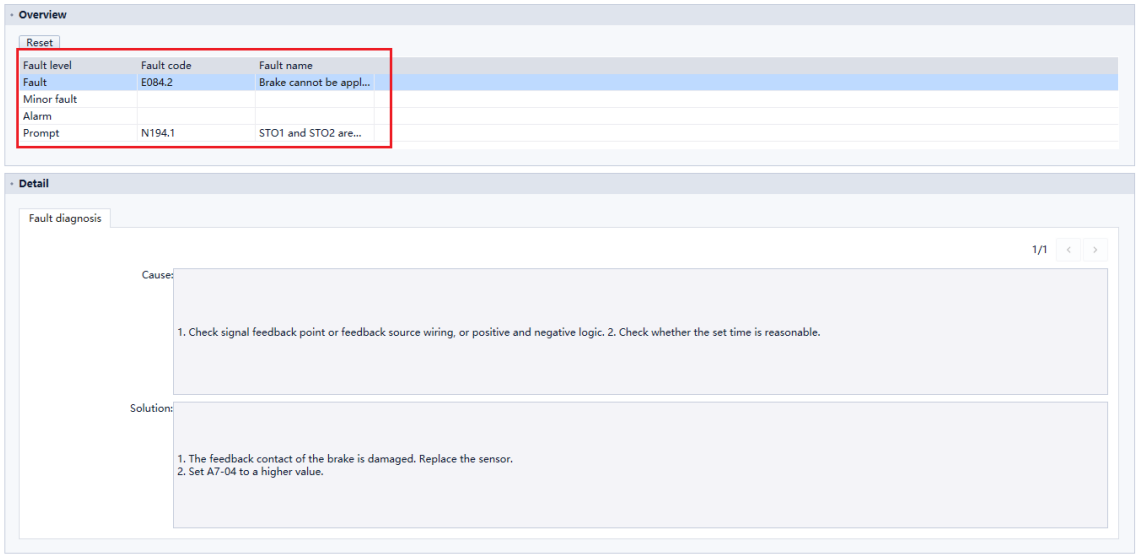
Error overview area: Displays basic information of current faults and allows for a "reset" operation.

Fault diagnosis area: Displays information of the fault causes and solutions.



6.5.3.3.2 Fault Display

After entering the fault management page, the fault display page is shown below.



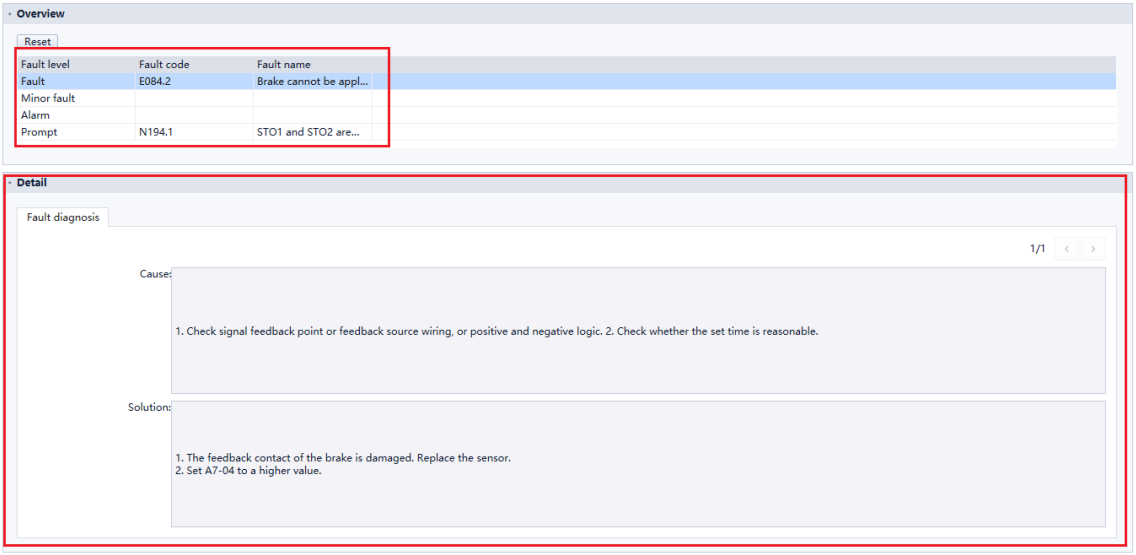
6.5.3.3.3 Fault Reset

The main solution to faults is "reset". The reset function can be used to reset the fault.

Limits:

Active only for resettable faults.

Available only after fault causes are rectified.



Function	Description
Fault information	Displays the fault code and fault name corresponding to the selected fault code.
Fault diagnosis	Displays the fault cause and solution corresponding to the fault code.
Page turn button	Some faults have multiple possible causes. Use the page turn button to view different fault diagnosis information.

6.5.3.3.4 Fault Diagnosis

The fault diagnosis area displays the cause and solutions for the current fault, as shown below. For detailed function descriptions, see the following table.



Function	Description
Cause	Displays the cause of the corresponding fault.
Solution	Displays the solution for the corresponding fault.
Page turn button	Some faults have multiple possible causes. Use the page turn button to view different fault diagnosis information.

6.5.3.4 Oscilloscope

6.5.3.4.1 Overview

Oscilloscope modes are divided into continuous oscilloscope and triggered oscilloscope.

Continuous oscilloscope: During on-site commissioning, you can monitor the operating state of the device in real time through selecting parameter channels needed, and then analyze the operating conditions of the device through the waveform changes of the parameter channel data.

Triggered oscilloscope: You can save the channel values to be monitored to the buffer of the drive when the object values reach the trigger condition configured. The values saved can be read and displayed in the form of a curve. This mode allows you to perform commissioning based on on-site conditions and observe the change of variables after specified conditions are met.

The following three sampling modes are available for the oscilloscope.

Sampling mode	Description
Continuous	Used to sample signals continuously without interruption.
Single shot	Used to trigger sampling once when specified trigger conditions are met.
Continuous trigger	Used to perform continuous sampling for multiple times when specified trigger conditions are met.



Note:

In the same project, two continuous oscilloscopes cannot run simultaneously.

The drive does not support simultaneous sampling by multiple oscilloscopes (including triggered and continuous oscilloscopes).

The oscilloscope can collect data from multiple drives under the same PLC.

An individual drive does not support simultaneous sampling by multiple triggered oscilloscopes.

6.5.3.4.2 Functions

The toolbar functions are divided into the following five parts.

Toolbar

Buttons in the auxiliary toolbar is shown in *"6.5.3.4.8 Analysis Assistance" on page 141*

Overview

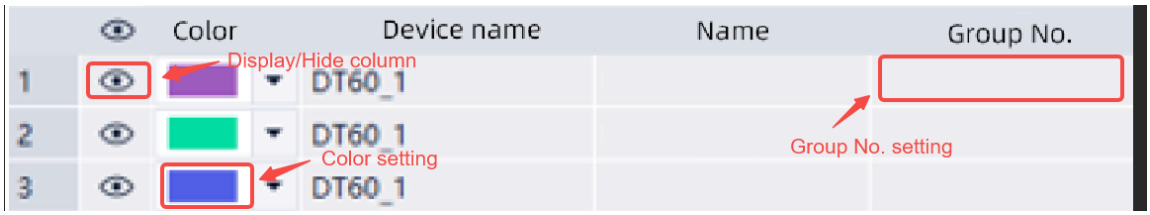
The overview diagram includes a collapse button and provides the area view function (you can view the curve in a specific area by dragging with the mouse).

Detailed Chart

The detailed area is the main display area (waveform area).

Channel

The channel table mainly includes signal display/hide, color settings, and grouping functions.



Display/Hide column: This column contains toggle buttons. By using these buttons, the visibility of signals in the detailed area can be switched.

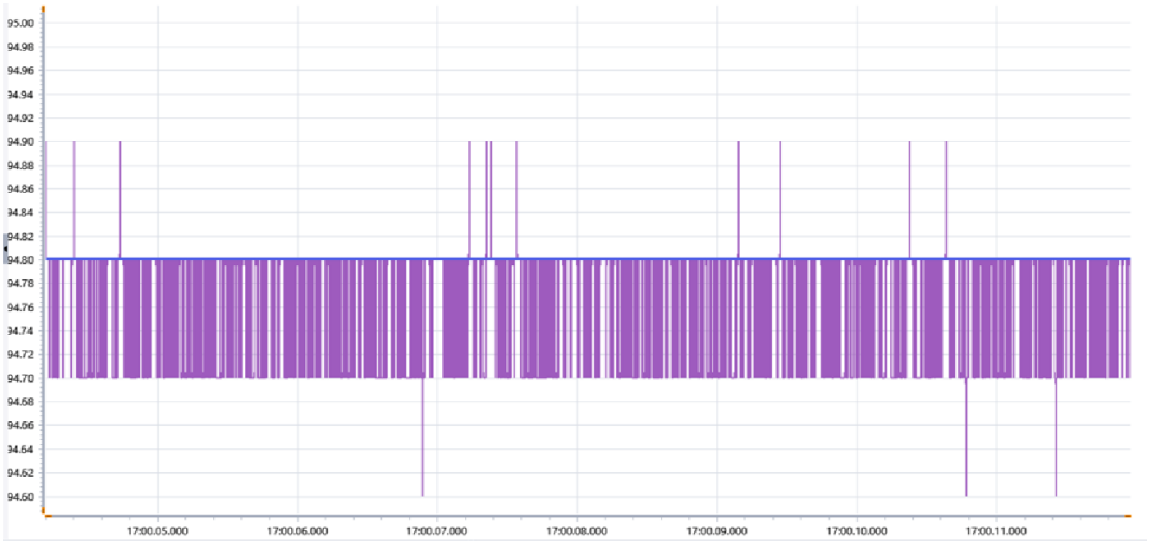
The toggle button in the column header applies to all signals.

As long as one signal is visible, the button in the column header will be displayed. The button is invisible only when all signals are hidden.

When hiding the currently viewed signal, the next visible signal in the current group will be the currently viewed signal. If there are no other visible signals in the current group, the next visible signal among all signals will be the currently viewed signal. If all signals have been hidden, the button in the column header will be hidden, and the detailed Chart will also revert to the default style.

When hiding a signal, if this signal is the last visible signal in the current group, the entire group will be hidden in the detailed Chart.

Color setting column: The set signal color will remain consistent in the Y-axis title, curve, and legend of the detailed chart.



Group number column: Signals with the same group number will be displayed in the same group.

- Grouping is not supported in single-channel mode (group number deactivated).
- Signals without a group number will form a group automatically.
- When there are no visible signals in a group, this group will be hidden.

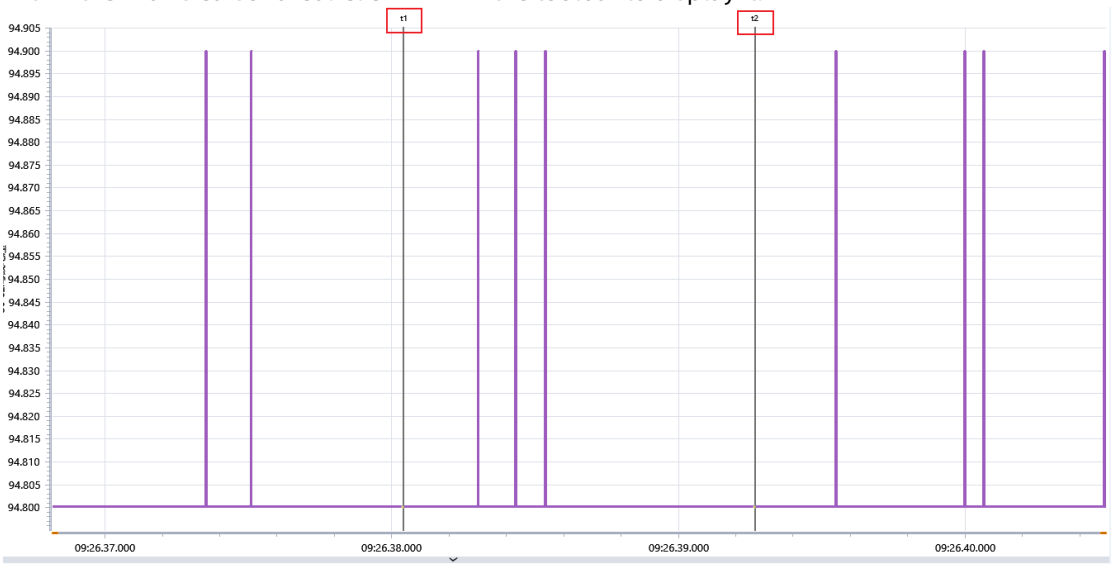
Measurement

Used to measure X-axis and Y-axis cursors.

- Y-axis cursor: Click the "Show Y-axis cursor" button on the toolbar to display it.
- The measurement table is used in conjunction with the X-axis cursor to display statistical results within the X-axis cursor area. Click  in the toolbar to display it.



- The measurement table is used in conjunction with the X-axis cursor to display statistical results within the X-axis cursor area. Click  in the toolbar to display it.



6.5.3.4.3 Configuration

Prerequisites

- A project has been created.
- The drive has been added.
- The drive is online.

Operation procedure (continuous oscilloscope)

1. Select the project tree and click on the created project.
2. Double-click in the detailed view area to open the "Oscilloscope" page.
3. Set sampling mode to "Continuous" and configure the corresponding parameters.
4. Select channel parameters.
5. Start the oscilloscope.

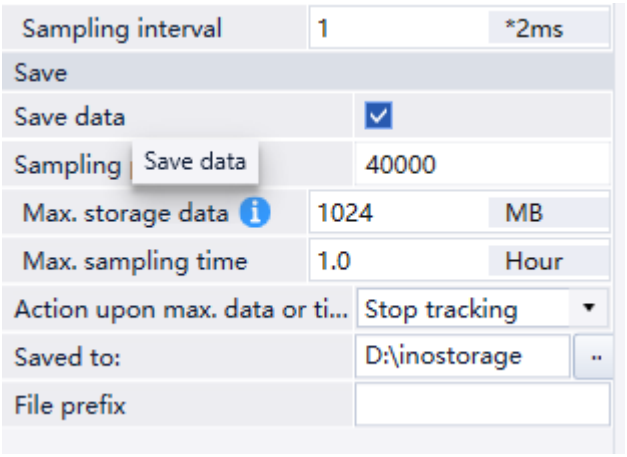
Operation procedure (triggered oscilloscope)

1. Select the project tree and click on the created project.
2. Double-click in the detailed view area to open the "Oscilloscope" page.
3. Set sampling mode to "Single trigger" or "Continuous trigger" and configure the corresponding parameters.
4. Select channel parameters.
5. Start the oscilloscope.

6.5.3.4.4 Continuous Oscilloscope

Sampling setting

Set the sampling interval. The default value is 1, with a configurable range of 1 to 200.



Storage setting

The following table shows the functions and detailed descriptions of the storage setting.

Function	Description
Storage of continuous data	Disabled by default. Check to enable the storage function before setting related parameters.
Sampling per file	The default value is 10000, with a configurable range of 10000 to 30000.
Maximum storage data	The default value is 1, with a configurable range of 1 to 1000000 in units of MB. During actual sampling, the error range is 0 MB to 3 MB when the storage capacity is met.
Maximum sampling time	The default value is 1 hour, with a configurable range of 1.0 to 24000 in units of hours.
Upper limit arrival	When the storage capacity or sampling time reaches the limit, you can choose to stop tracking (default) or delete old files.
Saved to	Used to select the local directory where oscilloscope data will be saved.
File prefix	Used to set the file prefix for saving the oscilloscope data. The prefix is empty by default.

6.5.3.4.5 Triggered Oscilloscope

Configure trigger conditions from the oscilloscope to the drive, then poll the trigger status. If triggered successfully, the data is read and displayed.

Sampling setting

The trigger mode only supports sampling on an individual device (current device). The sampling trigger mode is configured as single-shot.

The default sampling interval unit is 62.5 μs. If the device is online, read from the device. The sampling interval range is between 1 and 1000 x 62.5 in μs.

Trigger

1. Configure the data ratio for pre-trigger setting. Unit: %; configurable range: 0 to 100
2. Configure the condition relationship. You can select the relationship between trigger condition A and trigger condition B.

Function option	Description
A	The log data is triggered when condition A is met.
B	The log data is triggered when condition B is met.
A and B	The log data is triggered when both condition A and condition B are met.
A or B	The log data is triggered when either condition A or condition B is met.

3. Configure parameters for trigger conditions.

Function	Description
Trigger tag	Select the trigger variable from the drop-down box. The content is provided by the device file.
Event	Select the trigger event from the drop-down box. Options: rising edge, equal to, falling edge, edge change
Value	Enter the trigger value in the text box. Input range is limited based on the value range.
Value range	Displays the range of the currently selected trigger variable, which is non-editable.

Trigger process

1. Trigger progress prompts.

- The prompt indicating "Trigger not started" is displayed initially.
- After clicking "Activate record", the prompt indicating "Data in preparation" is displayed.
- During data reception, the percentage of data reception progress is displayed.
- If an error occurs during data reception, a prompt will be displayed.
- After data reception is done, the prompt indicating "Trigger completed" is displayed.

2. Trigger result

- When the device meets the set trigger conditions and trigger is done, the trigger data curve of the corresponding channel is displayed in the waveform area.

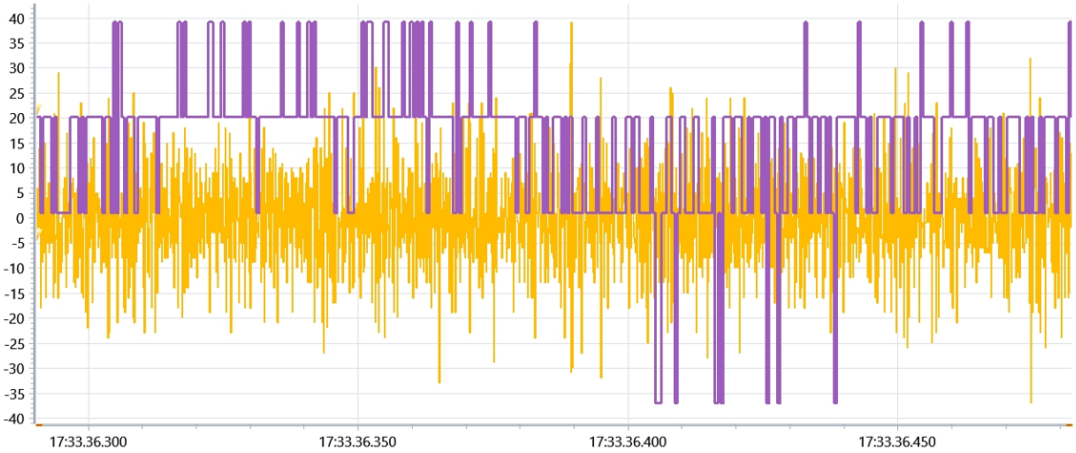


Figure 6-14 Single shot

6.5.3.4.6 Channel Selection

Channel selection

- Selection method:
  - Direct selection: Expand the list of normal channels or bit channels (click " " to expand all entries, click " " to collapse all entries), then select one or more channels.

- Channel search: Enter a keyword in the search box, click "  " to start searching, then select one or more channels from the search results (click "  " to expand all search results, click "  " to collapse all search results).

- Selection procedure:

  1. Select a configured device.
  2. Expand the list of normal channels or bit channels, then select one or more channels. Channels selected will be displayed in the information bar below.

     - After selecting channels, the corresponding signals will be added to the channel and measurement list below, with a random color assigned to each signal.
     - The first visible signal will be set as the signed viewed currently.
     - In the channel table, after selecting the newly added signals, the Y-axis title corresponding to the color will be displayed in the detailed Chart.
     - The corresponding signal and color will be displayed in the legend.

     Channel selection limits:

     A maximum of 6 normal channels and 8 bit channels can be selected.

Remove signal

After unchecking, the selected signal will be removed. Additionally, the corresponding content for this signal will be removed from the schematic page.

- Remove the signal from the channel and measurement list below.
- Remove the corresponding Y-axis and curve of this signal.
- Remove this signal from the legend.

6.5.3.4.7 Importing/Exporting Waveform Files

Export

After pausing the oscilloscope, click "Export data" on the toolbar to export oscilloscope data. Oscilloscope waveform files are automatically named using the format: file prefix timestamp_index. csv. After clicking "Save," the file will be exported to the specified location.

Import

Click "Import data" on the toolbar to import oscilloscope data. Select a data file with the suffix .csv, then click "Open" to display the import result.

6.5.3.4.8 Analysis Assistance

See the following table for description of the oscilloscope toolbar buttons.

Menu item		Description
	Start	Start the oscilloscope to sampling the data and plot the curve. • The drive must be online. • Activation failure can occur if there is an error in the parameter configuration page.
	Stop	Stop data sampling.
	Halt	The oscilloscope waveform stops scrolling and pauses at the current position.
	Move view	When this function is enabled, you can drag the curve within the view, which is mutually exclusive with the zooming function. Limits: Inhibited initially; selected and enabled by default upon continuous sampling; inhibited when sampling triggered
	Zoom	Used to zoom in/out the curve. When this function is enabled, you can select a segment of the waveform along the X and Y axes for observation, which is mutually exclusive with the drag function. Dragging the left mouse button from left to right zooms in. Dragging it from right to left zooms out to the default state.
	Vertical zoom	Used to zoom along the Y-axis direction. Limits: Inhibited initially; deselected but enabled by default upon continuous sampling; deselected and inhibited when sampling triggered
	Horizontal zoom	Used to zoom along the X-axis direction. Limits: Inhibited initially; deselected but enabled by default upon continuous sampling; deselected and inhibited when sampling triggered
	Zoom in	Used to zoom in the entire curve. Limits: Inhibited initially; enabled upon continuous sampling; inhibited when sampling triggered

Menu item		Description
	Zoom out	Used to zoom out the entire curve. Limits: Inhibited initially; enabled upon continuous sampling; inhibited when sampling triggered
	Show all	Show 100% on both X and Y axes. After this button is clicked, the buttons for display all on Y-axis and X-axis are selected automatically. Limits: Inhibited initially; enabled upon continuous sampling
	Numerical axis zoomed automatically	Used for 100% display in the Y-axis direction. Limits: Enabled and selected initially; selected and enabled by default upon continuous sampling; selected but inhibited when sampling triggered
	Show entire time range	Used for 100% display in the X-axis direction. Limits: Enabled but deselected initially; deselected and enabled by default upon continuous sampling; selected but inhibited when sampling triggered
	View display switchover	Used to switch between single-channel and multi-channel; single-channel display by default when oscilloscope opened
	Scatter plot	Used to display sampling points on the curve as small dots. Limits: Inhibited initially; enabled after sampling done successfully
	Show vertical measurement cursor	Used to display a set of cursors (t1, t2) horizontally, showing statistical information of sampled data between cursors (t1, t2) in the measurement table. Limits: Inhibited initially; inhibited during sampling and enabled after sampling done successfully

Menu item		Description
	Show horizontal measurement cursors	Used to display a set of cursors (Y1, Y2) vertically, showing cursor values in the measurement window. Limits: • Y-axis cursors are displayed within the channel of the current signal viewed. When switching the signal, Y-axis cursor switches accordingly. Inhibited initially; inhibited during sampling and enabled after sampling done successfully
	Import configuration	Used to import oscilloscope configuration file (Json format). Limit: Inhibited during start of sampling
	Export configuration	Used to export oscilloscope configuration file (Json format). Limit: Inhibited during start of sampling
	Export data	Used to export oscilloscope data file (CSV format). Limit: Inhibited during start of sampling
	Screenshot	Used to take a screenshot of the waveform on the current page.

In addition to the pan/zoom functions provided by the toolbar, the waveform area also provides the following functions.

When the zoom function is enabled, use the left mouse button to select a zoom area from left to right. Selecting from right to left will display all data covered by the overview area.

Zoom by mouse click:

X-axis direction: Hold down the Shift key until the Zoom X cursor appears. Click left mouse button to zoom in, and click right mouse button to zoom out.

Y-axis direction: Hold down the Ctrl key until the Zoom Y cursor appears. Click left mouse button to zoom out, and click right mouse button to zoom in.

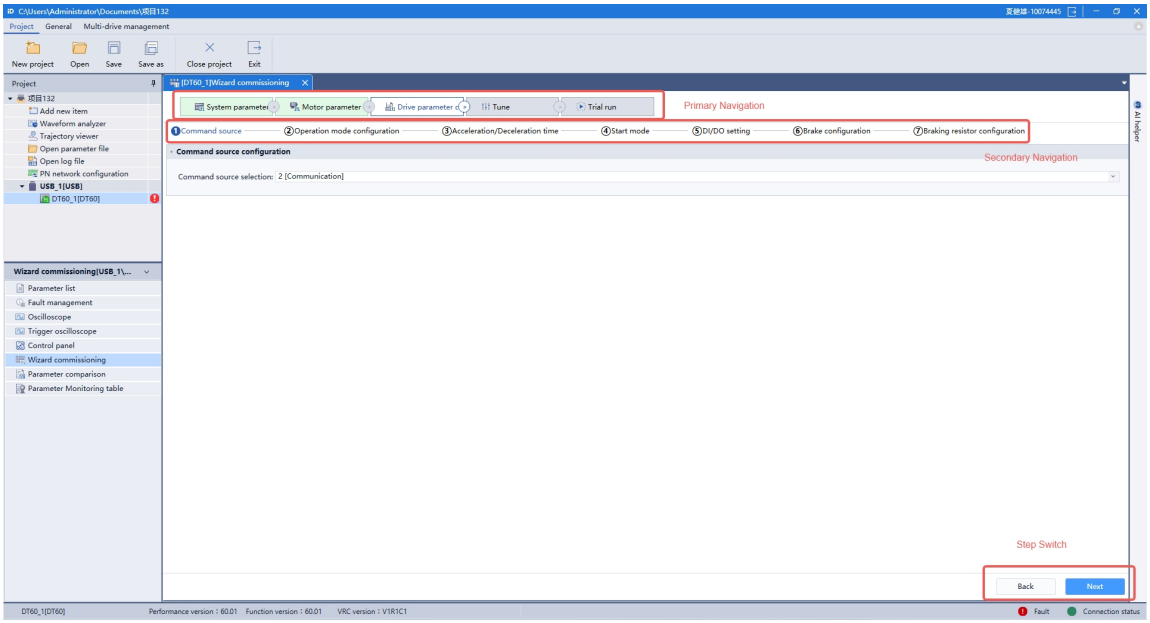
You can also zoom by the mouse wheel.

6.5.3.5 Wizard Commissioning

6.5.3.5.1 Overview

The wizard commissioning function is used to set system parameters, motor parameters, and drive parameters step by step and perform parameter auto-tuning and trial run to quickly adjust various parameters of the DT60 drive.

Double-click "Wizard commissioning" node in the detailed view to open the Wizard commissioning page. The wizard framework consists of primary navigation, secondary navigation, step switchover, and commissioning content. Each primary step consists of multiple secondary sub-steps. Click "Back" or "Next" to switch between steps. Clicking on a completed primary or secondary step with the mouse will directly navigate to that step.



6.5.3.5.2 System Parameter Configuration

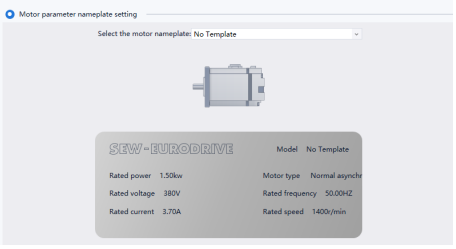
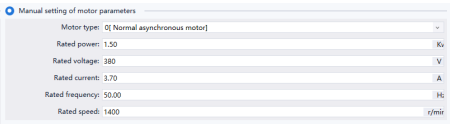
System parameter configuration is used to configure the operation mode, communication method, and application scenario of the drive.

Function	Diagram	Description
Operation mode	Operation mode: 0 [Speed control] 0 [Speed control] Communication mode: 1 [Torque control]	Used to configure the control method as speed control or torque control.
Communication mode	Communication mode: 2 [EtherNet/IP] 2 [EtherNet/IP] Application scenario: 3 [PROFINET]	Used to configure the device communication method as EtherNet/IP or PROFINET.
Application scenario	Application scenario: 3 [Vertical scenario] 0 [None] 1 [Horizontal line] 2 [Horizontal curve] 3 [Vertical scenario]	Used to configure the application scenario, which can be N/A, horizontal linear, horizontal curve, or vertical applications.

6.5.3.5.3 Motor Parameter Configuration

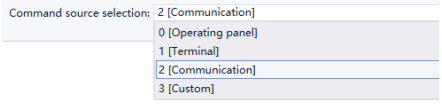
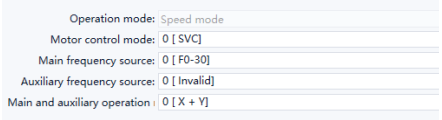
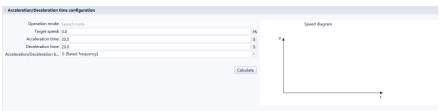
Motor parameter configuration is used to configure motor-related parameters through two methods: "Nameplate setting" and "Manual setting." Only one method can be selected at a time.

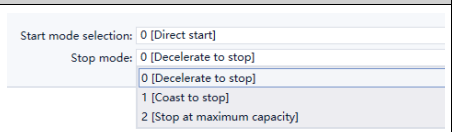
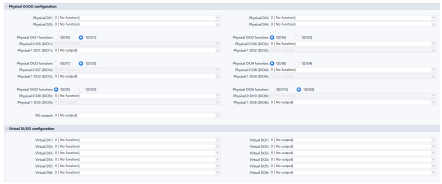
Table 6–14

Function	Diagram	Description
Nameplate setting		Five preset sets of SEW motor-related parameters are available. Selecting one from the drop-down box will switch the nameplate parameters accordingly. After nameplate setting applies, manual setting is deactivated.
Manual setting		Used to configure the motor type, rated power, rated voltage, rated current, rated frequency, and rated speed manually. After manual setting applies, nameplate setting is deactivated.

6.5.3.5.4 Drive Parameter Setting

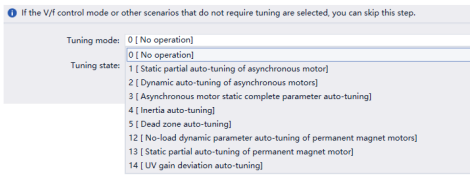
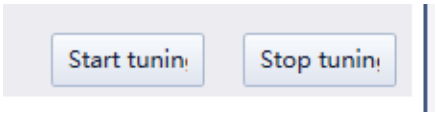
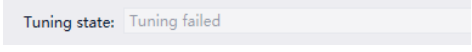
Drive parameter setting consist of seven secondary steps: "Command source," "Operation mode configuration," "Acceleration/deceleration time," "Start method," "DI/DO setting," "brake Configuration," and "Braking resistor configuration."

Function	Diagram	Description
Command source configuration		Configure the command source as the operating panel, terminal, communication, or user-defined setting.
Operation mode configuration		Read-only: Displays the operation mode configured in system parameters. Motor control mode: SVC or V/f control Main frequency source: Used to select the main frequency source. Auxiliary frequency source: Used to select the auxiliary frequency source. Main/Auxiliary operation relationship: Used to configure the operational relationship between the main frequency source and auxiliary frequency source.
Acceleration/ Deceleration time		Used to set target speed, acceleration time, deceleration time, and acceleration/ deceleration base frequency. Click the "Calculate" button to draw the acceleration/deceleration curve in the speed diagram area.

Function	Diagram	Description
Start/Stop method		Start method: You can select direct start or flying start. Stop method: You can select decelerate to stop, coast to stop, or stop at maximum capability.
DI/DO configuration		Physical DI/DOs include four fixed physical DIs, six configurable DI/DOs, and one RO. Virtual DI/DOs include six virtual DIs and six virtual DOs.
Brake configuration		Used to set brake-related parameters.
Braking resistor configuration		Used to configure the braking resistor. If no braking resistor is connected, this step can be skipped. After setting the drive model and resistance value, click "Start verification". The verification result will be displayed in the result box.

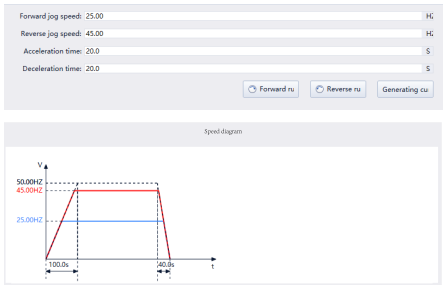
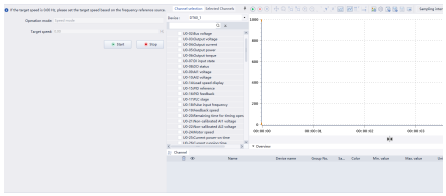
6.5.3.5.5 Perform motor parameter auto-tuning.

If the motor control mode is set to V/f control or if parameter auto-tuning is not required, this step can be skipped.

Function	Diagram	Description
Auto-tuning mode		Select the auto-tuning method.
Start/Stop of auto-tuning		Click "Start tuning" to start auto-tuning. Click "Stop tuning" to stop auto-tuning.
Auto-tuning state		Displays the auto-tuning state.

6.5.3.5.6 Trial Run

Trial run modes can be divided into jog mode and operation mode.

Function	Diagram	Description
Trial run through jog mode		After entering the positive jog speed, negative jog speed, acceleration time, and deceleration time, click the "Forward" or "Reverse" button to perform jog testing. Click the "Generate curve" button to generate a speed diagram.
Trial run through operation mode		After selecting the channels to be sampled through the oscilloscope on the right side, click the start button to start trial run and observe the oscilloscope channel curves.

7 Quick Commissioning and Trial Run

7.1 Commissioning Instructions

Commissioning flowchart

Start	
Commissioning preparation	*" Commissioning preparation" on page 152*
Reset default settings (A0-00).	*"7.4 Restoring Default Settings" on page 155*
Set motor parameters.	*" Set motor parameters." on page 157*
Set motor control method (F0-01).	*"7.6 Setting the Motor Control Method" on page 160* For a permanent magnet synchronous motor, SVC mode is recommended. If one drive is used to drive multiple motors, only V/f control can be used.
Set the motor control mode (F0-02).	*"7.7 Setting the Motor Control Mode" on page 161* In V/f mode, only speed control is supported. If torque control mode applies under normal operating conditions, switch to the speed control mode during initial commissioning for motor auto-tuning. After the auto-tuning is done, adjust the operating direction and switch to the torque control mode again.
Perform motor parameter auto-tuning.	*" Motor Parameter Auto-tuning" on page 161*
Set operation commands.	*" Set operation commands." on page 169*
Set frequency references.	*" Set frequency references." on page 171*
Set torque references.	*" Set torque references." on page 172*
Jog	*" Jog" on page 173*
Viewing Common Monitoring Parameters	*" Viewing Common Monitoring Parameters" on page 177*
Commissioning other common parameters.	*" Common commissioning parameters" on page 179*
Trial Run	*"7.15 Trial Run" on page 187*

End

7.2 Parameter Introduction

7.2.1 Function Parameter Groups

Parameters of the AC drive are grouped based on functions and displayed in three levels of menus, as shown below.

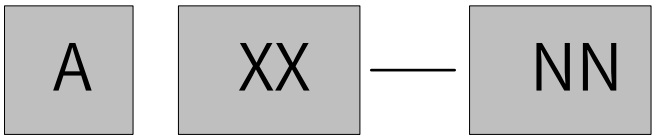


Figure 7-1 Parameter display

The letter A indicates the level-1 menu, which is represented by one letter and corresponds to a group of complete functions. For example, group A corresponds to the system functions and group b corresponds to the command channel.

The letter B indicates the level-2 menu, which is represented by one or two digits. The first and second level menus are combined to represent a specific group of functions. For example, group A0 is related to parameter management, and group A2 is related to system information.

NN indicates the level-3 menu, which is represented by a 2-digit number, corresponding to a certain parameter when combined with level-1 and level-2 menus. For example, A0-00 is a system initialization parameter.

Level-2 and level-3 menus are usually connected through the separator "-".

Parameters of the level-1 menu are shown in the following table.

Table 7–1 Parameter group

Level-1 group name	Level-1 parameter group description
F	Common parameter
A	System
b	Reference channel
C	Motor parameters
d/y	Motor control
E	Input/Output
H	Protection and assistance
n	Communication configuration
o	Free function block
P	Application function
L	Connector
U	Monitoring parameters

Parameters in group F are commonly used parameters, which includes all the commonly used parameters in other groups to facilitate commissioning. For example, parameters in group F1 are mapped from parameters in group C (motor parameters). When setting basic motor parameters, you can make quick settings in group F or set them in group C. These two groups are equivalent, with parameter values automatically synchronized.

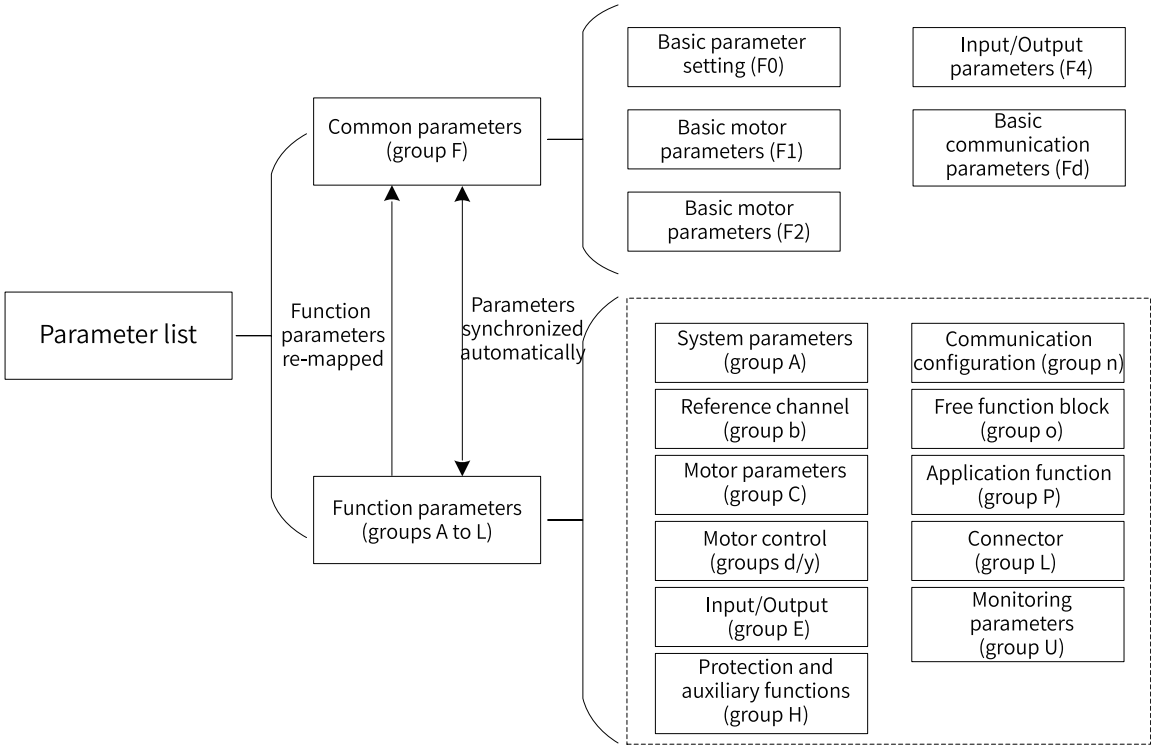


Figure 7-2 Parameter group diagram

7.2.2 Parameter Access Levels

The access levels are divided into standard, extended, expert, and manufacturer, with each level assigned with access to different parameters.

Table 7–2 Access level

Access level	Description	Remarks
1	Standard	Default parameter access level, which allows you to access the basic function parameters of the drive.
2	Extended	Mainly include extended motor function parameters, such as user-defined parameters and frequency detection parameters.
3	Expert	Password-protected parameters, which include complex performance commissioning parameters for the motor.
4	Manufacturer	Password-locked parameters for use by the manufacturer only. This level has the highest authority with access to all parameters.

The standard level is set by default. You can switch the access level through A0-11. The parameter access level currently in effect are displayed in A0-10. Standard and extended levels can be switched directly. Expert and manufacturer levels are password-protected, which cannot be switched directly. For details on switchover of parameter access levels, see *"14.2.2 Switching Parameter Access Level" on page 782*.

Table 7–3 Parameter access level switchover

Param.	Name	Display range
A0-10	Current system parameter access level	0: Standard 1: Extended 2: Expert 3: Manufacturer
A0-11	Parameter access level	0: Standard 1: Extended 2: Expert

Caution

If the expert password status (A0-14) is locked, you cannot switch directly to expert level.

7.3 Commissioning Preparation

7.3.1 Identifying the Motor Type

Check the motor nameplate to identify the motor type. For unknown motor type, identify the motor type through the following ways.

- Method 1: The asynchronous motor has slip, and the synchronous motor has no slip. Rated slip of the motor = Rated frequency x 60/Rated number of pole pairs - Rated speed. If the calculation result is not zero, it is an asynchronous motor.
- Method 2: Short the motor U/V/W cables and manually rotate the motor. If a noticeable increase in resistance is detected, it is a synchronous motor; otherwise, it is an asynchronous motor.

7.3.2 Selecting Motor Parameter Set on the Nameplate

Some motors may have multiple sets of parameters on the nameplates, as shown below. It is recommended to select the motor parameter set 1 as the rated parameters that input to the drive. See the following for details.

duty type	n(/min)	P (kW)	U(V)	I (A)	f (Hz)	cos/phi
S1	650	200	414	342	22.3	0.89
S1	765	200	480	296	26	0.88
S1	1950	200	480	300	66.5	0.87
S1	3000	130	480	192	101.5	0.87

U/f is directly proportional to the flux. The U/f of motor parameter set 1 and motor parameter set 2 is about 18.5, which is the rated flux coefficient. The U/f of motor parameter set 3 is 7.2, which is the field-weakening parameter. The U/f of motor parameter set 4 is 4.7, which is also the field-weakening parameter. The rated motor parameters in the drive cannot be used to set the field-weakening parameters. Selecting motor parameter set 3 or 4 can result in insufficient motor output. Therefore, only parameter set 1 or 2 can be selected. If the motor parameter set 2 is selected, the maximum output torque at low frequency cannot meet the design requirements. Therefore, it is

recommended to select motor parameter set 1. For the AC drive, the maximum output voltage is related to the bus voltage instead of the rated motor voltage, so setting the 1st parameter set will not result in insufficient output voltage.

7.3.3 Identifying Drive and Motor Information

Before starting commissioning, identify the following information.

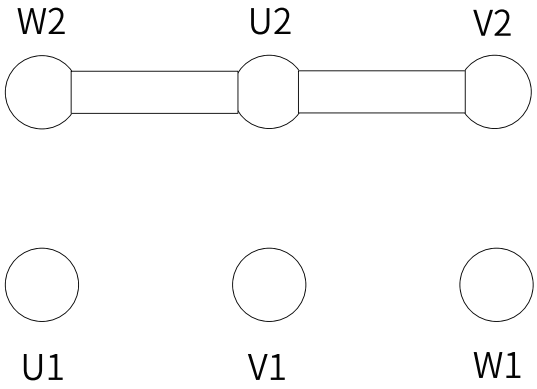
- Collecting motor data
  Identify the rated power, rated voltage, rated current, rated frequency, rated speed, and motor type on the motor nameplate.

  Parameter auto-tuning requires accurate motor nameplate parameters. Asynchronous motors and synchronous motors have different nameplate parameters. Identify the motor type before setting parameters, as shown by *"7.3.1 Identifying the Motor Type" on page 152*.

- Collecting the drive data
  Identify the product name, model, power, voltage class, and output current on the drive nameplate, and compare them with motor nameplate parameters to ensure the input/output range and power rating of the drive match those of the motor.

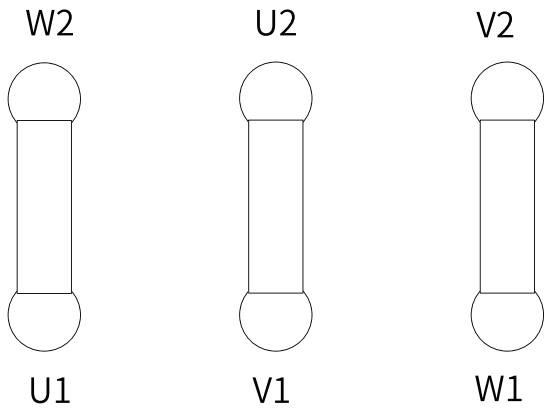
- Identifying motor connection method
  Check whether the motor connection method (Y-type or delta-type) is consistent with the motor nameplate. Incorrect motor connection can result in low torque output, low load capacity, and high output current.

Figure 7-3 Motor connection method





(a) Y connection





(b) Delta connection

7.3.4 Wiring Check

Connect the drive to the motor. Check the following items before power-on commissioning.

Table 7–4 Procedure

Item	Action	Compliance	completed
1	The power input of the main circuit is correctly connected based on terminal labels (R, S, and T).	☐	☐
2	The main circuit output terminals (U, V, and W) and motor cables (U, V, and W) are connected with the same phase sequence.	☐	☐
3	The power input terminals (R, S, and T) and output terminals (U, V, and W) of the main circuit are correctly connected. For example, the power input cable is not connected to the output end.	☐	☐
4	The drive and motor are grounded properly.	☐	☐
5	The auxiliary circuit power supply is correctly connected.	☐	☐
6	Communication cables are correctly connected.	☐	☐
7	External terminals such as I/O terminals are correctly connected.	☐	☐

7.3.5 Drive ON

After checking that the wiring is correct, connect the main circuit R, S, T to a three-phase AC power supply. Ensure that the drive power supply works properly when checking drive parameters.

7.3.6 Drive Model Verification

Check the following parameters based on the nameplate of the drive.

Table 7–5 Parameters to be checked

Param.	Name	Description
A3-02	Rated power of the drive	Displays the rated power of the drive.
A3-03	Rated current of the drive	Displays the rated current of the drive.
A3-04	Rated voltage of the drive	Displays the rated voltage of the drive.
A3-05	Maximum current of the drive	Defines the maximum current of the drive, which is based on the rated current of the drive.

If the product information such as the rated power, rated voltage, and rated current is not consistent with that on the nameplate, contact the service personnel for technical support.

7.3.7 Software Version Information

If you need to use a specific software version for commissioning, check the software version through the following parameters after software update.

Param.	Name	Display range
A2-22	Performance software version	0.00 to 655.35
A2-23	Function software version	0.00 to 655.35
A2-24	Performance software sub-version	0.00 to 655.35
A2-25	Function software sub-version	0.00 to 655.35

7.4 Restoring Default Settings

Scenarios for restoring default values

This function is used to restore parameters to default values. It is recommended in the following scenarios. Note that parameters that already configured will also be reset, so back up critical parameters before restoring default settings.

- The drive is commissioned for the first time.
- Parameters that have been configured are unknown, or some parameters have been modified inadvertently.
- The drive operates improperly due to modification on some parameters during commissioning (record normal parameters before restoring default settings).
- Parameters are in the abnormal state with alarms or faults generated.
- The application macro function of the drive needs to be set, which requires parameters to be restored to default settings first (record parameters that already configured in advance and set these parameters to the configured values again after parameter reset).

Procedure for restoring default settings

1. Parameter backup: Used to back up parameters that already configured to prevent these parameters from being reset to default values. For how to back up parameters, see *"17.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1283*.
2. Function trigger: Set A0-00 [Parameter initialization] to restore default settings.
   Different values of A0-00 indicate different functions. See details in related parameters. After default settings are restored, A0-00 is set to 0 again automatically.

   If motor parameters have not been set or motor parameters also need to be reset, it is recommended to set A0-00 [Parameter Initialization] to 3 [Reset default parameters (including motor parameters)].

   If motor parameters have already been set and reset is not needed, it is recommended to set A0-00 [Parameter Initialization] to 1 [Restore default parameters (excluding motor parameters)].
3. Function execution: After step 2, wait until A0-00 [Parameter initialization] is cleared. When A0-00 [Parameter initialization] changes from 1/3/503 to 0, parameters are restored successfully and you can continue commissioning.

Parameters for restoring default settings

Table 7–6 Parameters for restoring default settings

Param.	Name	Default value	Value range	Description
A0-00	Parameter initialization	0: Not applied	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: Not applied 1: Restore default parameters (excluding motor parameters) - Most function parameters are restored to default values, except manufacturer parameters, motor parameters, and log parameters. 2: Clear log information - Fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption are cleared. 3: Restore default parameters (including motor parameters) - Most function parameters are restored to default values, except manufacturer parameters and log parameters. 4: Back up current user parameters4: Back up the current parameter values, which function in the same way as the setpoint 400 of A0-39. 5: Clear fault information - The fault information recorded in group H6 to Hb is cleared. 501: Restore backup parameters - Parameters backed up by setting A0-00 to 4 are restored, which is the same as the function when A0-38 [Restore backup parameters] is set to 500. 503: Restore default parameters (including motor parameters) and clear log information - Most function parameters are restored to default values, except manufacturer parameters. Manufacturer parameters include model parameters. Log parameters include the fault log, cumulative operating time, and cumulative power-on time. Note: After parameters are restored to default values, this parameter is automatically restored to 0.

7.5 Setting Motor Parameters

7.5.1 Setting Asynchronous Motor Parameters

Related parameters

When an asynchronous motor is used, see the motor nameplate to set the following motor parameters.

Table 7–7 Asynchronous motor parameter setting

Param.	Name	Description	Mandatory
F1-00 (C4-00)	Motor type	Defines the motor type. C4-00 [Motor type] is mapped to F1-00 in group F. These two parameters have the same function. Value description: 0: Regular asynchronous motor 2: Permanent magnet synchronous motor	Yes
F1-01 (C4-01)	Rated power of the motor	Defines the rated motor power in kW. C4-01 [Rated power of the motor] is mapped to F1-01 in group F. These two parameters have the same function.	Yes
F1-03 (C4-03)	Rated voltage of the motor	Defines the rated motor voltage in V. C4-03 [Rated motor voltage] is mapped to F1-03 in group F. These two parameters have the same function.	Yes
F1-04 (C4-04)	Rated current of the motor	Defines the rated motor current in A. C4-04 [Rated current of the motor] is mapped to F1-04 in group F. These two parameters have the same function.	Yes
F1-06 (C4-06)	Rated frequency of the motor	Defines the rated motor frequency in Hz. C4-06 [Rated motor frequency] is mapped to F1-06 in group F. These two parameters have the same function.	Yes
F1-07 (C4-07)	Rated speed of the motor	Defines the rated motor speed in rpm. C4-07 [Rated motor speed] is mapped to F1-07 in group F. These two parameters have the same function.	Yes
F1-10 (C4-10)	Maximum frequency of the motor	Defines the allowable maximum frequency of the motor in Hz. C4-10 [Maximum motor frequency] is mapped to F1-10 in group F. These two parameters have the same function.	Optional
F1-11 (C4-11)	Minimum frequency of the motor	Defines the allowable minimum frequency of the motor in Hz. C4-11 [Minimum motor frequency] is mapped to F1-11 in group F. These two parameters have the same function.	Optional
F1-14 (C4-14)	Number of motor pole pairs	Defines the number of motor pole pairs. C4-14 [Number of motor pole pairs/(Number of poles/2)] is mapped to F1-14 in group F. These two parameters are equivalent. Note: When this parameter is set to 0, the number of motor pole pairs is automatically calculated by the system and the effective value is displayed in F1-14.	Optional

Note

The motor parameters in group F1 in the table are mapped from motor parameters in group C4. The settings of the two groups are equivalent.

Precautions

To set the rated speed of an asynchronous motor based on the synchronous speed, first check the recommended slip rate based on the motor power, as shown in the following table, and then calculate the rated motor speed through the formula: rated speed = synchronous speed - recommended slip rate x synchronous speed.

Power	2.2 kW	3.7 kW	5.5 kW	7.5 kW	11 kw	15 kW	22 kW
Recommend-ed slip rate	6%	5.0%	4%	4%	3.5%	3%	2.5%

After motor parameters are set based on the nameplate, if the output current is excessively high during no-load operation in V/f mode, reduce the rated voltage by 10 V to 20 V, and then perform parameter auto-tuning again to get better control performance.

7.5.2 Setting Synchronous Motor Parameters

Related parameters

When a synchronous motor is used, set the following motor parameters according to the motor nameplate.

Table 7–8 Setting synchronous motor parameters

Param.	Name	Description	Mandatory
F1-00 (C4-00)	Motor type selection	Defines the motor type. C4-00 [Motor type] is mapped to F1-00 in group F. These two parameters have the same function. Value description: 0: Regular asynchronous motor 2: Permanent magnet synchronous motor	Yes
F1-01 (C4-01)	Rated power of the motor	Defines the rated motor power in kW. C4-01 [Rated power of the motor] is mapped to F1-01 in group F. These two parameters have the same function.	Yes
F1-03 (C4-03)	Rated voltage of the motor	Defines the rated motor voltage in V. C4-03 [Rated motor voltage] is mapped to F1-03 in group F. These two parameters have the same function.	Yes
F1-04 (C4-04)	Rated current of the motor	Defines the rated motor current in A. C4-04 [Rated current of the motor] is mapped to F1-04 in group F. These two parameters have the same function.	Yes
F1-06 (C4-06)	Rated frequency of the motor	Defines the rated motor frequency in Hz. C4-06 [Rated motor frequency] is mapped to F1-06 in group F. These two parameters have the same function.	Yes
F1-07 (C4-07)	Rated speed of the motor	Defines the rated motor speed in rpm. C4-07 [Rated motor speed] is mapped to F1-07 in group F. These two parameters have the same function.	Yes
F1-10 (C4-10)	Maximum frequency of the motor	Defines the allowable maximum frequency of the motor in Hz. C4-10 [Maximum motor frequency] is mapped to F1-10 in group F. These two parameters have the same function.	Optional
F1-11 (C4-11)	Minimum frequency of the motor	Defines the allowable minimum frequency of the motor in Hz. C4-11 [Minimum motor frequency] is mapped to F1-11 in group F. These two parameters have the same function.	Optional
F1-12 (C4-12)	Back EMF of synchro-nous motor	Defines the effective value of linear back EMF of the synchronous motor at rated speed, which can be auto-tuned. C4-12 [Synchronous motor back EMF] is mapped to F1-12 in group F. These two parameters have the same function.	Optional
F1-14 (C4-14)	Number of motor pole pairs	Defines the number of motor pole pairs. C4-14 [Number of motor pole pairs/(Number of poles/2)] is mapped to F1-14 in group F. These two parameters are equivalent. Note: When this parameter is set to 0, the number of motor pole pairs is automatically calculated by the system and the effective value is displayed in F1-14.	Optional

Note: The motor parameters in group F1 in the table are mapped to motor parameters in group C4. The settings of the two groups are equivalent.

Note

The following functions are supported: speed control, current limit, torque limit, power limit, overvoltage suppression, undervoltage suppression, and energy-saving control.

7.5.3 Setting the Carrier Frequency

The carrier frequency of the drive is set by A5-01 [Carrier frequency reference]. In addition to being limited by A5-01 [Carrier frequency reference] and A5-00 [Maximum carrier frequency], the carrier frequency is also controlled by functions such as "Carrier frequency adjustment with synchronous frequency" and "Random PWM". For details, see description of A5-09 to A5-13.

Related parameters

Table 7–9 Parameter for setting carrier frequency

Param.	Name	Default value	Value range
A5-01	Carrier frequency reference	4.0	0.8 kHz to 20.0 kHz

Precautions

For high-speed motors, ensure that:

A5-01 [Carrier frequency reference] > (12 x maximum output frequency)

If A5-01 < 12 x maximum output frequency, oscillation and overcurrent may occur due to insufficient control frequency during high-speed operation. A low carrier frequency at high-speed operation may result in high output current harmonics, high motor temperature rise during long-term operation, and even demagnetization of the synchronous motor.

7.6 Setting the Motor Control Method

You can set the motor control mode through F0-01 [Motor control method].

The drive supports V/f and SVC control.

The V/f control is applicable to scenarios without high requirements on load control performance, such as fans and pumps.

The SVC control is an open-loop vector control mode that suitable for high-performance control applications such as machine tools, centrifuges, wire drawing machines, and injection molding machines.

Related parameters

Param.	Name	Default value	Value range
F0-01 (d0-00)	Motor control method	2	0: SVC 2: V/f

Note

F0-01 is mapped from d0-00, and these two parameters are equivalent.

Precautions

When F1-00 [Motor type] is set to 0 [Regular asynchronous motor], F0-01 [Motor control method] can be set according to the application requirements. When F1-00 [Motor type] is set to 2 [Permanent magnet synchronous motor], the SVC control mode is recommended.

If one drive is used to drive multiple motors, only V/f control can be used.

7.7 Setting the Motor Control Mode

The drive supports two motor control modes: speed control and torque control, which can be set through F0-02 [Motor control mode].

Related parameters

Param.	Name	Default value	Value range
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3 to 12: DI1 to DI10 Other: B connector

Note

F0-02 in the table is mapped from d0-01 in group F. These two parameters are equivalent.

Precautions

If F0-01 [Motor control mode] is set to V/f mode, only the speed control mode is supported.

If torque control mode applies under normal operating conditions, switch to the speed control mode during initial commissioning for motor auto-tuning. After the auto-tuning is done, adjust the operating direction and switch to the torque control mode again.

7.8 Motor Parameter Auto-tuning

7.8.1 Auto-Tuning Procedure

Application scenario

Perform motor parameter auto-tuning before operation to match the drive to different motors. The following scenarios require motor parameter auto-tuning.

1. Vector control

2. V/f control of asynchronous motor (Static auto-tuning is required if flying start is needed.)

Operation flowchart

The basic steps for parameter auto-tuning through the operating panel or software tool (iFA) are as follows.

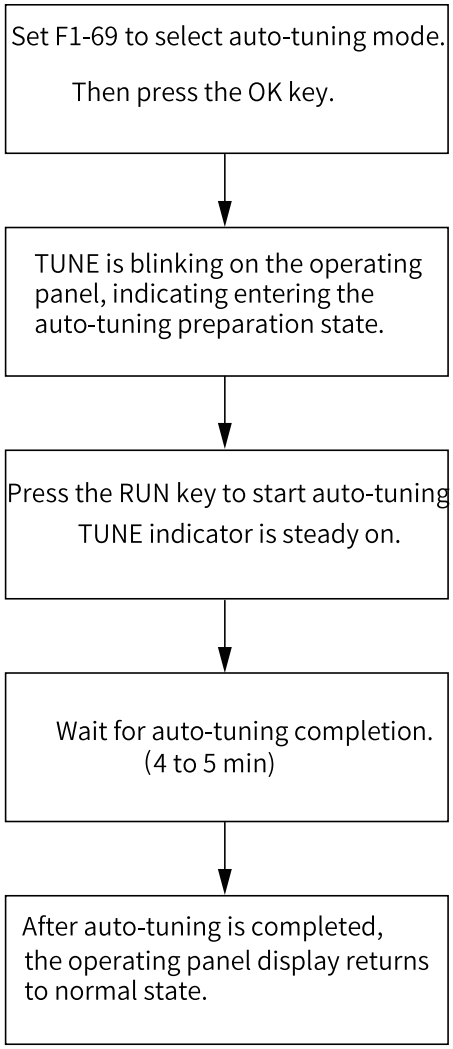


Figure 7-4 Parameter auto-tuning through the operating panel

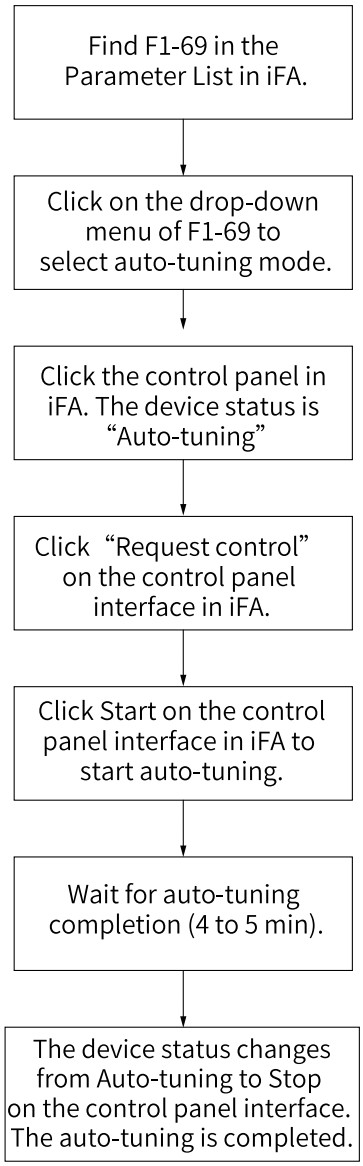


Figure 7-5 Parameter auto-tuning through the software tool (iFA)

Related parameters

Table 7–10 Parameters for setting motor parameter auto-tuning

Param.	Name	Default value	Value range	Description
F1-69 (C2-00)	Motor parameter auto-tuning mode	0	0: Not applied 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning	Defines the motor parameter auto-tuning mode. Value description: 0: Not applied 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning Note: Dynamic auto-tuning and inertia auto-tuning apply to applications where the motor can rotate without load. The motor does not need to be disconnected completely from the load to reach the no-load state. As long as no obvious load torque is detected after rotation, the no-load state applies. Static auto-tuning applies to applications where the motor cannot rotate. In dynamic auto-tuning, all parameters will be auto-tuned to ensure the optimal operating performance. Asynchronous motor: Compared with dynamic auto-tuning, in the complete static auto-tuning mode, inertia and friction torque parameters are not auto-tuned, and the mutual induction and no-load current are less accurate. Compared with the static complete auto-tuning, mutual induction and no-load current are not auto-tuned in static partial auto-tuning. Synchronous motor: Compared with dynamic auto-tuning, back EMF, inertia, and friction torque are not auto-tuned in static auto-tuning.

Note

F1-69 in the table is mapped from motor parameter C2-00. The settings of the two parameters are equivalent.

7.8.2 Asynchronous Motor Parameter Auto-Tuning

Mode selection

For better ease of use and control performance, the commissioning priority is as follows: 1> 2> 3> 4. Parameter auto-tuning for asynchronous motors is shown in *"Figure 7-6 Asynchronous motor parameter auto-tuning mode selection" on page 165*.

1. You can download the updated parameter files with commissioned parameters to the new motors and drives of the same models.
2. During initial commissioning, if the motor can rotate freely, it is recommended to set F1-69 [Motor parameter auto-tuning selection] to 2 [Dynamic parameter auto-tuning of asynchronous motor] to achieve optimal control performance.

3. If dynamic auto-tuning is not available and F1-30 [No-load current of asynchronous motor] and F1-28 [Mutual inductance of asynchronous motor] values are known, set F1-69 [Motor parameter auto-tuning selection] to 1 [Static partial parameter auto-tuning of asynchronous motor]. After auto-tuning is done, set the accurate no-load current and mutual inductance.
4. In cases where the motor cannot rotate and accurate no-load current/inductance are not known, you can set F1-69 [Motor parameter auto-tuning selection] to 3 [Static complete auto-tuning of asynchronous motor].

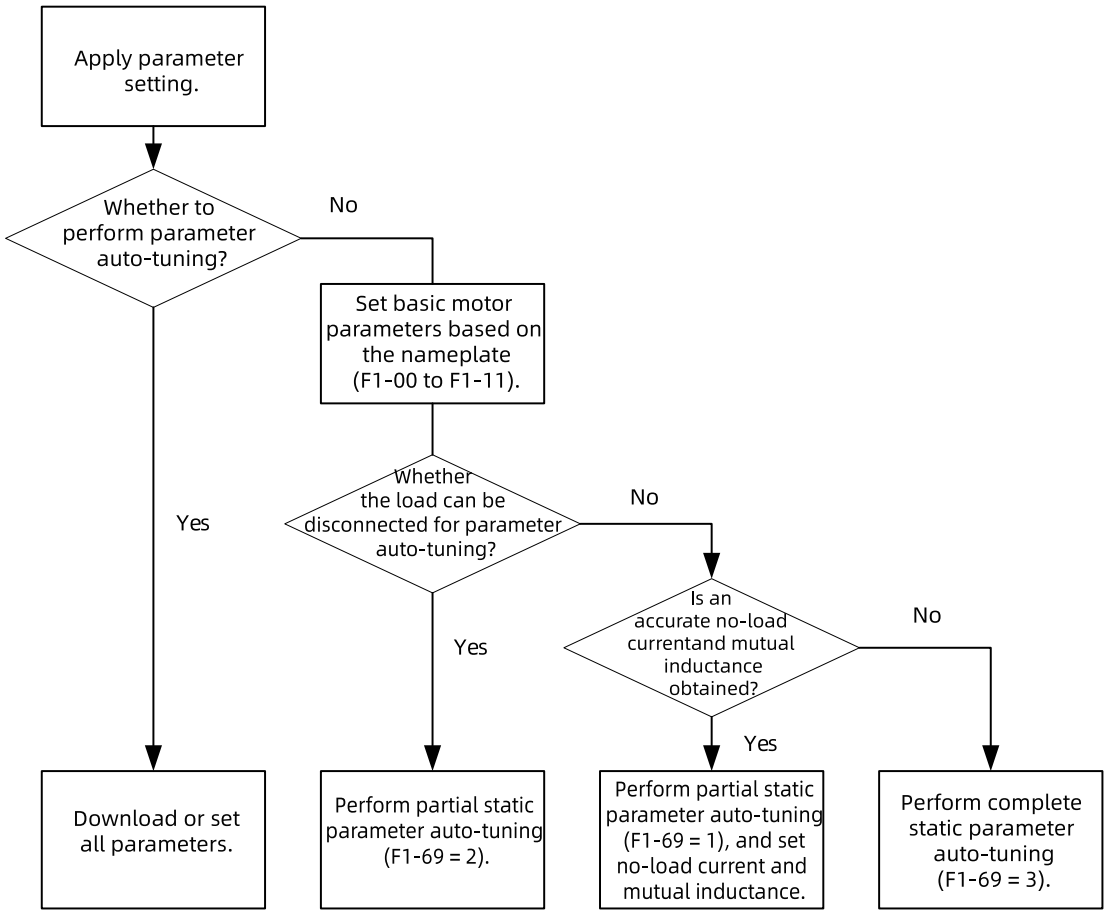


Figure 7-6 Asynchronous motor parameter auto-tuning mode selection

Related parameters

Table 7–11 Auto-tuned parameters for asynchronous motors

Param.	Name	Static partial auto-tuning of asynchronous motor	No-load dynamic auto-tuning of asynchronous motor	Static complete auto-tuning of asynchronous motor	Inertia auto-tuning	Description
F1-20	Stator resistance	Yes	Yes	Yes	-	-
F1-22	Asynchronous motor rotor resistance	Yes	Yes	Yes	-	-
F1-24	Asynchronous motor leakage inductance	Yes	Yes	Yes	-	-

Param.	Name	Static partial auto-tuning of asynchronous motor	No-load dynamic auto-tuning of asynchronous motor	Static complete auto-tuning of asynchronous motor	Inertia auto-tuning	Description
F1-28, F1-30	Asynchronous motor mutual inductance and no-load current	-	Yes	Yes	-	The no-load current and mutual inductance are critical to the low-speed performance of asynchronous motor in SVC mode. No-load dynamic auto-tuning ensures optimal performance. Static partial auto-tuning cannot detect the no-load current mutual inductance. You need to set the correct value manually. After static complete auto-tuning, the motor can run but the control effect is not optimal.
C5-02 to C5-09	Magnetic field saturation flux curve of asynchronous motor	-	Yes	-	-	-
A3-30 to A3-46	Dead zone compensation curve	Yes	Yes	Yes	-	The dead zone compensation curve is critical to the low-speed performance in SVC mode, which must be included when you set parameters or download parameter files.
F2-02, F2-03, F1-48	SVC speed loop Kp/Ti, inertia ratio	-	Yes	-	Yes	The system with fixed inertia can execute inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.

7.8.3 Synchronous Motor Parameter Auto-tuning

Mode selection

The parameter auto-tuning process of synchronous motors is shown in *"Figure 7-7 Synchronous motor parameter auto-tuning mode" on page 167*. The commissioning priority is recommended as follows: 1 > 2 > 3.

1. You can download the updated parameters files with commissioned parameters to the new motors and drives of the same models.

2. During initial commissioning, if the motor can rotate freely, it is recommended to set F1-69 [Motor parameter auto-tuning selection] to 12 [Dynamic parameter auto-tuning of permanent magnet motor] to achieve optimal control performance.
3. If dynamic auto-tuning is not available but F1-12 [Back EMF of the motor] is known, set F1-12 first, and then set F1-69 [Motor parameter auto-tuning selection] to 13 [Static partial auto-tuning of permanent magnet motor].
4. When the motor cannot rotate and the accurate back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning.

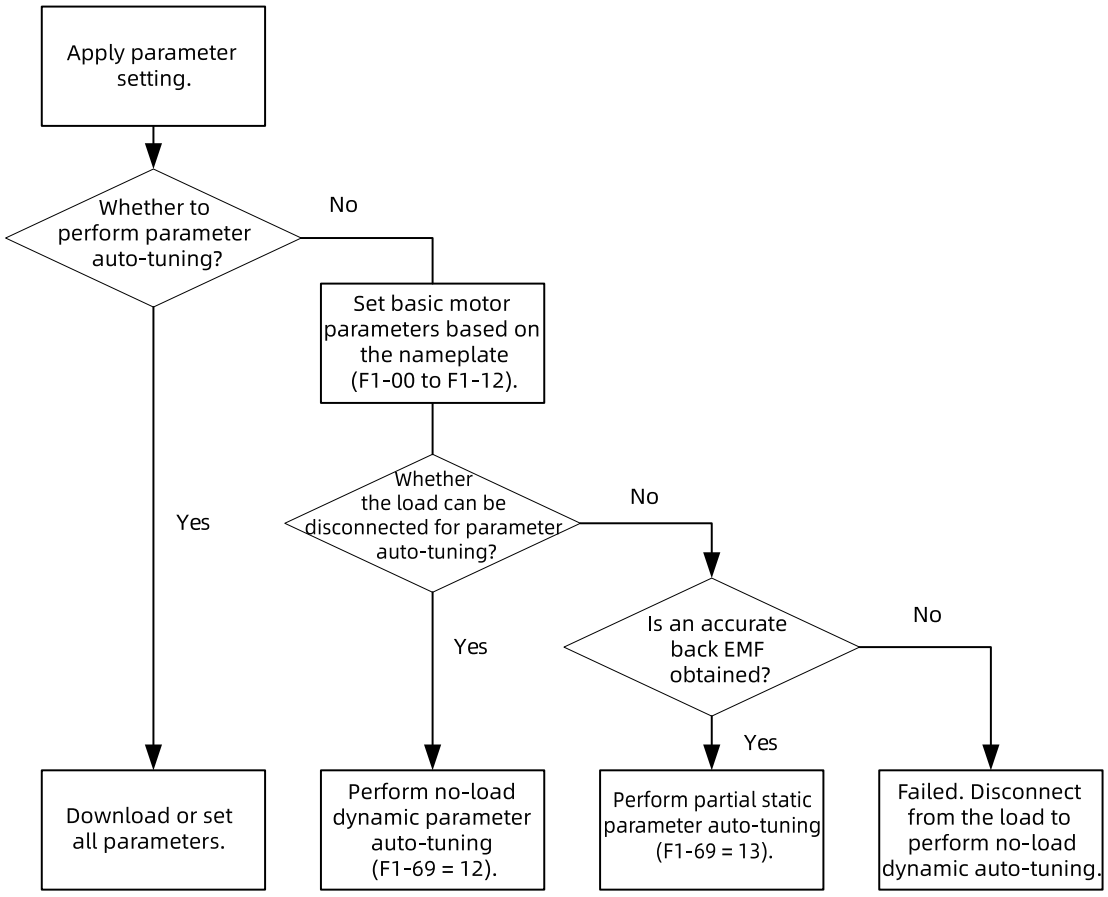


Figure 7-7 Synchronous motor parameter auto-tuning mode

Related parameters

After auto-tuning is done, the auto-tuned motor parameters are automatically saved to corresponding parameters. Parameters to be auto-tuned vary with the auto-tuning methods, as shown in the following table.

Table 7–12 Auto-tuned parameters for synchronous motors

Param.	Name	With-load auto-tuning of synchronous motor	No-load dynamic auto-tuning of synchronous motor	Static complete auto-tuning of synchronous motor	Inertia auto-tuning	Description
F1-12	Back EMF of synchronous motor	-	Yes	-	-	The back EMF refers to the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It affects the performance in low-speed operation greatly. For synchronous motors, if no-load dynamic auto-tuning is not available, it is recommended to check the motor nameplate or consult the motor manufacturer to set an accurate motor back EMF. F1-12 indicates the back EMF at rate speed. If the effective value of back EMF indicated on the nameplate is 120 V/krpm, the rated back EMF = d0-05/1000 x 120 V. The back EMF refers to the effective value of the line voltage. If the back EMF is unknown, disconnect the motor from the load to perform no-load dynamic auto-tuning. The above procedure only need to be performed once for motors with the same specifications. After that, you can manually input the back EMF value.
F1-20	Motor stator resistance	Yes	Yes	Yes	-	-
F1-32, F1-34	d-axis and q-axis inductance	Yes	Yes	Yes	-	-
C5-30 to C5-55	Inductance saturation curve	Yes	Yes	Yes	-	The inductance saturation curve is critical to the performance in SVC mode, which must be included when you set parameters or download parameter files.
A3-30 to A3-46	Dead zone compensation curve	Yes	Yes	Yes	-	The dead zone compensation curve is critical to the low-speed performance in SVC mode, which must be included when you set parameters or download parameter files.
F2-02, F2-03, C4-62	SVC speed loop Kp/Ti, inertia ratio	-	Yes	-	Yes	The system with fixed inertia can execute inertia auto-tuning to obtain accurate moment of inertia. Turning on the acceleration torque feedforward can achieve good acceleration/deceleration follow performance. The auto-tuning can obtain a proper speed loop Kp/Ti, which improves the resistance to load disturbance.

7.9 Setting Operation Commands

7.9.1 Selecting Control Channel

The command source is the source or input mode of operation commands to control the start, stop, forward run, reverse run, jog, and fault reset of the drive. See *"9.2.1 Selecting Control Channel and Operation Command" on page 289* for related parameters.

7.9.2 Operation Control Through the Operating Panel

You can start/stop the drive through the built-in operating panel.

Procedure

Set F0-03 [Main command source of control channel 1] to 0 [Operating panel] to set the operating panel as the command source, so that you can start/stop the drive through the operating panel.

- In the stop state, press  to set the start command of the drive.
- In the operation state, press  to set the stop command of the drive.
- In the fault state, press  to set the fault reset command.

7.9.3 Operation Control Through Terminals

You can start/stop the drive through the digital state of the DI terminal.

Procedure

1. Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
2. Select the terminal as the source.
   - Six terminal control modes are available, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2.
   - For example, when you set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A], the terminal start/stop source is module A (two-wire mode 2 by default).
   - You can switch freely between terminal modules A and B, enabling transition from terminal module A (configured as two-wire mode 2) to terminal module B (configured as three-wire mode 1).
3. Set the terminal control mode.
   For example, set b9-01 [Mode of terminal start/stop module A] to 4 [IN1P (rising edge) for start, IN2 for stop].
4. Defines the functions of each DI terminal.
   For example, set E0-00 [DI1 function selection] to 1 [Terminal A control_IN1] and E0-01 to 2 [Terminal A control_IN2].
5. After the terminal mode and each DI terminal function are configured, start/stop and fault reset can be performed on the drive through the DI terminal.

For example, when you enable DI1 with DI2 activated, the drive runs at the set frequency. If DI2 opens, the drive stops immediately.

See functions and related parameters in *"9.2.4 DI-Based Operation" on page 294*.

7.9.4 Operation Control Through Communication

Start or stop the drive through remote communication.

Procedure

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.
2. When the command source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive.
   7311H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

See functions and related parameters in *"9.2.5 Operation Control Through Communication" on page 306*.

7.9.5 Operation Control Through User-defined Channel

The user-defined main command source are available in control channels 1 and 2. The control channel 1 is activated by default. You can set the user-defined commands through parameters in groups b1 and b2.

Procedure

1. Set F0-03 [Main command source of control channel 1] to 3 [User-defined] to set the user-defined channel as the command source.
2. Set b1-01 [User-defined ON_OFF1 (start/stop) source] to 3 [DI1].

3. Set E0-00 [DI1 terminal function selection] to 0 [No function].
4. Set b1-02 [User-defined OFF2 (Coast to stop) source 1] to 1 [Invalid] and b1-03 [User-defined OFF3 (Quick stop) source 1] to 1 [Invalid].
5. After configuring the user-defined channel parameters and DI1 function, you can start/stop the drive through DI1.
   For example, when DI1 is enabled, the drive starts. When DI1 is disconnected, the drive stops.

See functions and related parameters in *"9.2.6 Operation Control Through User-Defined Channel" on page 311*.

7.10 Setting Frequency References

7.10.1 Selecting the Setting Channel

You can change the setting channel through b0-03 [Setting channel selection]. See details in *"9.3.1 Setting Channel and Frequency Reference" on page 316*.

7.10.2 Setting Frequency Through Parameters

You can set the frequency directly through parameters.

Procedure

1. Set F0-29 [Main frequency source] = 0 [F0-30].
2. Set F0-30 [Digital reference of main frequency] to the target frequency.
3. When the main frequency is set by parameters, in addition to directly modifying the value of the parameters to set the frequency, you can also set the frequency using the UP/DOWN keys.

After preceding settings are done, you can increase the frequency reference by pressing  on the operating panel or decrease the frequency by pressing  in real time.

For details, see *"9.3.2.2 Setting Main Frequency Through Parameter" on page 320*.

7.10.3 Setting Frequency Through Multi-reference

Set b5-00 [Main frequency source] to 6 [Multi-reference]. Up to 16 multi-references can be set, which can be selected through b8-03 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit3] or combination of input signals from the four DI terminals.

Procedure

Set F0-29 [Main frequency source] to 6 [Multi-reference].

You can assign the multi-reference terminal function to the DI and switch among pre-set multi-references through the DI. Up to 16 multi-references are supported. You can set four groups of multi-references through parameters in group F.

For details, see *"9.3.2.4 Setting the Main Frequency through Multi-references" on page 323*.

7.10.4 Setting Frequency Through PID

PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value.

Procedure

1. When setting F0-29 [Main frequency source] to 8 [PID], the PID controller output is set as the active frequency source.
2. To use PID as the frequency source, enable the PID function through setting P2-00 [Process PID enable] to 1 [Enable].
3. Set the PID reference source and feedback source. By default, P2-02 [PID reference source] is set to 0 [Value reference] (defined by P2-03), and P2-04 [PID feedback source] is set to 0 [AI1].

See functions and related parameters in *"9.3.2.6 Setting Main Frequency Through PID" on page 335*.

7.10.5 Setting Frequency Through Communication

Set b5-00 [Main reference source] to 9 [Communication] to set communication as the main reference source.

Procedure

The following shows how to set "Communication" as the main frequency source of channel 1.

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 and select the 7310H speed setting configuration.
3. Send a write command to the drive through the host controller.

When the frequency source is set to communication, you need to configure basic communication parameters to enable the AC drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the AC drive to write communication commands to the AC drive. For details on the communication configuration method and communication address, see *"9.3.2.7 Setting the Main Frequency Through Communication" on page 342*.

7.11 Setting Torque References

7.11.1 Selecting the Setting Channel

Procedure

Set b0-03 [Setting channel selection] to change the active setting channel.

See details in *"9.4.2 Selecting Torque Reference Source" on page 367*.

7.11.2 Setting Torque Through Parameter

Set the reference value of b5-14 [Digital torque reference] as the active torque source.

Procedure

Set b5-13 [Torque reference source] to 0 [b5-14].

See details in *"9.4.3 Setting Torque Reference Through Parameter" on page 370*.

7.11.3 Setting Torque Frequency Through Communication

Set the torque through communication.

Procedure

1. Set b0-03 to 0 and b5-13 to 9 to select communication as the main torque reference source of setting channel 1.

2. Set n0-14 to select 7310H torque reference configuration.

3. Send a write command to the drive through the host controller.

When the torque reference is set through communication, you need to configure basic communication parameters to enable the drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the drive to write communication commands to the drive.

For details on the communication configuration method and communication address, see *"9.4.7 Setting Torque Reference Through Communication" on page 384*.

7.12 Jog

7.12.1 Selecting the Setting Channel

In some applications, the drive needs to run at a low speed temporarily to facilitate equipment testing. You can use the jog mode in this case. See *"9.6.2 Jog Frequency Source" on page 421* for the jog reference setting channel.

Procedure

Set b0-03 [Setting channel selection] to change the active setting channel.

Related parameters

Table 7–13 Setting channel selection

Param.	Name	Default value	Value range
b0-03	Setting channel selection	0	0: Setting channel 1 1: Setting channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector

7.12.2 Setting Jog Frequency

Same as the main frequency source, the jog frequency source can be set through the parameter, AI, multi-reference, or communication as defined by F0-56 [Source of jog frequency 1] and F0-58 [Source of jog frequency 2].

When the jog command is active, the frequency reference of the drive is defined by the jog frequency.

- When jog 1 command is active, the frequency reference of the drive is the jog frequency 1.
- When jog 2 command is active, the frequency reference of the drive is the jog frequency 2.

For jog references set through digital reference or multi-reference, replace parameters with jog-related parameters.

Procedure

1. Set the source of jog frequencies 1 and 2 through F0-56 [Source of jog frequency 1] and F0-58 [Source of jog frequency 2].
2. Set other parameters based on the frequency source selected according to *" Set frequency references." on page 171*.

Related parameters

Table 7–14 Parameters related to jog frequency

Param.	Name	Default value	Value range
F0-56 (b5-07)	Source of jog frequency 1	0: F0-57	0: F0-57 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F0-58 (b5-09)	Source of jog frequency 2	0: F0-59	0: F0-59 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector

When F0-56 [Source of jog frequency 1] is set to 0 [F0-57] or F0-58 [Source of jog frequency 2] is set to 0 [F0-59], set the reference value of F0-57 as the source of jog frequency 1 or set the reference value of F0-59 as the source of jog frequency 2.

Param.	Name	Default value	Value range
F0-57 (b5-08)	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz
F0-59 (b5-10)	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz

7.12.3 Setting Jog Commands Through Terminals

You can start/stop the drive by setting operation commands through DI state. When jog command is set, the drive runs at the jog frequency.

The jog ramp-up/down time can be defined by F0-63 [Jog ramp-up time], F0-64 [Jog ramp-down time], or b7-04 to b7-27 (Ramp time in normal operation), as selected by F0-62 [Jog ramp source selection].

Procedure

1. Set F0-03 [Main command source of control channel 1] to 1 to select the terminals as the active command source.
2. Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
3. Set F4-03 [DI1 function selection] to 4 [Terminal start/stop module A jog 1] and F4-04 [DI2 function selection] to 5 [Terminal start/stop module A jog 2].
4. Set F0-62 [Jog ramp source selection] to 1 [Jog ramp time].
5. Set F0-63 [Jog ramp-up time] to 20.0s and F0-64 [Jog ramp-down time] to 20.0s.

After preceding settings are done, if DI1 input is active, the drive starts at jog frequency 1. If DI2 input is active, the drive starts at jog frequency 2. If both DI1 and DI2 are closed, the drive starts jog frequency 1.

Related parameters

Table 7–15 Parameters related to jog

Param.	Name	Default value	Value range
F4-03 (E0-00)	DI1 function selection	1	4: Terminal start/stop module A jog 1(JOG1) 5: Terminal start/stop module A jog 2(JOG2)
F4-04 (E0-01)	DI2 function selection	4	
F4-05 (E0-02)	DI3 function selection	9	
F4-06 (E0-03)	DI4 function selection	12	
F4-07 (E0-04)	DI5 function selection	13	
F4-08 (E0-05)	DI6 function selection	0	
F4-09 (E0-06)	DI7 function selection	0	
F4-10 (E0-07)	DI8 function selection	0	
F4-11 (E0-08)	DI9 function selection	0	
F4-12 (E0-09)	DI10 function selection	0	
F0-62 (b7-31)	0: Ramp time in normal operation 1: Ramp time in jog	0	Defines the ramp-up/down time during jog. b7-31 [Jog ramp source] is mapped to F0-62 in group F. These two parameters have the same function. Value description: 0: Ramp time in normal operation The ramp time in jog is the same as that in normal operation. 1: Ramp time in jog The ramp time in jog is set separately (F0-63, F0-64).

Param.	Name	Default value	Value range
F0-63 (b7-32)	Ramp-up time in jog	20	Defines the time required for the output frequency to ramp up from 0 to F0-46 [Base frequency for ramp-up/down] in the jog mode. F0-63 is mapped to b7-32 [Ramp acceleration time of jog] in group F. These two parameters have the same function. Note: The ramp-up current must be limited to a value below the overcurrent capacity of the drive, preventing the drive from tripping due to overcurrent stall.
F0-64 (b7-33)	Ramp-down time in jog	20	Defines the time required for the output frequency to ramp down from F0-46 [Base frequency for ramp-up/down] to 0 in the jog mode. b7-33 [Jog ramp deceleration time] is mapped to F0-64 in group F. These two parameters have the same function. Note: The ramp-down time must be set to a value that prevents excessively high smoothing circuit voltage, preventing the drive from tripping due to regenerative overvoltage stall.

7.13 Viewing Common Monitoring Parameters

You can view the default monitoring parameters in the stop or operational state through the monitoring page on the operating panel, as shown in *" Status Monitoring" on page 108*.

Enter U group parameters through the operating panel to view commonly used monitoring parameters.

7.13.1 Basic Monitoring Parameters

Param.	Name	Monitoring range
U0-02	Bus voltage	0.0 V to 6553.5 V
U0-03	Output voltage	0 V to 65535 V
U0-04	Output current	0.00 A to 655.35 A
U0-05	Output power	-3276.8 kW to +3276.7 kW
U0-06	Output torque	-3276.8 to +3276.7
U0-35	Target torque	-200.0% to +200.0%
U0-65	Torque upper limit	-2000.0% to +2000.0%
U2-01	Current control channel	0: Control channel 1 1: Control channel 2
U2-02	Current setting channel	0: Setting channel 1 1: Setting channel 2

7.13.2 Speed Monitoring Parameters

Param.	Name	Monitoring range
U0-00	Operating frequency	0.00 Hz to 600.00 Hz
U0-01	Frequency reference	0.00 Hz to 600.00 Hz
U0-14	Load speed display	0 rpm to 65535 rpm
U0-19	Actual motor frequency	-327.68 Hz to +327.67 Hz
U0-30	Main frequency reference	-327.68 Hz to +327.67 Hz
U0-31	Auxiliary frequency reference	-327.68 Hz to +327.67 Hz
U0-59	Frequency reference (%)	-3276.8 to +3276.7
U0-60	Operating frequency (%)	-3276.8 to +3276.7
U0-69	Actual motor frequency (signed)	-327.68 Hz to +327.67 Hz
U0-70	Actual motor speed (signed)	-32768 rpm to +32767 rpm
U0-75	Actual motor frequency (unsigned)	0.00 Hz to 655.35 Hz

7.13.3 Terminal Monitoring Parameters

Param.	Name	Monitoring range
U0-07	DI state	0x0000 to 0xFFFF
U0-08	DO state	0x0000 to 0xFFFF

7.13.4 Data Received Through Communication

Param.	Name	Monitoring range
U0-28	Reference value set through communication	-300.00 % to +300.00%
U3-23	Monitoring on speed reference 1 set through communication (0x1000)	-32767 to +32768
U3-16	Speed reference 2 set through communication (0x7310)	0 to 65535
U3-33	Control word 1 set through communication (0x7321)	0x0000 to 0xFFFF
U3-17	Control word 2 set through communication (0x7311)	0x0000 to 0xFFFF

7.13.5 Other Common Monitoring Parameters

Param.	Name	Monitoring range
U0-15	PID setting	0 to 65535
U0-16	PID feedback	0 to 65535
U0-17	PLC phase	0 to 65535
U2-05	Current multi-speed selection	0 to 65535
U2-06	Current multi-speed effective value	-3276.8 to +3276.7
U0-82	Heatsink temperature	-20.0°C to +120°C

7.14 Common Commissioning Parameters

7.14.1 Control Method and Control Mode

Param.	Name	Default value	Monitoring range
F0-01 (d0-00)	Motor control method	2	0: SVC 2: V/f
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3 to 12: DI1 to DI10 Other: B connector

7.14.2 Frequency Setting Parameters

Param.	Name	Default value	Value range
F0-25 (A0-70)	Decimal places of frequency reference	2	1: One decimal place 2: Two decimal places
F0-29 (b5-00)	Main frequency source	0	0: F0-30 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 to A2-17
F0-31 (b5-02)	Auxiliary frequency source	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F0-32 (b5-03)	Calculation relationship between main and auxiliary references	0	0: X + Y 1: X - Y 2: Max. (|X|, |Y|) 3: Min. (|X|, |Y|) 4: X × Y

Param.	Name	Default value	Value range
F0-33 (b5/-04)	Additional frequency source	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F0-34 (b5/-05)	Source of main frequency gain coefficient	0	0: 100% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector

7.14.3 Parameters Related to Multi-references

Param.	Name	Default value	Value range
F0-38 (b8-08)	Source of multi-reference 0	0	0: F0-39 5: PID 6: b5-01/b6-01 Other: F connector
F0-39 (b8-09)	Multi-reference 0	0.0	b8-42 and b8-43
F0-40 (b8-10)	Multi-reference 1	0.0	b8-42 and b8-43
F0-41 (b8-11)	Multi-reference 2	0.0	b8-42 and b8-43
F0-42 (b8-12)	Multi-reference 3	0.0	b8-42 and b8-43

7.14.4 Parameters for Setting V/f Curve

When F0-01 [Motor control mode] is set to 2 [V/f], V/f-related parameters need to be set. V/f control is divided into V/f curve, which can be linear or multi-point curves, and decoupled V/f mode.

Param.	Name	Default value	Value range
d2-00	V/f curve type	0	0: Linear 1: Multi-point 10: Decoupled V/f
d2-02	Frequency point 1 of multi-point V/f curve	0.0 Hz	0 to d2-03
d2-03	Frequency point 2 of multi-point V/f curve	0.0 Hz	d2-02 to d2-04
d2-04	Frequency point 3 of multi-point V/f curve	0.0 Hz	d2-03 to 600.0 Hz

Param.	Name	Default value	Value range
d2-08	Voltage point 1 of multi-point V/f curve	0.0	0.0 V to 1000.0 V
d2-09	Voltage point 2 of multi-point V/f curve	0.0	0.0 V to 1000.0 V
d2-10	Voltage point 3 of multi-point V/f curve	0.0	0.0 V to 1000.0 V
d2-47	Voltage upper limit in decoupled V/f	100.0%	50.0% to 200.0%
d2-48	Source of V/f decoupled voltage	0	0: d2-49 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
d2-49	Digital reference of V/f decoupled voltage	0 V	0 to C4-03
d2-50	Voltage ramp-up time in decoupled V/f	0.0s	0.0s to 1000.0s
d2-51	Voltage ramp-down time in decoupled V/f	0.0s	0.0s to 1000.0s
d2-52	RFG time of V/f decoupled frequency	0	0: Set to 0 forcibly 1: Preset RFG time
d2-53	Stop mode in decoupled V/f	0	0: Frequency and voltage reduced to 0 independently 1: Frequency reduced after voltage reduced to 0 2: Coast to stop (newly added)

7.14.5 SVC Curve Parameters

When F0-01 [Motor control mode] is set to 0 [SVC], you need to set SVC-related parameters. The following table shows the related parameters. F2-02 to F2-03 set the control parameters, and F2-04 to F2-12 adjust the effective speed loop parameters according to the actual operating conditions.

Param.	Name	Default value	Value range
F2-02 (d3-02)	Speed loop Kp in SVC mode	5.0	0.0 to 6000.0
F2-03 (d3-03)	Speed loop Ti in SVC mode	0.127s	0.000s to 20.000s
F2-04 (d3-06)	Zero speed switchover frequency	1.0%	0 to d3-09
F2-05 (d3-07)	Zero speed Kp calibration coefficient	100.0%	0.0% to 1000.0%
F2-06 (d3-08)	Zero speed Ti calibration factor	100.0%	0.0% to 1000.0%
F2-07 (d3-09)	Low speed switchover frequency	10.0%	0.0% to d3-12

Param.	Name	Default value	Value range
F2-08 (d3-10)	Low speed Kp calibration factor	100.0%	0.0% to 1000.0%
F2-09 (d3-11)	Low speed Ti calibration factor	100.0%	0.0% to 1000.0%
F2-10 (d3-12)	High speed switchover frequency	100.0%	d3-09 to 400.0%
F2-11 (d3-13)	High speed Kp calibration factor	100.0%	0.0% to 1000.0%
F2-12 (d3-14)	High speed Ti calibration factor	100.0%	0.0% to 1000.0%

7.14.6 Motor Phase Sequence Switchover Parameters

Unlike the speed reversal function, the direction of the speed reference is not changed when the motor phase sequence is switched, but the actual operating direction of the motor changes to the opposite direction.

Param.	Name	Default value	Value range
F2-14 (d0-14)	Motor direction selection	0	0: Default direction 1: Opposite direction

7.14.7 Ramp-up/down Parameters

Param.	Name	Default value	Value range
F0-45 (b7-00)	Ramp-up/down mode	0	0: Linear 1: S-curve
F0-46 (b7-01)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference
F0-48 (b7-04)	Ramp-up time of ramp 1	20.0 s	0.0s to 6500.0s
F0-49 (b7-05)	Ramp-down time of ramp 1	20.0 s	0.0s to 6500.0s
F0-50 (b7-06)	Ramp-up start arc of ramp 1	0.00s	0.00s to 650.00s
F0-51 (b7-07)	Ramp-up end arc of ramp 1	0.00s	0.00s to 650.00s
F0-52 (b7-08)	Ramp-down start arc of ramp 1	0.00s	0.00s to 650.00s
F0-53 (b7-09)	Ramp-down end arc of ramp 1	0.00s	0.00s to 650.00s

7.14.8 Frequency Limit Parameters

Param.	Name	Default value	Value range
F2-22 (d1-03)	Digital reference of positive frequency upper limit 1	800.0%	F2-26 to 800.0%
F2-23 (d1-04)	Digital reference of negative frequency upper limit 1	-800.0%	-800.0% to F2-27
F2-24 (d1-05)	Source of positive frequency upper limit 2	0 [800.0%]	0: 800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F2-25 (d1-06)	Source of negative frequency upper limit 2	1 [Inverted value of d1-05]	0: -800% 1: Inverted value of d1-05 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F2-26 (d1-07)	Digital reference of positive frequency lower limit 1	0.0%	0.0% to F2-22
F2-27 (d1-08)	Digital reference of negative frequency lower limit 1	0.0%	F2-23 to 0.0%
F2-30 (d1-09)	Digital reference of torque upper limit 1	150.0%	0.0% to 800.0%
F2-31 (d1-10)	Digital reference of torque lower limit 1	-150.0%	-800.0% to 0.0%
F2-32 (d1-11)	Source of torque upper limit 2	0	0: 800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
F2-33 (d1-12)	Source of torque lower limit 2	1	0: -800% 1: Inverted value of d1-11 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector

7.14.9 Common Protection Parameters

Param.	Name	Default value	Value range
F2-36 (d0-41)	Over-excitation gain (V/f)	90%	0% to 200%
F2-37 (d2-26)	Overcurrent suppression enable	1	0: Disable 1: Enable
F2-38 (d2-27)	Overcurrent suppression threshold	200%	80% to 300%
F2-39 (d1-54)	Overvoltage suppression enable	0x0001	bit0: Overvoltage suppression enable in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable
F2-40 (d1-55)	Voltage threshold for overvoltage suppression	770.0 V	600.0 V to A3-57
F2-43 (d1-63)	Response to undervoltage	0	0: Not respond 1: Suppress undervoltage 2: Decelerate to stop
F2-44 (d1-64)	Voltage threshold for undervoltage suppression	430.0 V	A3-55 to 500.0 V

7.14.10 Startup Parameters

Param.	Name	Default value	Value range
F2-15 (d0-02)	Startup mode	0	0: Direct start 1: Flying start
F2-16 (d0-03)	Speed tracking mode	4	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking
d0-23	Starting frequency	0.00 Hz	0.00 Hz to 10.00 Hz
d0-24	Starting frequency hold time	0.0s	0.0s to 1000.0s
d0-25	DC braking time at start	0.0s	0.0s to 100.0s
d0-26	DC braking current at start	50%	0% to 800%

7.14.11 Stop Mode Parameters

Param.	Name	Default value	Value range
d0-04	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability
d0-05	OFF2 (coast to stop) mode	0	0: Coast to stop
d0-06	OFF3 (quick stop) mode	0	0: Quick stop 1: Stop with maximum capability
d0-27	Starting frequency of DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz
d0-28	Waiting time of DC braking at stop	0.0s	0.0s to 100.0s
d0-29	DC braking time at stop	0.0s	0.0s to 100.0s
d0-30	DC braking current at stop	50%	0% to 800%

7.14.12 Carrier Frequency Parameters

Param.	Name	Default value	Value range
F2-48 (A5-06)	Overmodulation coefficient	103.0 %	0.0% to 110.0%
F2-50 (A5-01)	Carrier frequency reference	4.0 kHz	0.8 kHz to 20.0 kHz

7.14.13 I/O Parameters

Param.	Name	Default value	Value range
F4-00 (b9-00)	Terminal start/stop module A/B selection	0	0: Module A 1: Module B Other: B connector
F4-01 (b9-01)	Mode of terminal start/ stop module A	3	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start and IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop and IN3 for direction 6: IN1P (rising edge) for start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop
F4-02 (b9-09)	Mode of terminal start/ stop module B	3	Same as F4-01

Param.	Name	Default value	Value range
F4-03 (E0-00)	DI1 function selection	1	-
F4-04 (E0-01)	DI2 function selection	4	
F4-05 (E0-02)	DI3 function selection	9	
F4-06 (E0-03)	DI4 function selection	12	
F4-07 (E0-04)	DI5 function selection	13	
F4-08 (E0-05)	DI6 function selection	0	
F4-09 (E0-06)	DI7 function selection	0	
F4-10 (E0-07)	DI8 function selection	0	
F4-11 (E0-08)	DI9 function selection	0	
F4-12 (E0-09)	DI10 function selection	0	
F4-14 (E1-00)	RO output selection	2	-
F4-15 (E1-04)	DO function selection	0	

7.14.14 Communication Parameters

The following are the common communication parameters of the drive.

Table 7–16 Common communication parameters

Param.	Name	Default value	Value range
Fd-00	Commissioning address (for commissioning software/operating panel)	1	1 to 127
n0-10	Communication type selection	1	1: Reserved 2: EtherNet/IP 3: PROFINET
n5-00	EtherNet/IP-DHCP selection	0	0: Disable 1: Enable
n5-01	EtherNet/IP - Most significant byte of IP address	0	0 to 255
n5-02	EtherNet/IP - Second most significant byte of IP address	0	0 to 255
n5-03	EtherNet/IP - Third byte of IP address	0	0 to 255

Param.	Name	Default value	Value range
n5-04	EtherNet/IP - Least significant byte of IP address	0	0 to 255
n5-05	EtherNet/IP - Most significant byte of subnet mask	0	0 to 255
n5-06	EtherNet/IP - Second most significant byte of subnet mask	0	0 to 255
n5-07	EtherNet/IP - Third byte of subnet mask	0	0 to 255
n5-08	EtherNet/IP - Least significant byte of subnet mask	0	0 to 255
n5-09	EtherNet/IP - Most significant byte of gateway	0	0 to 255
n5-10	EtherNet/IP - Second most significant byte of gateway	0	0 to 255
n5-11	EtherNet/IP - Third byte of gateway	0	0 to 255
n5-12	EtherNet/IP - Least significant byte of gateway	0	0 to 255
n6-01	PROFINET - Most significant byte of the IP address	0	0 to 255
n6-02	PROFINET - Second most significant byte of the IP address	0	0 to 255
n6-03	PROFINET - Third byte of the IP address	0	0 to 255
n6-04	PROFINET - Least significant byte of the IP address	0	0 to 255
n6-05	PROFINET - Most significant byte of the subnet mask	0	0 to 255
n6-06	PROFINET - Second most significant byte of the subnet mask	0	0 to 255
n6-07	PROFINET - Third byte of subnet mask	0	0 to 255
n6-08	PROFINET - Least significant byte of subnet mask	0	0 to 255
n6-09	PROFINET - Most significant byte of gateway	0	0 to 255
n6-10	PROFINET - Second most significant byte of gateway	0	0 to 255
n6-11	PROFINET - Third byte of gateway	0	0 to 255
n6-12	PROFINET - Least significant byte of gateway	0	0 to 255

7.15 Trial Run

After ensuring that the related parameters are set correctly, try disconnecting the motor from the load or reduce the load to the minimum to perform trial run. Then check whether the motor direction and status meet the control requirements.

7.16 Quick Copy after Commissioning

This function is used to copy the commissioned parameters to the other drives quickly to achieve batch commissioning.

8 Communication

8.1 Connecting Communication System

In the communication system, data is divided into cyclic data and service data.

- Cyclic data belongs to cyclic interaction data, also known as process data that typically used to transmit control words, setpoints, status words, and actual values.
- Service data belongs to acyclic interaction data that transmitted only after a corresponding request is executed, also known as mailbox data that typically used for reading and writing parameters.

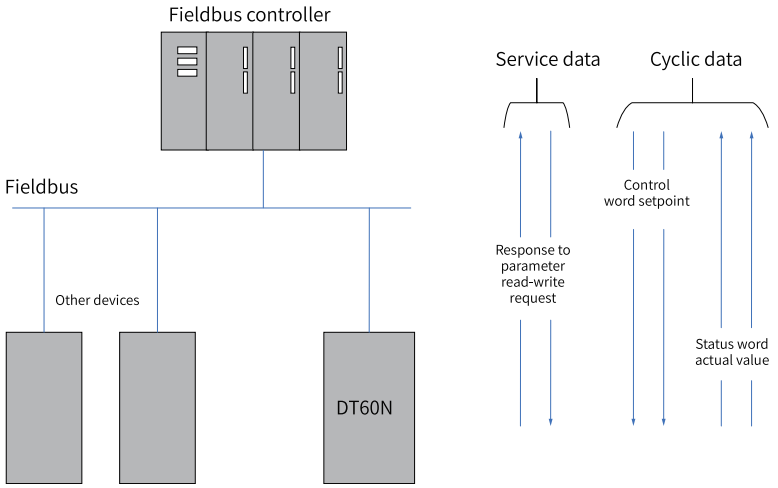


Figure 8-1 Communication system connection diagram

Note

Visit Inovance official website to download the communication configuration file or contact Inovance technical support to obtain the communication configuration file.

8.2 List of Communication Protocols

See the following table for communication protocols supported by DT60.

Model	Protocol	Hardware
DT60	EtherNet/IP/PROFINET (standard)	M12 interface of the drive

Visit Inovance official website to download the communication configuration file or contact Inovance technical support to obtain the communication configuration file.

8.3 Communication Configuration Flowchart

The communication configuration of the drive is generally performed according to the following procedure.

1. Connect the communication circuit correctly according to the selected communication type, and connect the drive to the bus system.
2. Configure the communication between the drive and the bus controller according to the selected communication type, including:
   a. Set communication parameters in the drive to ensure that the drive communication parameters match those of the bus controller.
   b. Configure the bus controller to ensure that communication connection is established between the drive and the bus controller Note 1.
3. Set functions that need to be set through communication. Make the communication data received by the drive as the source for the corresponding function Note 2 Note 3.

Note 1: First set n0-10 [Communication type selection] to 2 [EtherNet/IP] or 3 [PROFINET]. Switch the communication type to the required type before setting the corresponding communication parameters.

Note 2: For example, if the bus controller sends a command word to control start/stop of the drive, set the main command source for the active control channel (two control channels available: F0-03/b1-00 as channel 1 and b3-00 as channel 2) to 2 [Communication].

Note 3: For example, if the bus controller sends a frequency reference to control the output frequency of the drive, set the main frequency source (two setting channels available: F0-29/b5-00 as channel 1 and b6-00 as channel 2) to 9 [Communication].

8.4 Parameter Communication Address

The communication address of the parameter is in unsigned 16-bit format, represented in hexadecimal. For example, the communication address of F1-10 is 0xF10A.

The communication address of the parameter can be obtained from the corresponding user guide or from the communication address column in the parameter list of the commissioning software.

Additionally, the drive provides a non-persistent communication address. If the parameter modified through communication does not need to be preserved after power-off, simply changing the value in the non-persistent communication address. The non-persistent communication address of the parameter is the persistent communication address plus 100.

Caution

Generally, the parameter is written to the communication address of the read-write parameter, and the parameter value is saved at power failure. It is forbidden to write values to the storage communication address frequently, which may affect the service life of the storage device of the AC drive.

8.4.1 Control Word and Status Word

8.4.1.1 Control Word

The control word setting range for communication is 0 to 8, with the following options.

Comm. address	Description
0x7311H	0: Stop (the drive stops according to the OFF1 stop mode)
	1: Forward run
	2: Reverse run
	3: Jog 1
	4: Jog 2
	5: Coast to stop
	6: Stop (the drive stops according to the OFF1 stop mode)
	7: Reset fault
	8: Emergency stop (the drive performs emergency stop according to the OFF3 stop mode)

The control word setting is active only after the main command source (b1-00/F0-03, or b3-00) in the currently set control channel (b0-02) is set to 2 [Communication].

The meaning of the communication target frequency (address 7310H) is as follows:

Param.	Description
Target frequency	You can set the target frequency of the drive through this data during communication. The data format of this address is defined by n0-14 [7310H Speed setting selection].

The setting is active only after the main frequency source (F0-29/b5-00 or b6-00) in the active setting channel is set to 9 [Communication].

The data format of the frequency reference is determined by the setting of n0-14 [7310H Speed setting Selection], as shown below.

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
0 [Frequency (unsigned 16-bit)]	Hz	Unsigned 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				2000	20.00 Hz
1 [Frequency (signed 16-bit)] (Default)	Hz	Signed 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				-1000	-10.00 Hz
2 [Speed (signed 16-bit)]	rpm	Signed 16-bit	No decimal places	1500 (2 pairs of motor poles)	1500 rpm (50.00 Hz)
				-1500 (2 pairs of motor poles)	1500 rpm (-50.00 Hz)
3 [Percentage (corresponds to rated frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (Rated frequency:50.00 Hz)	10.00 % (5.00 Hz)
				-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)
4 [Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (maximum frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

8.4.1.2 Status Word

The meaning of each bit of the status word of communication is shown below.

Comm. address	bit	Definition	Description
0x7044H	0	0 = Stop	Stop state of the drive
		1 = Running	Operating state of the drive
	1	0 = Motor rotating forwardly	Actual motor speed > 0
		1 = Motor rotating reversely	Actual motor speed < 0
	2	0 = No fault	No fault occurred on the drive
		1 = Fault occurred	Fault occurred on the drive Reset the fault by writing 7 to the control word.
	3	0 = Frequency not reached	The operating frequency of the drive does not reach the target frequency detection range.
		1 = Frequency reached	The operating frequency of the drive has reached the target frequency detection range (target frequency ±per-unit frequency A2-04 x frequency arrival detection window P0-38).
	4 to 7	Reserved	-
	8 to 15	Fault code	Current fault code of the drive

The meaning of the communication target frequency is as follows.

Param.	Description
Operating frequency	Indicates the operating frequency of the drive. Data format is signed 16-bit with 2 decimal places.

8.4.2 Special Communication Address

This drive provides special communication address that can be read and written, allowing the host controller to write certain values to achieve function setting through communication. The special communication addresses described in this section are non-retentive at power failure.

*"8.4.2.1 Special Communication Control Word" on page 193*and *"8.4.2.2 Special Communication Status Word" on page 194* are active only when the special communication protocol is enabled (n0-18 = 1).

Table 8–1

Param.	Name	Default value	Value range	Description
n0-18	Communication protocol	0	0: Standard Inovance protocol 1: SEW protocol 2: AB protocol	Used to select the communication protocol. 0 - Standard Inovance protocol ① Set the target frequency through communication address 0x7310. ② Set the control word through communication address 0x7311. ③ Display the motor actual frequency through communication address 0x7045. ④ Display the drive status through communication address 0x703D/0x7044. 1 - SEW communication protocol: ① Set the control word through communication address 0x7319 (for bit definitions, see descriptions of U3-25). ② Set the target frequency through communication address 0x731A (for function definitions, see descriptions of U3-26). ③ Set the acceleration/deceleration time through communication address 0x731B (for function definitions, see descriptions of U3-27). ④ Display the general status word through communication address 0x705B (for bit definitions, see descriptions of U0-91). ⑤ Display status word 1 through communication address 0x705C (for bit definitions, see descriptions of U0-92). ⑥ Display the actual current through communication address 0x705D. ⑦ Display status word 2 through communication address 0x705E (for bit definitions, see descriptions of U0-94). 2 - AB communication protocol: ① Set the control word through communication address 0x733A (for bit definitions, see descriptions of U3-58). ② Set the frequency through communication address 0x733B. ③ Display the drive operation status through communication address 0x733C (for bit definitions, see descriptions of U3-60). ④ Display the motor operating frequency through communication address 0x733D. ⑤ Display the DI input status through communication address 0x733E (for bit definitions, see descriptions of U3-62). ⑥ Display the output current through communication address 0x733F. ⑦ Display the drive faulty status through communication address 0x7340.

8.4.2.1 Special Communication Control Word

Comm. address		Description
Special communication protocol - control word	7319H	bit0: Controller start 0: Start 1: Brake apply bit1: Start/Emergency stop 0: Emergency stop 1: Start bit2: Start/Stop 0: Stop according to F2-17 1: Start bit3 to bit4: Reserved bit5: Parameter switchover (switch motor parameters and acceleration/deceleration time parameters) bit6: Fault reset (rising-edge-triggered) bit7: Reserved bit8: Forced brake release 0: Inactive 1: Brake release bit9 to bit15: Reserved
Special communication protocol - Speed reference	731AH	In the Q14 fixed-point format, the hexadecimal range 0xC000 to 0x4000 is scaled to represent the percentage range from -100% to 100%.
Special communication protocol - Acceleration/ Deceleration time	731BH	Directly set to F0-48/49. The acceleration/deceleration time base is selected by F0-46.

8.4.2.2 Special Communication Status Word

Comm. address		Description
Special communication protocol - General status word	705BH	bit0: Maintenance switch 0: Bus normal 1: Enable bit1: 24 V power supply 0: Bus normal 1: Single 24 V power supply bit2 to bit6: Reserved bit7: System fault 1: Faults occurred on the drive 0: No fault/alarm occurred bit8 to bit15: Reserved
Special communication protocol - status word 1	705CH	Displays the SEW status word 1. bit0: Running 1: The drive has output. 0: The drive has no output. bit1: Ready to run 1: The drive is ready to run. 0: The drive is not ready to run. bit2: Process data valid 1: The process data is valid, and the drive can be controlled by master. 0: The process data is invalid, and the drive cannot be controlled by master. bit3: Reserved bit4: Parameter switchover display (Displays the current motor parameter set switched, including acceleration/ deceleration parameters.) bit5: Fault/Alarm display 1: Faults/Alarms occurred 0: No fault/alarm occurred bit6 to bit7: Reserved bit8 to bit15: The drive status is displayed when no fault or alarm (reserved) occurs. The main fault/alarm code is displayed when faults or alarms occurred.

Comm. address		Description
Special communication protocol - Actual current value	705DH	Displays the SEW actual current value: Displayed in percentage with an accuracy of 0.1%. The input value 800 equals 80.0% x rated current of the motor.
Special communication protocol - Status word 2	705EH	bit0: Running 1: The drive has output. 0: The drive has no output. bit1: Ready to run 1: The drive is ready to run. 0: The drive is not ready to run. bit2: Process data valid 1: The process data is valid, and the drive can be controlled by master. 0: The process data is invalid, and the drive cannot be controlled by master. bit3: Reserved bit4: Parameter switchover display (Displays the current motor parameter set switched, including acceleration/ deceleration parameters.) bit5: Fault/Alarm display 1: Faults/Alarms occurred 0: No fault/alarm occurred bit6 to bit7: Reserved bit8: Feedback brake status 1: Brake applying 0: Brake release bit9 to bit14: DI1 to DI6 (including two DIOs) bit15: Reserved

8.4.2.3 Other Commonly-Used Special Addresses

Address for drive status query

When reading the operating state through communication, the communication addresses are 703DH and 7044H. The host controller gets the operating state of the drive through reading the address data. The addresses are defined as follows.

Comm. address		Property	Description
Drive status 1	703DH	Read-only	The values read through 703DH are converted to values in decimal. The drive states corresponding to different values are as follows. 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault
Drive state 2	7044H	Read-only	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status - 0: Stop; 1: Run bit1: Operating direction - 0: Forward; 1: Reverse bit2: Fault state - 0: No fault; 1: Faulty bit3: Frequency arrival - 0: Not reached; 1: Reached bit4 to bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.

DO terminal control

When the RO/DO1/VDO function (E1-00/E1-01 to E1-06/E1-10 to E1-15) is set to 20 [Communication], the host controller can control the DO terminals of the drive through the special communication address 7312H. The address is defined as follows.

Comm. address		Property	Description
DO terminal control	7312H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. When the bit is 1, the corresponding terminal output is valid. When the bit is 0, the corresponding terminal output is invalid. The mapping relationship between bits and DOs is described in the following table. bit0: RO bit1 to bit6: DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15, VDO1 to VDO6

For example, set E1-00 [RO output function selection] to 20 [Communication], and then set the corresponding communication parameters. Write 0001H to 7312H in the instruction format and set bit0 to 1 to activate RO output.

Fault information query

When the status of the drive is read through communication, the communication addresses are 702DH to 7030H. The host controller can obtain the current faulty status of the drive by reading the address. The communication address is defined as follows.

Comm. address		Property	Description
Fault code	702DH	Read-only	Current fault code of the drive
Minor fault code	702EH	Read-only	Current minor fault code of the drive
Alarm code	702FH	Read-only	Current alarm code of the drive
Prompt code	7030H	Read-only	Current prompt code of the drive

8.4.3 Mapping Table (AC Drive Data)

Mapping table

See the following table for commonly used monitoring and setting parameters in communication.

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Change mode	Value range	Unit	Data type	Param.
Basic state of the drive							
0x7000	28672	Operating frequency	Read-only	0.00 to 600.00	Hz	Unsigned 16-bit	U0-00
0x7001	28673	Frequency reference	Read-only	0.00 to 600.00	Hz	Unsigned 16-bit	U0-01
0x7002	28674	Bus voltage	Read-only	0.0 to 6553.5	V	Unsigned 16-bit	U0-02
0x7003	28675	Output voltage	Read-only	0 to 65535	V	Unsigned 16-bit	U0-03
0x7004	28676	Output current	Read-only	0.00 to 655.35	A	Unsigned 16-bit	U0-04
0x7005	28677	Output power	Read-only	-3276.8 to +3276.7	kW	Signed 16-bit	U0-05
0x7006	28678	Output torque	Read-only	-3276.8 to +3276.7	%	Signed 16-bit	U0-06
0x702D	28717	Fault code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-45
0x702E	28718	Minor fault code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-46
0x702F	28719	Alarm code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-47
0x7030	28720	Prompt code	Read-only	0.0 to 6553.5	-	Unsigned 16-bit	U0-48
0x7052	28754	Heatsink temperature	Read-only	-20.0 to +120.0	℃	Signed 16-bit	U0-82
0x7053	28755	Drive cavity temperature	Read-only	-20.0 to +120.0	℃	Signed 16-bit	U0-83
Digital input status							
0x7007	28679	DI state	Read-only	bit0 to bit9: States of DI1 to DI10 bit10 to bit15: States of VDI1 to VDI6 bit value: 0: Low level 1: High level	-	Unsigned 16-bit	U0-07

Comm. address (Hexadecimal)	Comm. address (Decimal)	Name	Change mode	Value range	Unit	Data type	Param.
Digital output status							
0x7008	28680	DO state	Read-only	bit0: RO state bit1 to bit6: States of DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15: States of VDO1 to VDO6 bit value: 0: Low level 1: High level	-	Unsigned 16-bit	U0-08
Common setting of the drive							
0xF030 (0xB704)	61488 (46852)	Ramp-up time of ramp 1	Read/Write	0.0 to 6500.0	s	Unsigned 16-bit	F0-48 (b7-04)
0xF031 (0xB705)	61489 (46853)	Ramp-down time of ramp 1	Read/Write	0.0 to 6500.0	s	Unsigned 16-bit	F0-49 (b7-05)

8.5 EtherNet/IP Drive Control

8.5.1 Introduction

EtherNet/IP protocol is based on the TCP/IP protocol stack and uses both connection-oriented and connectionless communication methods. It defines two types of communication: explicit communication and implicit communication.

- Explicit communication: Data is transmitted through TCP (Transmission Control Protocol), which is suitable for transmitting high-accuracy data with relaxed real-time constraints. Explicit communication is further divided into UCMM (Unconnected Explicit Messages) and Class3 (Connected Explicit Messages) based on connection methods.
- Implicit communication: Data is transmitted through UDP (User Datagram Protocol), which is suitable for transmitting data with strict real-time constraints. Implicit messages consist of only one type: Class1 "Implicit Message (I/O Messages)".

EtherNet/IP is a high-speed, real-time, flexible, easy-to-integrate, expandable, and secure industrial automation network protocol that widely used in industrial automation control systems.

8.5.2 Communication Specifications

Table 8–2 Communication specifications

Item	Content
Communication protocol	EtherNet/IP
Services available	PDO (Process Data Object) SDO (Server Data Object)
Physical layer	10/100Base-TX
Communication mode	Half/Full duplex auto-negotiation
Topology	Linear, star, tree, ring
Transmission rate	10/100 Mbit/s Adaptive
Transmission medium	Shielded twisted pair of CaT 5e or higher
Transmission distance (m)	< 100
Communication port	44818 (tcp), 2222 (udp)
Communication type	UCMM, Class3, Class1
EtherNet/IP frame length (bytes)	64 to 1518
Cyclic data	Fixed 32 bytes (16 status/control words)
Acyclic data (bytes)	6 to 512
Communication cycle (ms)	1 to 50000
Maximum number of connections	1 (Proprietary connection)
Maximum cable length (m)	100
Maximum number of slaves	N/A
Number of request messages that can be received at the same time	N/A

8.5.3 Communication System Connection

EtherNet/IP requires shielded twisted pair cables with standard M12 port. The shielded cable must be of Cat5e (or higher) can comply with the TIA/EIA-568-B standard, with each cable shorter than 100 m.

The EtherNet/IP protocol itself does not impose any restrictions on the number of slaves in the network. During on-site implementation, the actual number of devices in the network is determined by the master or network addresses.

EtherNet/IP supports bus, star, ring, and tree topologies.

Bus topology

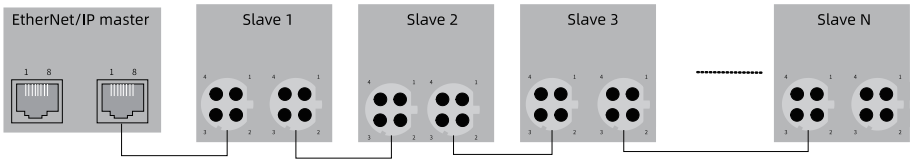


Figure 8-2 Bus topology

In bus topology, the cable is first routed out from the master to any M12 port of the first device, and then routed from another M12 port to the next device, and so on sequentially.

Bus topology features easy wiring and low cost, but if an upstream device fails, all devices downstream of the fault point cannot communicate.

Star topology

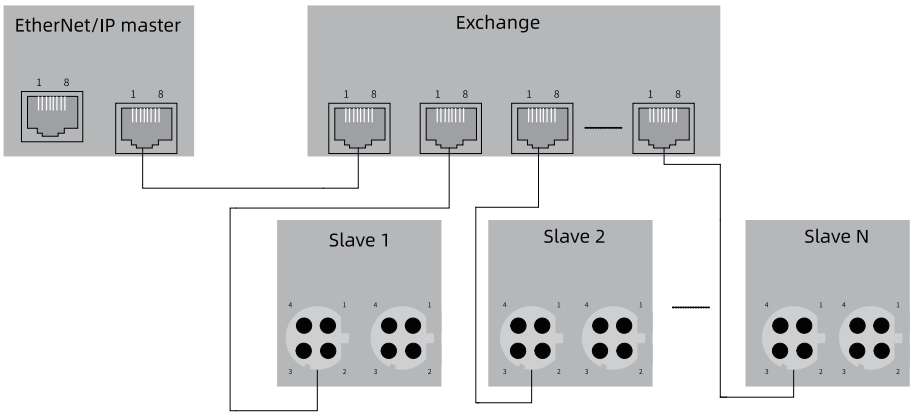


Figure 8-3 Star topology

For wiring with star topology, the cable is first routed out from the master to a network switch, then connected to each device through the switch.

Compared to bus topology, star topology requires an additional switch. A single device failure does not affect communication of other devices, but if the switch fails, communication for all devices is affected.

Tree topology

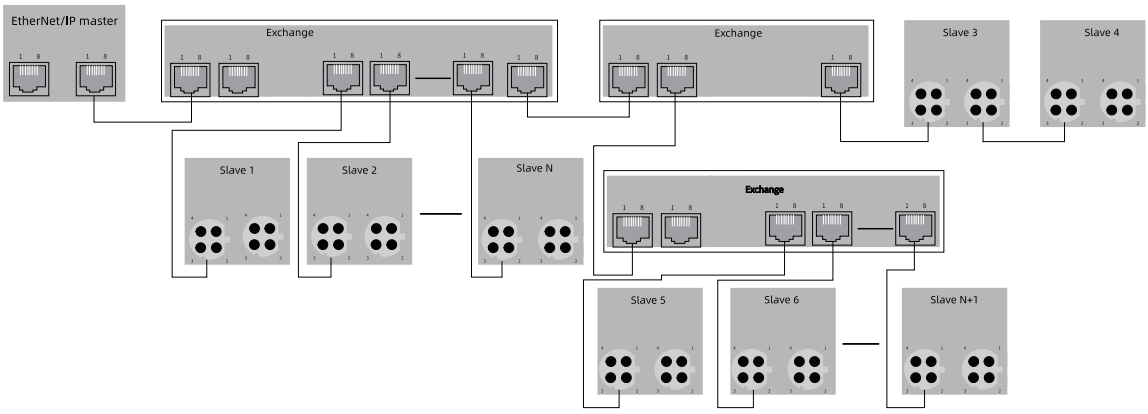


Figure 8-4 Tree topology

The tree topology combines the star and bus topologies, allowing more flexible on-site layout, but also inherits the disadvantages of both topologies. When a switch in the tree topology fails, all devices connected to that switch cannot communicate normally.

Ring topology

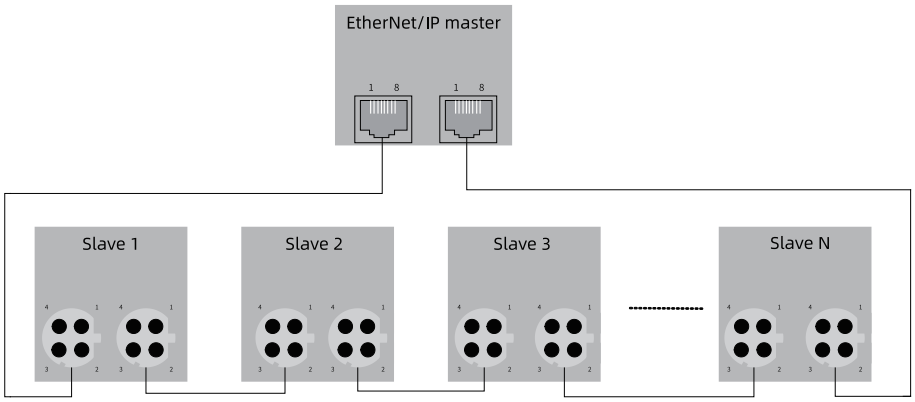


Figure 8-5 Ring topology

The ring topology is a derivative of the bus topology, differing from the bus topology in that the cable from the last device is routed to another port on the master.

This topology inherits the advantages of the bus topology, and a single node fault within the topology does not affect the entire topology. However, this topology requires the master to support and enable DLR management function, or the topology must include a DLR manager. Otherwise, network storms can occur, resulting in a complete collapse of the topology.

8.5.4 Message

8.5.4.1 Message Structure

EtherNet/IP is based on the traditional TCP/IP protocol suite, which uses three connection types: Class 1, Class 3, and UCMM. Among these, Class 3 and UCMM are explicit messages based on the TCP protocol, with the overall frame format as shown in "EtherNet/IP Explicit Message Frame." Class 1 is an implicit message based on the UDP protocol, with the overall frame format as shown in "EtherNet/IP Implicit Message Frame."

In actual applications, acyclic data is exchanged using explicit messages (UCMM and Class 3) and cyclic data is exchanged using implicit messages (Class 1 data).

Note that the EtherNet/IP protocol operates at the application layer of the TCP/IP four-layer network model, and the TCP/IP protocol suite is extensive, so only the EtherNet/IP protocol frame is described here. Others such as EtherNet header, IP datagram, and TCP/UDP messages are not detailed.

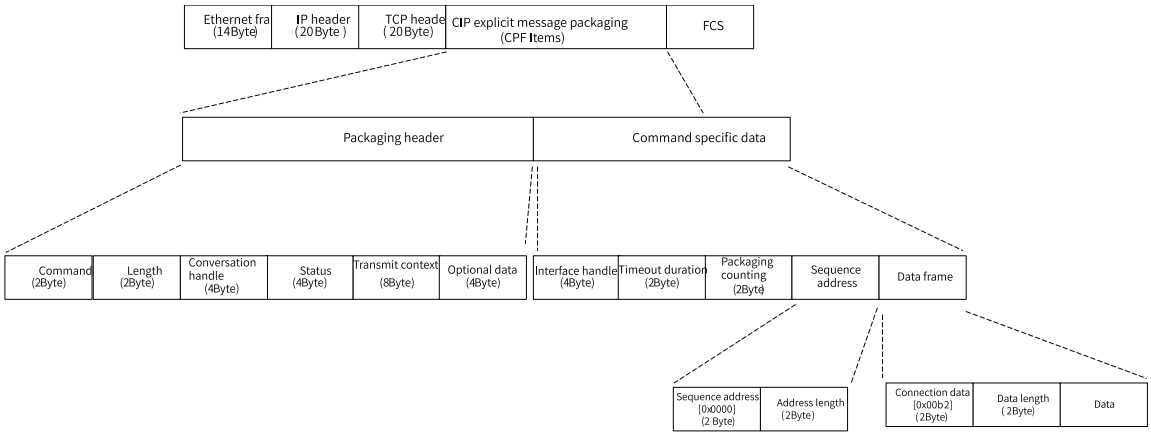


Figure 8-6 EtherNet/IP explicit message

The CIP encapsulation for transmitting acyclic explicit messages consists of a header and command-specific data, as shown below.

Table 8–3 Explicit data frame definition

Field			Description
EtherNet frame header			EtherNet frame information
IP header			IP data encapsulation information
TCP header			TCP encapsulation information
Header	Command		UCMM: SendRRData command (0x6F) Class 3: SendUnitData command (0x70)
	Length		Command-specific data length
	Session handle		Assigned by the device during session registration
	State		0
	Send context		Generated during session registration
	Optional data		0
Command-specific data	Interface handle		0
	Timeout		Any value
	Encapsulation packet	Encapsulation count	2 (one address encapsulation and one data encapsulation)
		Address ID	UCMM: 0 Class3: 0xa1
		Address length	UCMM: 0 Class: 4
		Address data	UCMM: Not applicable Class3: Generated when session is opened
		Data ID	UCMM: 0x00b2 Class3: 0x00b1
		Data length	Actual length of acyclic data transmitted
		Data	Acyclic data transmitted

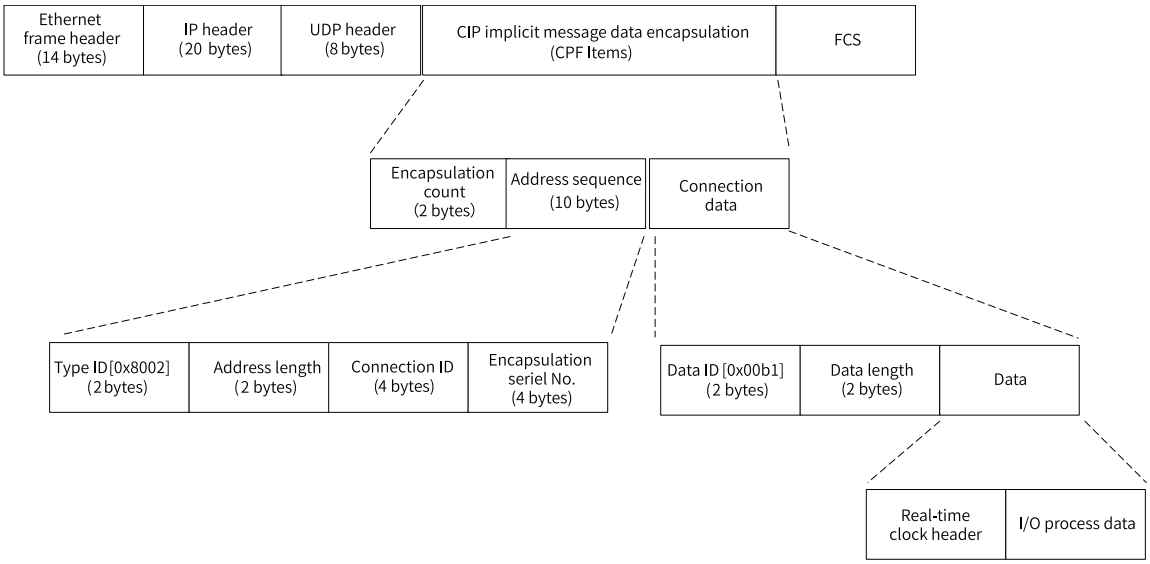


Figure 8-7 EtherNet/IP implicit message packet

Process data is transmitted using implicit message packets. See the table below for encapsulation description.

Field		Description
EtherNet frame header		EtherNet frame information
IP header		IP data encapsulation information
UDP header		UDP encapsulation information
Encapsulation count		2
Address sequence	Type ID	0x8002
	Length	8
	Connection ID	Generated during session registration
	Encapsulation sequence number	Initial value is 1, increment by 1 per data packet
Connection data	Data ID	0x000B1
	Data length	Process data length
	Data	Process data

8.5.4.2 Process Data Interconnection

Process data supports transmission of up to 16 control words. Among these control words, the first two from master to device (O->T) are fixed as control command and operating frequency, and the rest are user-defined control words. The first two from device to master (T->O) represent the status and operating frequency of the drive, and the rest are user-defined. See the table below for detailed message format.

Note

This section only displays the I/O process data. For the complete frame format, see the EtherNet/IP Class 1 message structure.

Table 8–4 Master process data format

Output data [0]	Output data [1]	Output data [2 to 15]
Communication control command (0x7011)	Operating frequency (0x7010)	User-defined control word
1st control word (2 bytes)	2nd control word (2 bytes)	3rd to 16th control words (2 bytes for each, 28 bytes in total)

Table 8–5 Device process data format

Input data [0]	Input data [1]	Input data [2 to 15]
Device status (0x7044)	Current frequency (0x7045)	User-defined status word
1st status word (2 bytes)	2nd status word (2 bytes)	3rd to 16th status words (2 bytes for each, 28 bytes in total)

8.5.4.3 Message Application Example

Process data

Set the command source to communication (F0-29/b1-00 = 0, or b3-00 = 0), and control the drive to make the motor run forwardly at 50 Hz.

Table 8–6 Example for master process data

Output data [0]	Output data [1]	Output data [2]	Output data [3]	...	Output data [15]
0x0001	0x0032	0x0000	0x0000	-	0x0000
1st control word	2nd control word	3rd control word	4th control word	-	16th control word

Cyclic device status return, forward rotation at 1500 r/min

Table 8–7 Example of slave process data

Input data [0]	Input data [1]	Input data [2]	...	Input data [15]
0x0011	0x05dc	0x0000	-	0x0000
1st status word	2nd status word	3rd status word	-	16th status word

Acyclic data

This example only demonstrates the data content in the message (namely, the data items in the CIP encapsulation), for example, retrieving the current device operating time (control word 0xad03).

Request message:

Data ID	Length	Access type	Path length	Path type	Path value	Path type	Path value	Path type	Path value
0x00b2 (UCMM access)	0x000a	0x0e (Request)	0x04	0x20 (Class)	0x93	0x24 (Instance)	0x01	0x31 (Attribute)	0x00ad03

Response message:

Data ID	Length	Access type	Path length	State	Data
0x00b2	0x0006	0x8e (Response)	0x04	0x0000 (Success)	0x07bd

8.5.4.4 Control Word and Status Word

8.5.4.4.1 Control Word

The control word setting range for communication is 0 to 8, with the following options.

Comm. address	Description
0x7311H	0: Stop (the drive stops according to the OFF1 stop mode)
	1: Forward run
	2: Reverse run
	3: Jog 1
	4: Jog 2
	5: Coast to stop
	6: Stop (the drive stops according to the OFF1 stop mode)
	7: Reset fault
	8: Emergency stop (the drive performs emergency stop according to the OFF3 stop mode)

The control word setting is active only after the main command source (b1-00/F0-03, or b3-00) in the currently set control channel (b0-02) is set to 2 [Communication].

The meaning of the communication target frequency (address 7310H) is as follows:

Param.	Description
Target frequency	You can set the target frequency of the drive through this data during communication. The data format of this address is defined by n0-14 [7310H Speed setting selection].

The setting is active only after the main frequency source (F0-29/b5-00 or b6-00) in the active setting channel is set to 9 [Communication].

The data format of the frequency reference is determined by the setting of n0-14 [7310H Speed setting Selection], as shown below.

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
0 [Frequency (unsigned 16-bit)]	Hz	Unsigned 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				2000	20.00 Hz
1 [Frequency (signed 16-bit)] (Default)	Hz	Signed 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				-1000	-10.00 Hz
2 [Speed (signed 16-bit)]	rpm	Signed 16-bit	No decimal places	1500 (2 pairs of motor poles)	1500 rpm (50.00 Hz)
				-1500 (2 pairs of motor poles)	1500 rpm (-50.00 Hz)
3 [Percentage (corresponds to rated frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (Rated frequency:50.00 Hz)	10.00 % (5.00 Hz)
				-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
4 [Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (maximum frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

8.5.4.4.2 Status Word

The meaning of each bit of the status word of communication is shown below.

Comm. address	bit	Definition	Description
0x7044H	0	0 = Stop	Stop state of the drive
		1 = Running	Operating state of the drive
	1	0 = Motor rotating forwardly	Actual motor speed > 0
		1 = Motor rotating reversely	Actual motor speed < 0
	2	0 = No fault	No fault occurred on the drive
		1 = Fault occurred	Fault occurred on the drive Reset the fault by writing 7 to the control word.
	3	0 = Frequency not reached	The operating frequency of the drive does not reach the target frequency detection range.
		1 = Frequency reached	The operating frequency of the drive has reached the target frequency detection range (target frequency ±per-unit frequency A2-04 x frequency arrival detection window P0-38).
	4 to 7	Reserved	-
	8 to 15	Fault code	Current fault code of the drive

The meaning of the communication target frequency is as follows.

Param.	Description
Operating frequency	Indicates the operating frequency of the drive. Data format is signed 16-bit with 2 decimal places.

8.5.5 Communication Port

This series of drive supports the EtherNet/IP protocol, using the LIN1 and LIN2 markings on the housing for communication. The two M12 ports are equivalent and direction-insensitive.

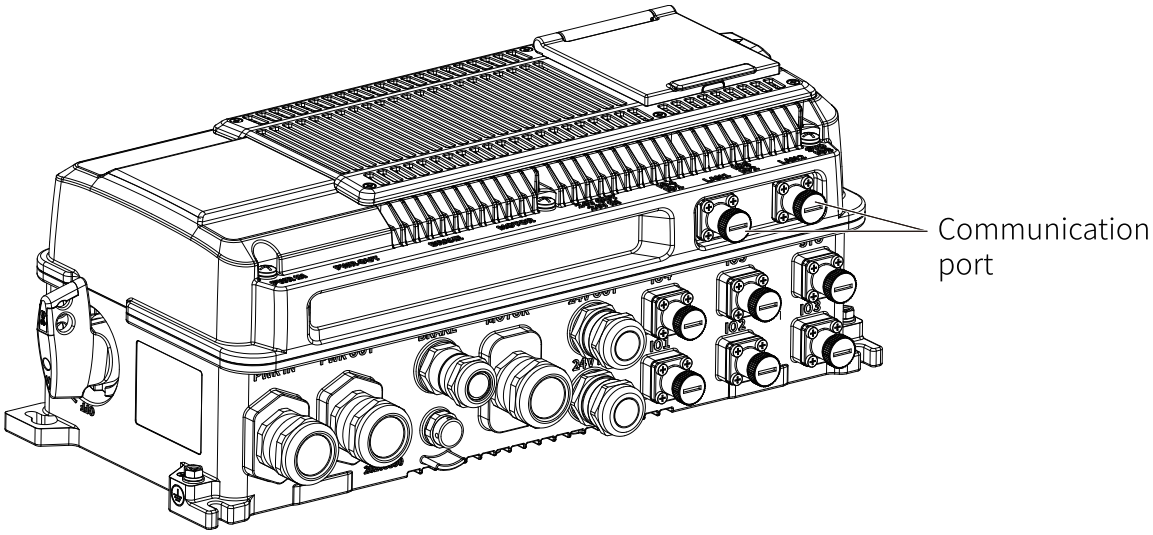


Table 8–8 Description of EtherNet/IP communication port

External port	Type	Type of information transmitted	Mark	Name	Function
LIN1	M12	100 M bus	LIN1	100 M bus cascading port	Supports two communication protocols: EIP/PN, which can be selected through n0-10. EIP/PN is direction-insensitive.
LIN2	M12	100 M bus	LIN2	100 M bus cascading port	Supports two communication protocols: EIP/PN, which can be selected through n0-10. EIP/PN is direction-insensitive.

8.5.6 Connecting the Drive To Bus System

The EtherNet/IP bus uses a standard M12 port. The cable shall be a shielded twisted pair cable of at least CaT 5e and meeting the TIA/EIA-568-B standard. The shield must be properly grounded. The maximum cable length between two devices is 100 m.

Connection procedure

1. Switch on the system power supply.
2. See the communication networking topology in *"8.5.3 Communication System Connection" on page 199* and connect the network cable to the shielded network port terminal, as shown in *"Figure 8-8 EtherNet/IP communication connection" on page 208*. For communication interface specifications, see *"8.5.5 Communication Port" on page 206*.

Note

In EtherNet/IP communication, IN and OUT of the communication port are direction-insensitive.

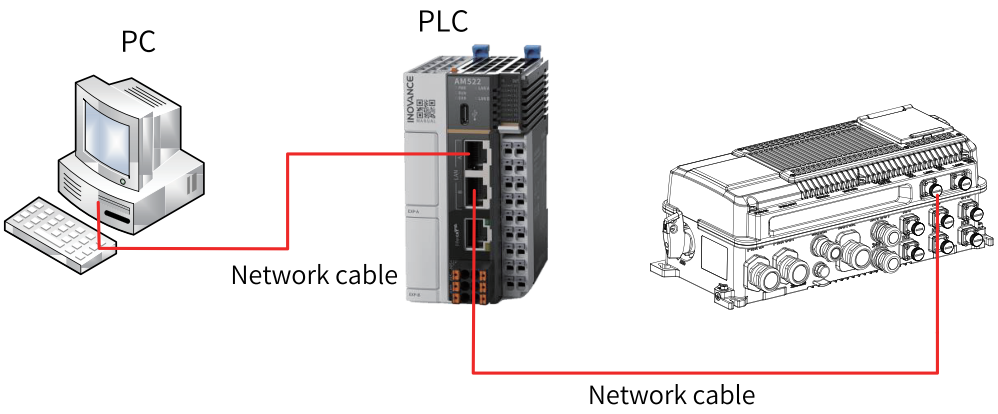


Figure 8-8 EtherNet/IP communication connection

3. Set n0-10 to 2.
4. Configure the IP addresses in n5-01 to n5-04, subnet masks in n5-05 to n5-08, and gateway addresses in n5-09 to n5-12.
5. Restart the power supply.

8.5.7 Configuring Communication Between the Drive and Controller

When using EtherNet/IP communication, the controller must support the EtherNet/IP protocol. It is recommended to use a EtherNet/IP branded controller to avoid compatibility issues.

The following basic operations are required for EtherNet/IP communication with the drive.

1. Perform wiring according to *"8.5.3 Communication System Connection" on page 199*.
2. Switch the device communication mode to EtherNet/IP (n0-10 = 2), set communication as the active command source (F0-03 = 2), and select communication as the main frequency reference source of setting channel 1 (b0-03 = 0 and b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait for a few seconds until the indicators Linkx and ACTx turn on, indicating that EtherNet link has been established.
4. Configure communication between the master (controller) and slave (drive) as shown in *" Communication Configuration Instance" on page 212*.

8.5.8 Communication Parameters

Table 8–9 EtherNet/IP parameters

Param.	Name	Default value	Value range	Change mode	Description
n5-00 (Fd-58)	DHCP enable	0	0: Disable 1: Enable	At stop	Used to enable DHCP (Dynamic Host Configuration Protocol). Value description: 0: The DHCP function is disabled. 1: The DHCP function is enabled. Note: After enabling DHCP, the IP address-related parameters n5-01 to n5-12 are invalid, which are assigned by DHCP server.
n5-01 (Fd-59)	Most significant byte of the IP address	0	0 to 255	At stop	Indicates the most significant byte of the IP address. For example, if the IP address is 192.168.1.2, this parameter displays 192. Note: The setting range is 0 to 255.
n5-02 (Fd-60)	Second most significant byte of the IP address	0	0 to 255	At stop	Defines the second most significant byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 168. Note: Same as n5-01
n5-03 (Fd-61)	Third byte of the IP address	0	0 to 255	At stop	Defines the third byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 1. Note: Same as n5-01
n5-04 (Fd-62)	Least significant byte of the IP address	0	0 to 255	At stop	Defines the least significant byte of IP address. For example, if the IP address is 192.168.1.2, this parameter displays 2. Note: Same as n5-01
n5-05 (Fd-63)	Most significant byte of the subnet mask	0	0 to 255	At stop	Defines the most significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: Same as n5-01
n5-06 (Fd-64)	Second most significant byte of the subnet mask	0	0 to 255	At stop	Defines the second most significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: Same as n5-01

Param.	Name	Default value	Value range	Change mode	Description
n5-07 (Fd-65)	Third byte of subnet mask	0	0 to 255	At stop	Defines the third byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 255. Note: Same as n5-01
n5-08 (Fd-66)	Least significant byte of the subnet mask	0	0 to 255	At stop	Defines the least significant byte of subnet mask. For example, if the subnet mask is 255.255.255.255, this parameter displays 0. Note: The setting range is 0 to 255.
n5-09 (Fd-67)	Most significant byte of the gateway	0	0 to 255	At stop	Defines the most significant byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 192. Note: Same as n5-01
n5-10 (Fd-68)	Second most significant byte of the gateway	0	0 to 255	At stop	Defines second most significant byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 168. Note: Same as n5-01
n5-11 (Fd-69)	Third byte of gateway	0	0 to 255	At stop	Defines the third byte of gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 1. Note: Same as n5-01
n5-12 (Fd-70)	Least significant byte of the gateway	0	0 to 255	At stop	Defines the least significant byte of the gateway address. For example, if the gateway address is 192.168.1.1, this parameter displays 1. Note: Same as n5-01

8.5.9 Communication Fault Diagnosis

Table 8–10 Diagnosis method for EtherNet/IP communication fault

Fault code	Fault name	Cause	Verification method	Solution
E165.1	EtherNet/IP EtherNet communication timeout	The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. If the voltage is still unstable after preceding causes are rectified, replace the power supply.
		A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
		The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.
E165.2	EtherNet/IP hardware error	The EtherNet integrated circuit is faulty.	Check whether the MCB network port, PHY integrated circuit, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

Fault code	Fault name	Cause	Verification method	Solution
E165.3	MAC address not programmed for EtherNet/IP	MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.
E165.4	EtherNet/IP IP address conflict	IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

8.5.10 Communication Configuration Instance

8.5.10.1 EtherNet/IP Communication Configuration Example between the Drive and Inovance AC801 Controller

Prerequisites

Software acquisition and hardware wiring:

1. Log in to Inovance website https://www.inovance.com/global to download the programming software InoProShop and the latest EDS file.
2. Use an M12-to-RJ45 EtherNet cable or an M12-to-M12 network cable to connect the LAN A or LAN B port of the AC801 to port 1 or 2 of the drive. See details in *"8.5.6 Connecting the Drive To Bus System" on page 207*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Speed reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to rated frequency/signed 16-bit/2 decimal places); 4: Percentage (corresponding to maximum frequency/signed 16-bit/2 decimal places)

Set the torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. It is recommended to set n0-14 [7310H Speed reference selection] to 2 [Speed (signed 16-bit)].

Step 3: Establish EtherNet/IP communication.

1. Set n0-10 to 2 (through the operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait a few seconds until the Linkx and ACTx indicators turned on, indicating that the slave is connected to the master successfully, with data exchange generated.
3. Create a project.

   Open InoProShop and create a project. Select "AC801-02-U0R0" in the "Device" pane.

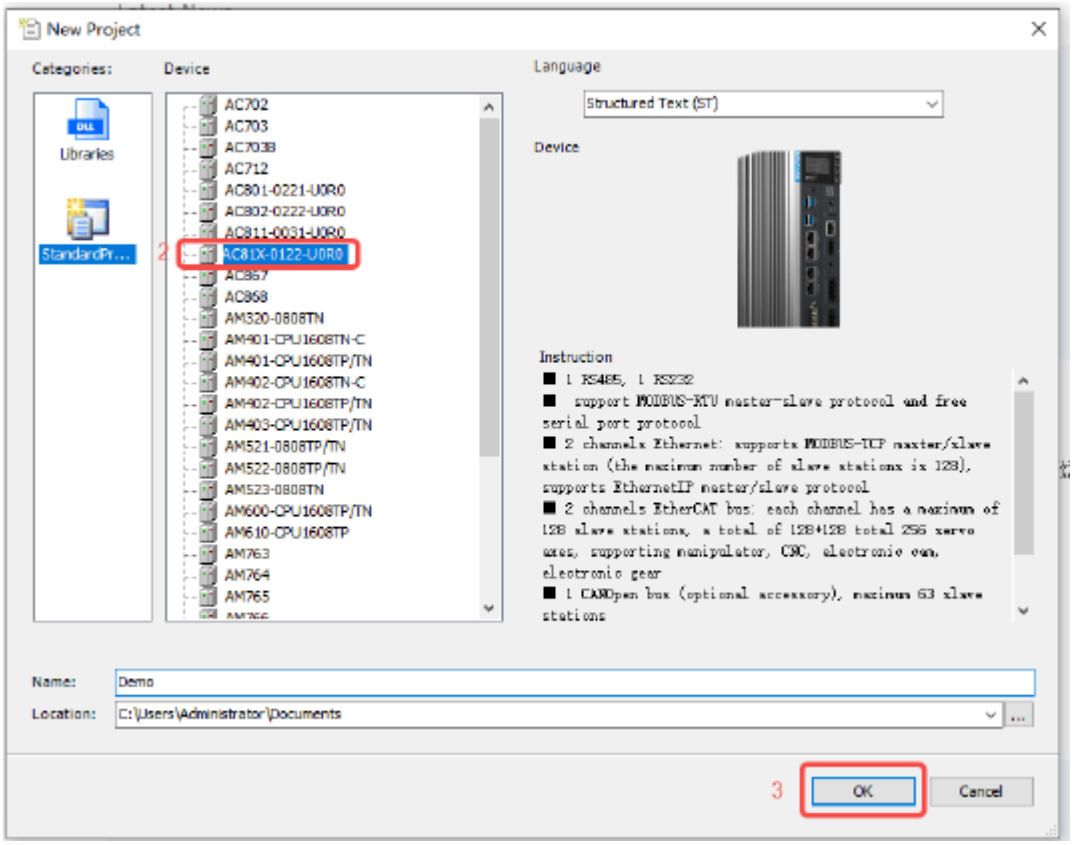


Figure 8-9 Select the master device.

4. Import the EDS file and add a slave.

   Open the "Network configuration" interface, click on the PLC, and set the current communication protocol to "EtherNet/IP master." Click "Import EDS file" at the top, import the EDS file, and then import the device into the device list on the right.

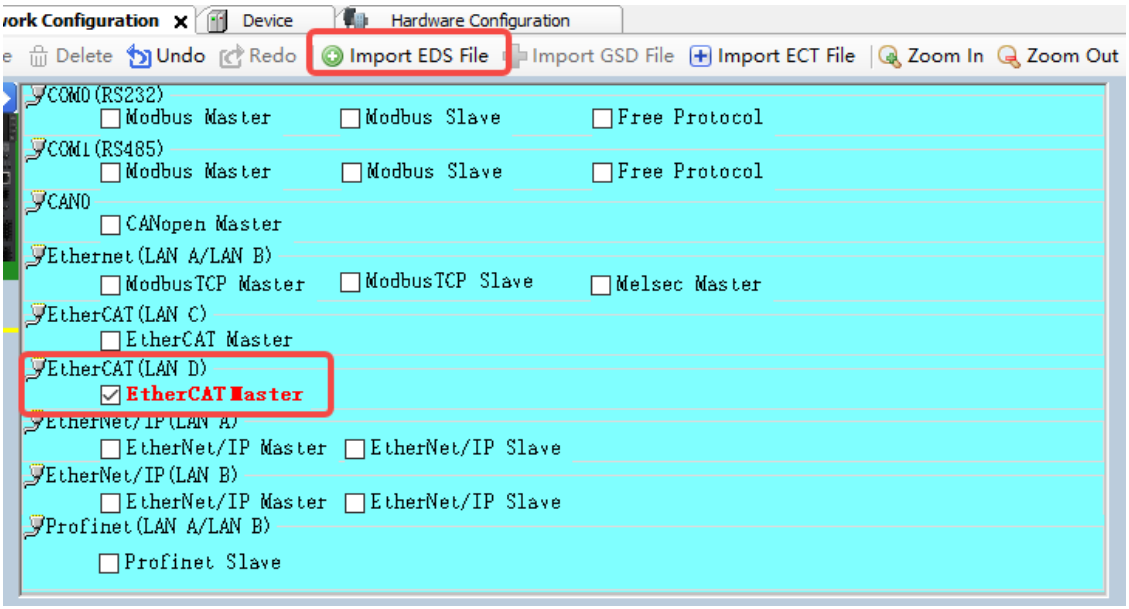


Figure 8-10 Selecting the slave device

5. Configure the slave parameters.

a. Select the drive and enter the corresponding "IP address" of the device.

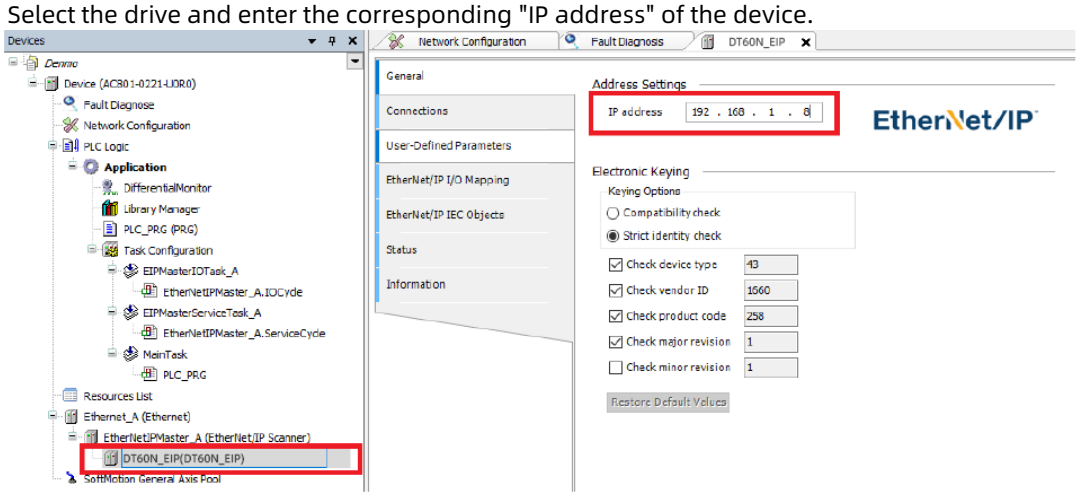


Figure 8-11 Configuring the IP address

b. Click "Connection" on the left side and configure the communication parameters and process data mapping addresses according to actual requirements.

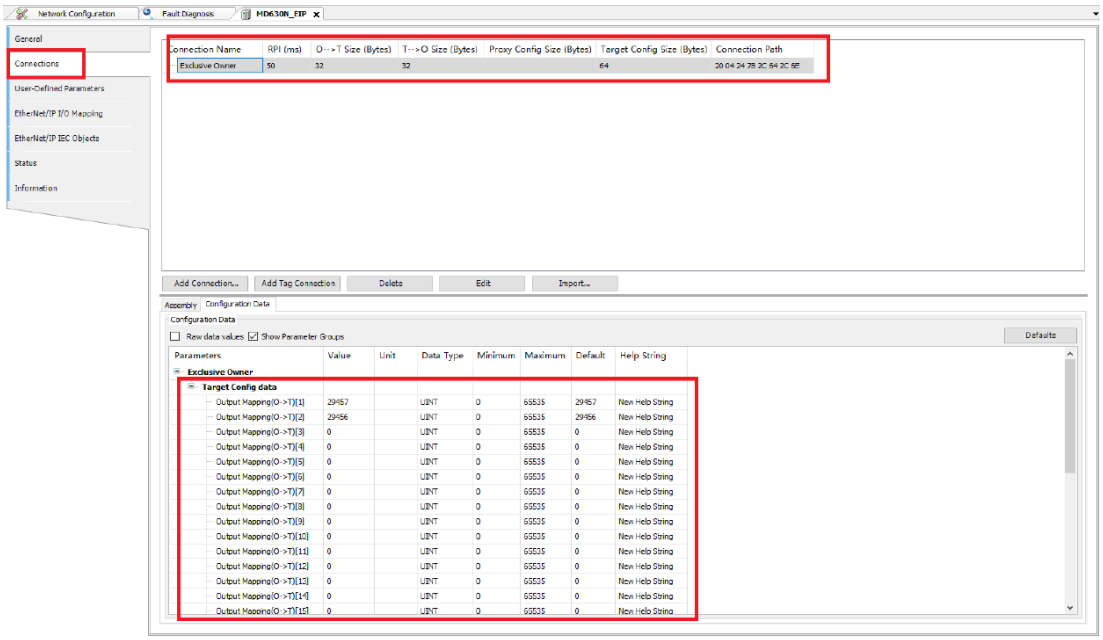


Figure 8-12 Configuring process data mapping

6. Compile the program, download it to the PLC, and run it to establish the connection between the PLC and the controller.

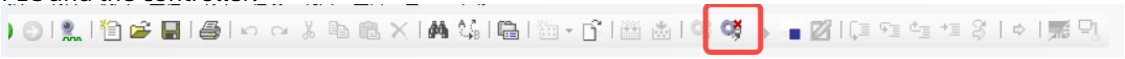


Figure 8-13 Starting EtherNet/IP communication

Step 4: Control the drive through communication.

1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.

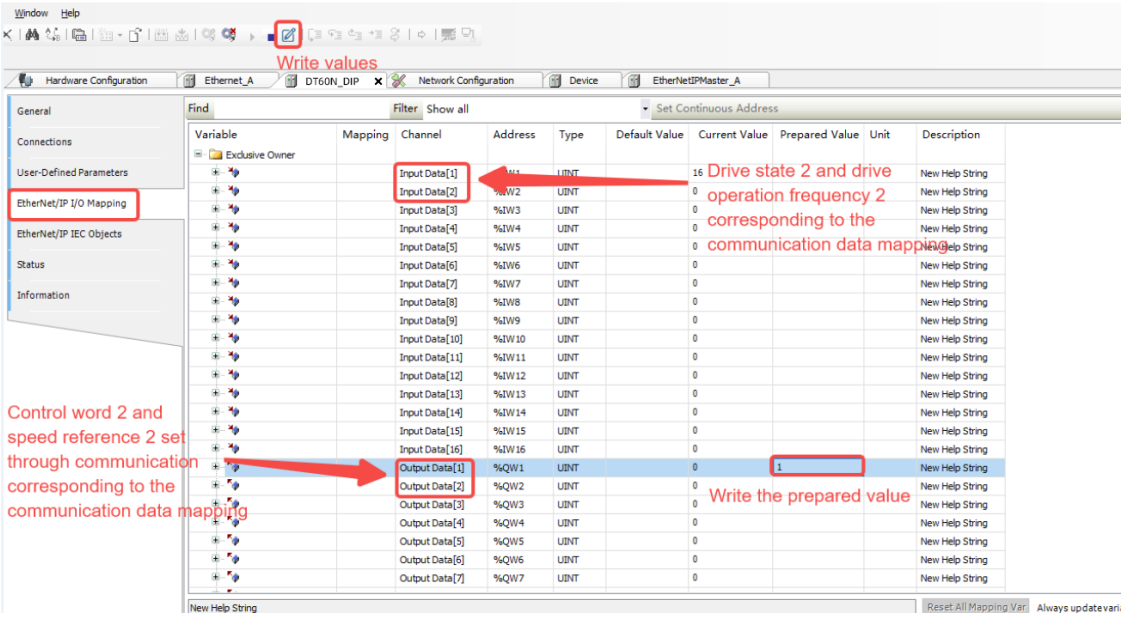


Figure 8-14 Configuring communication data mapping

2. For start/stop control and frequency/torque reference through EtherNet/IP communication, read and write specific communication addresses of the drive. In other words, the specific addresses need to be mapped to the PDO data of EtherNet/IP.
   For simple start/stop control and frequency/torque reference, 7311H and 7310H need to be mapped to the PDO data.

   7311H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

   For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

   7310H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address. The property of values written by this address is switched by n0-14 [7310H Speed reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

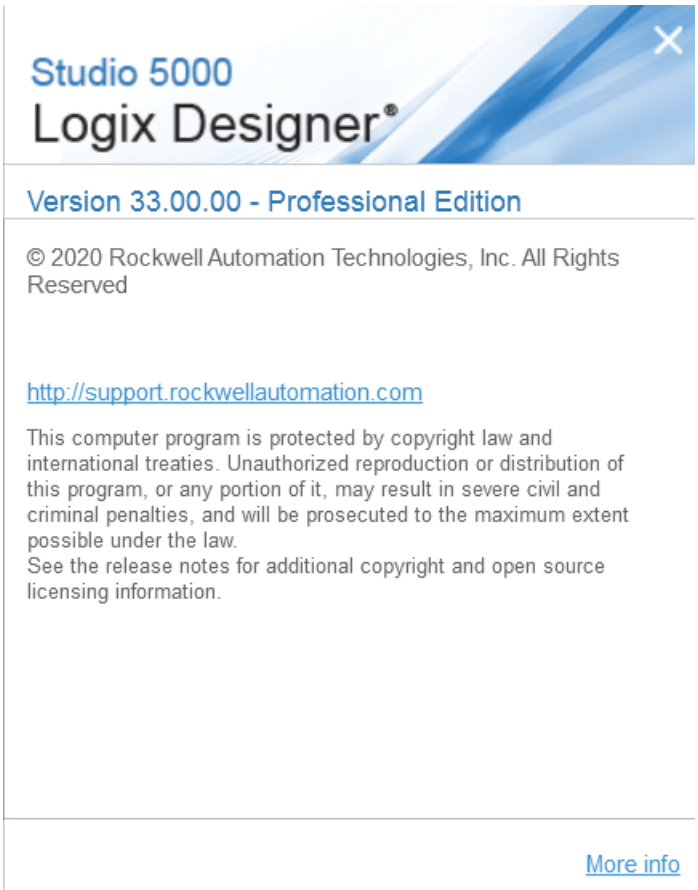
   In default settings, when n0-14 [7310H Speed reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

   The corresponding feedback states are defined in the following table.

Comm. address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status - 0: Stop; 1: Run bit1: Operating direction - 0: Forward; 1: Reverse bit2: Fault state - 0: No fault; 1: Faulty bit3: Frequency arrival state - 0: Not reached; 1: Reached bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
Operating frequency 2 of the drive	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

8.5.10.2 Configuration Example for EtherNet/IP Communication Between the Drive and Rockwell Master L1756-L82

In this configuration example, Studio5000 and master 1756-L82 are used.



Rockwell official website: support.rockwellautomation.com

Prerequisites

1. See *"8.5.6 Connecting the Drive To Bus System" on page 207* to complete the communication network connection.
2. Install the Rockwell PLC host controller Studio5000 to the PC.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

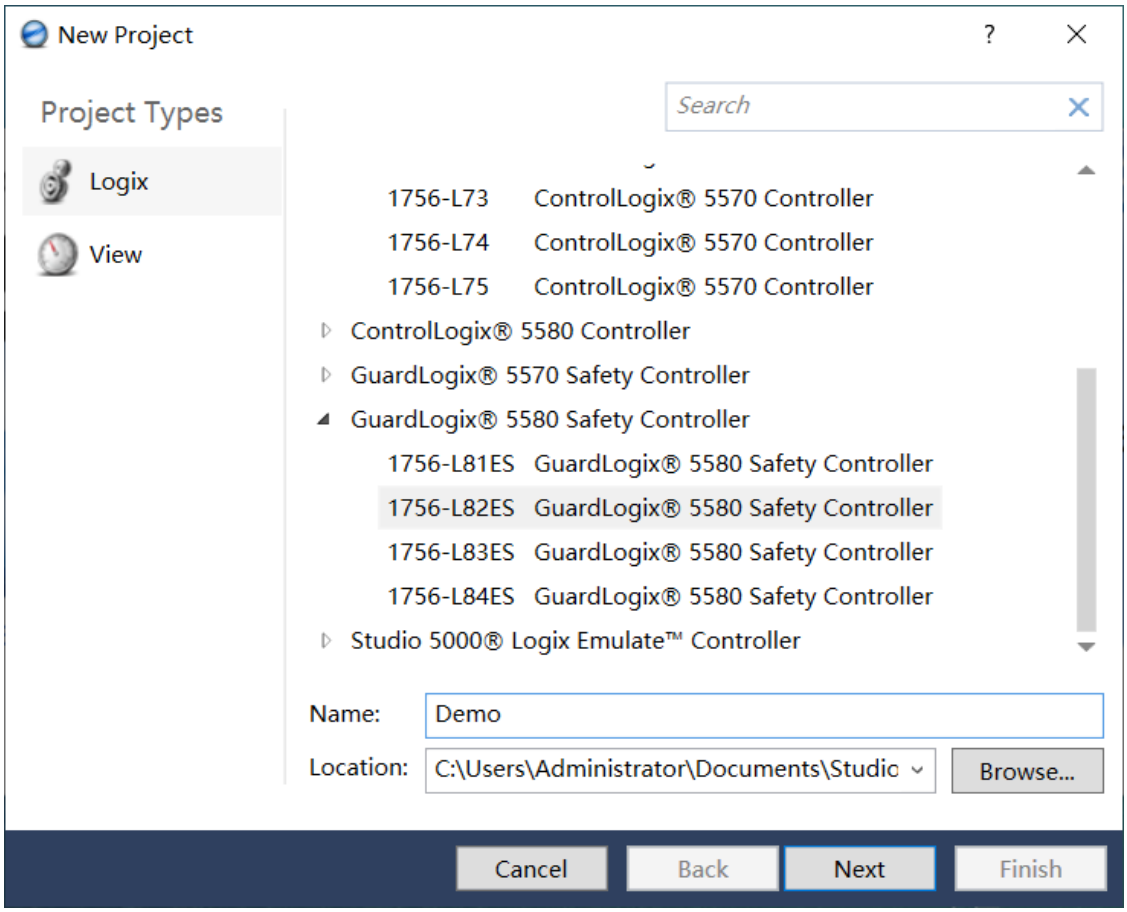
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Speed reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to rated frequency/signed 16-bit/2 decimal places); 4: Percentage (corresponding to maximum frequency/signed 16-bit/2 decimal places)

Set the torque as follows:

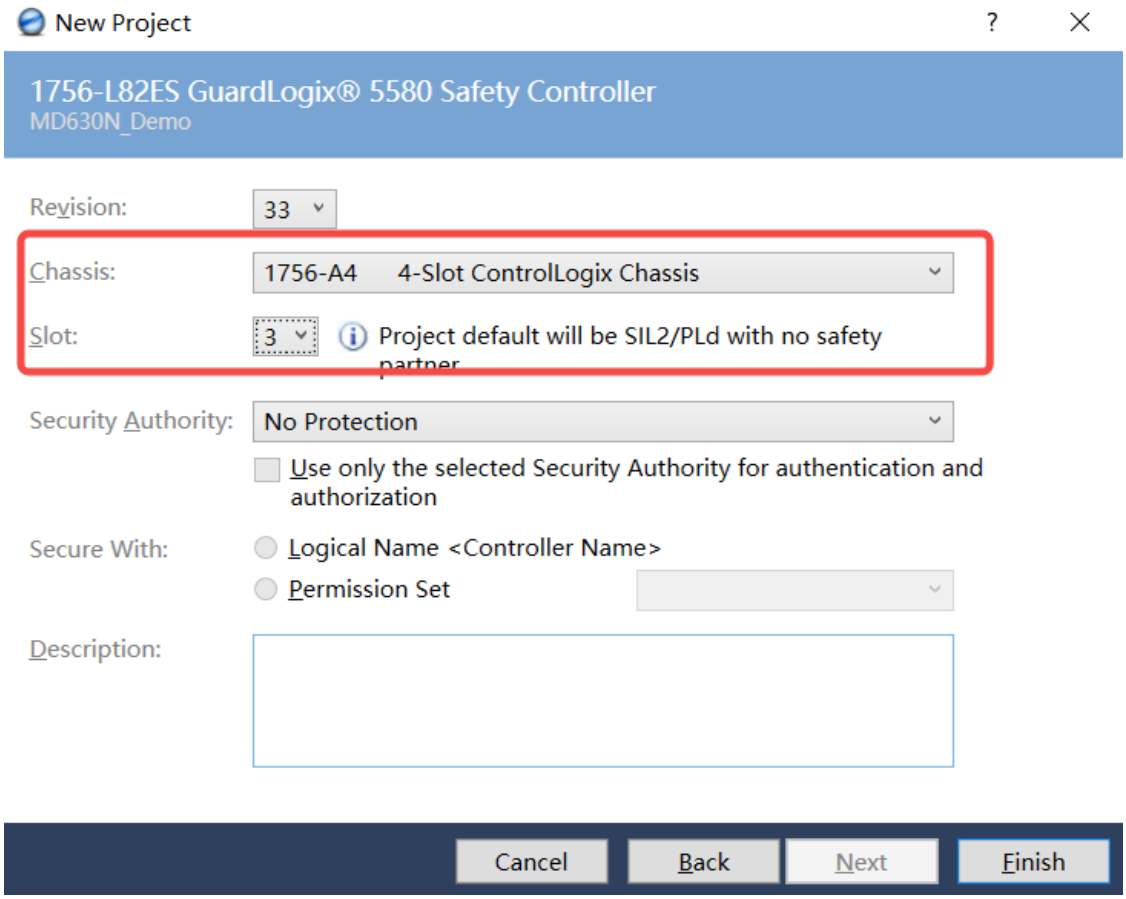
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. It is recommended to set n0-14 [7310H Speed reference selection] to 2 [Speed (signed 16-bit)].

Step 3: Establish EtherNet/IP communication.

1. Set n0-10 to 2 (through the operating panel or the software tool). Set the communication mode to EtherNet/IP.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   Select 1756-L82ES of the controller model "CompactLogix 5580 Controller". Click "Next" when the selection is done.

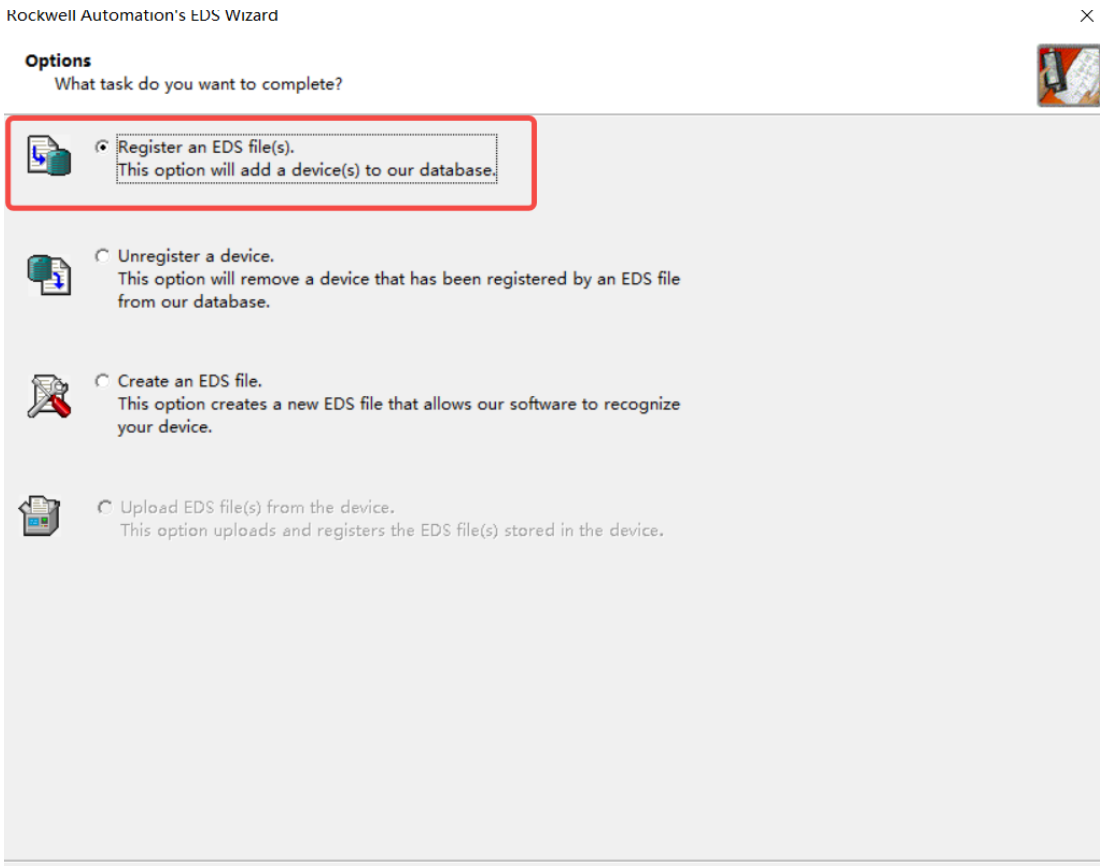


4. Select the chassis of the device and the slot number of the controller. In this example, the chassis model is 1756-A4 and the slot number of the controller is 3. Click "Finish" when the selection is done.

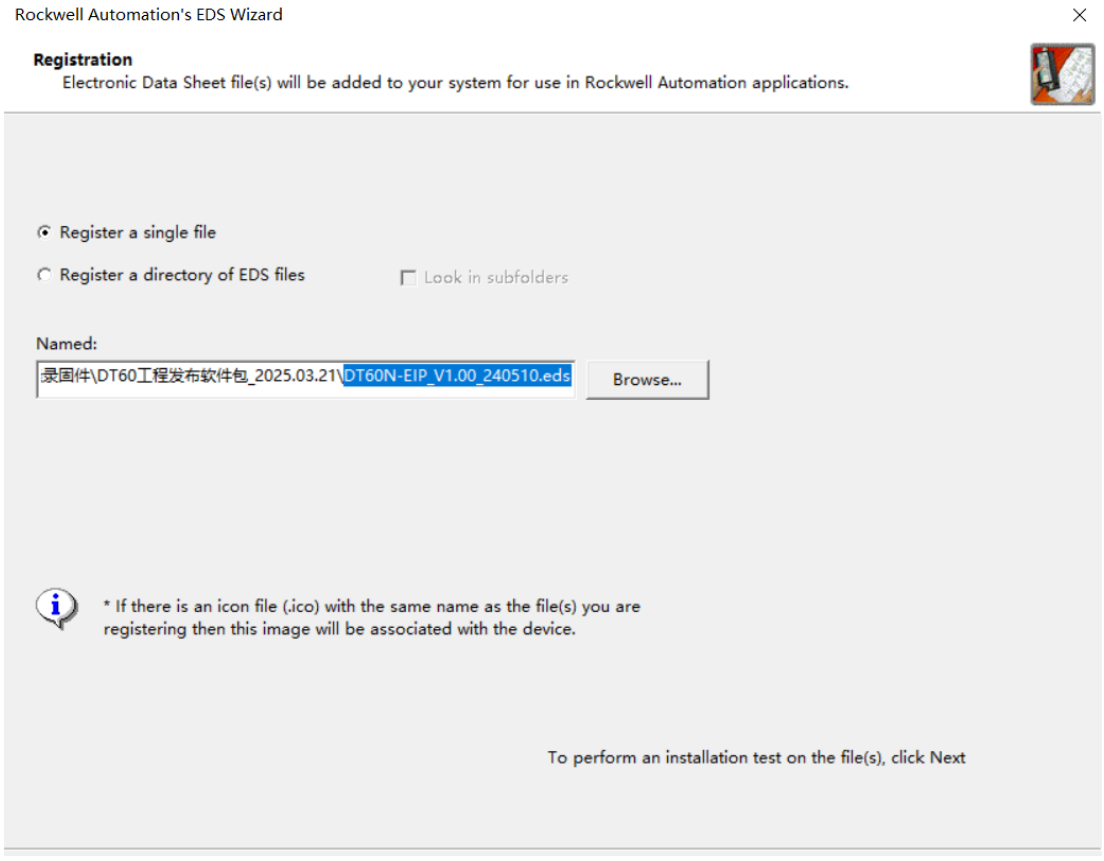


5. Import the EDS file.

   a. Click "Tools > EDS Hardware Installation Tool", and then click "Next" and select "Registeran EDS file(s)".



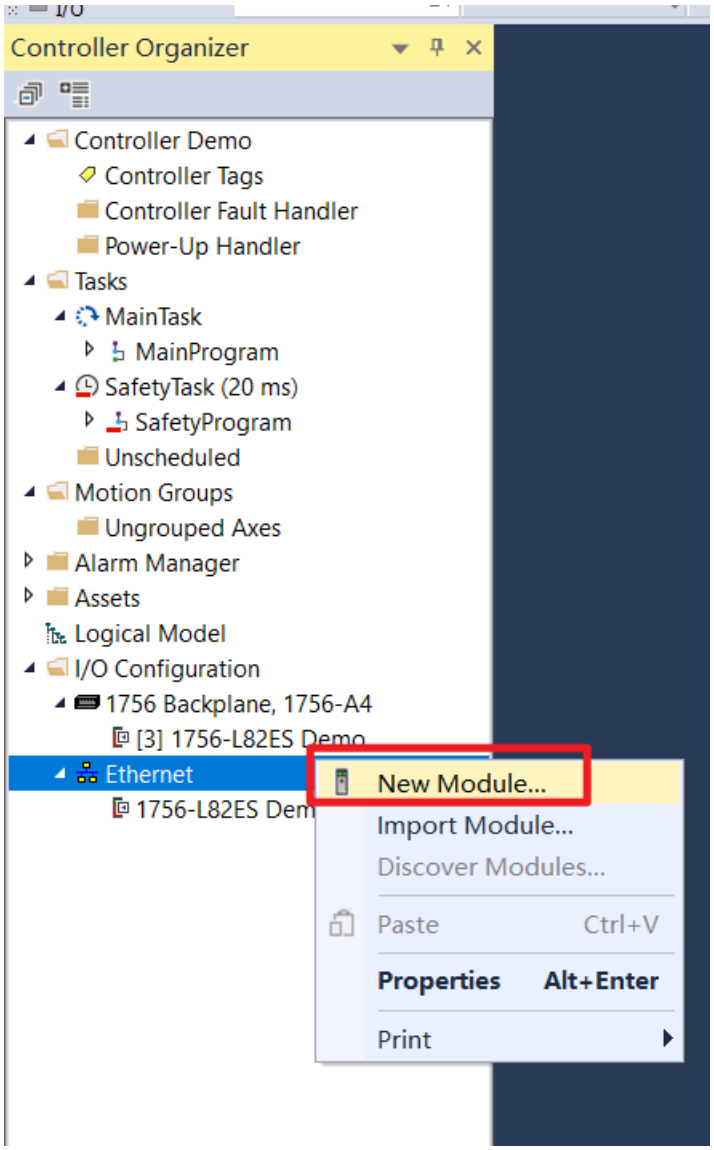
b. Select the corresponding EDS file and click "Next" until the end.



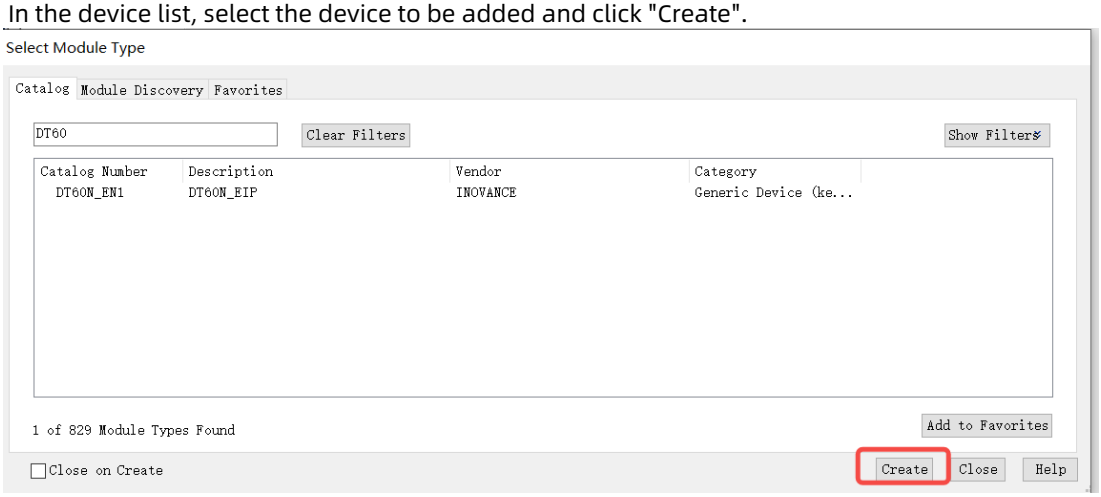


6. Add devices to the project.

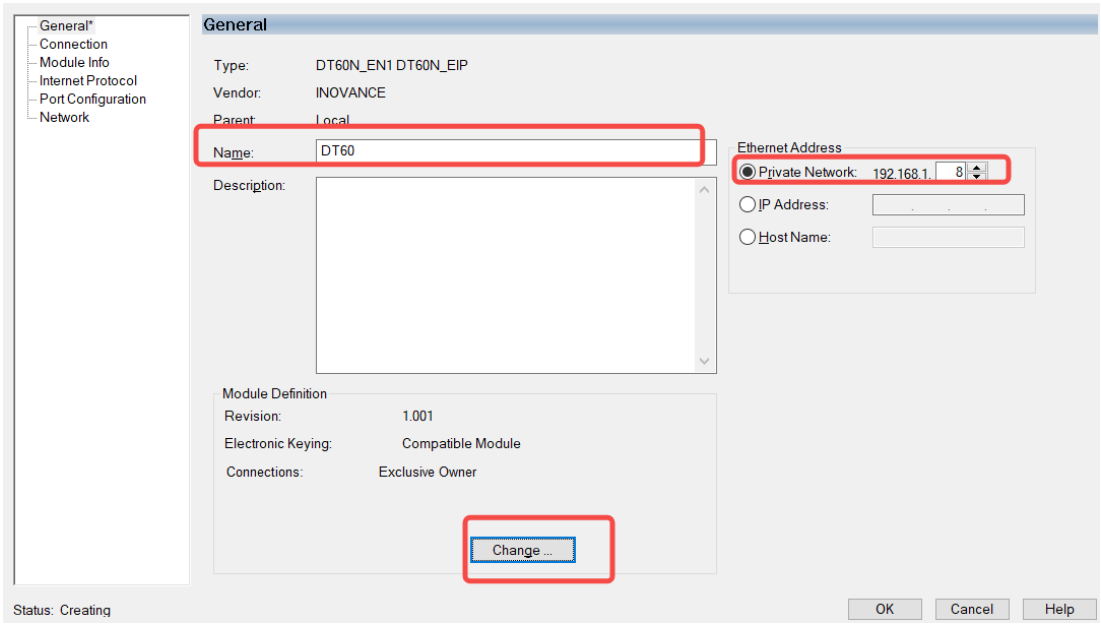
   a. Right-click "EtherNet" and select "New Module".



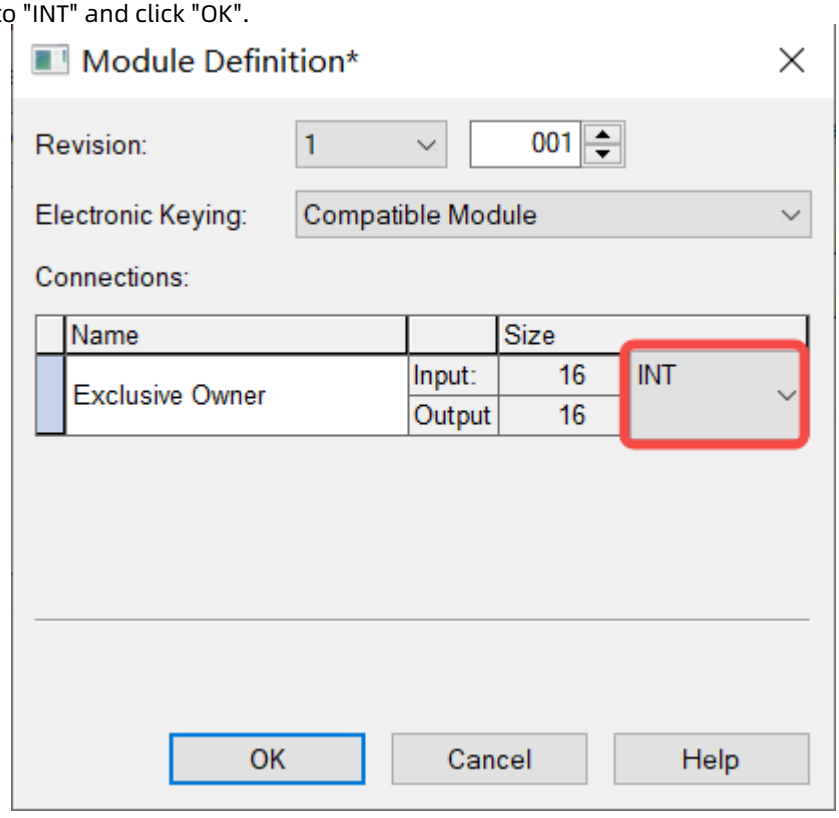
b. In the device list, select the device to be added and click "Create".



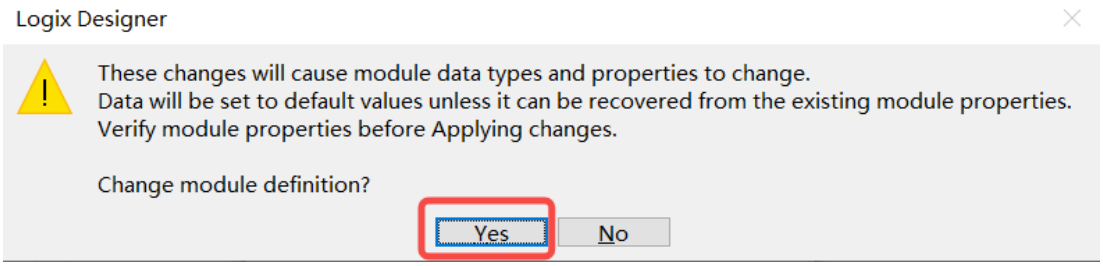
c. Select "General" on the left and set the "Name" and "IP Address" of the device. The IP address here needs to be the same as the IP address in the device communication parameters. After settings are done, click "Change".



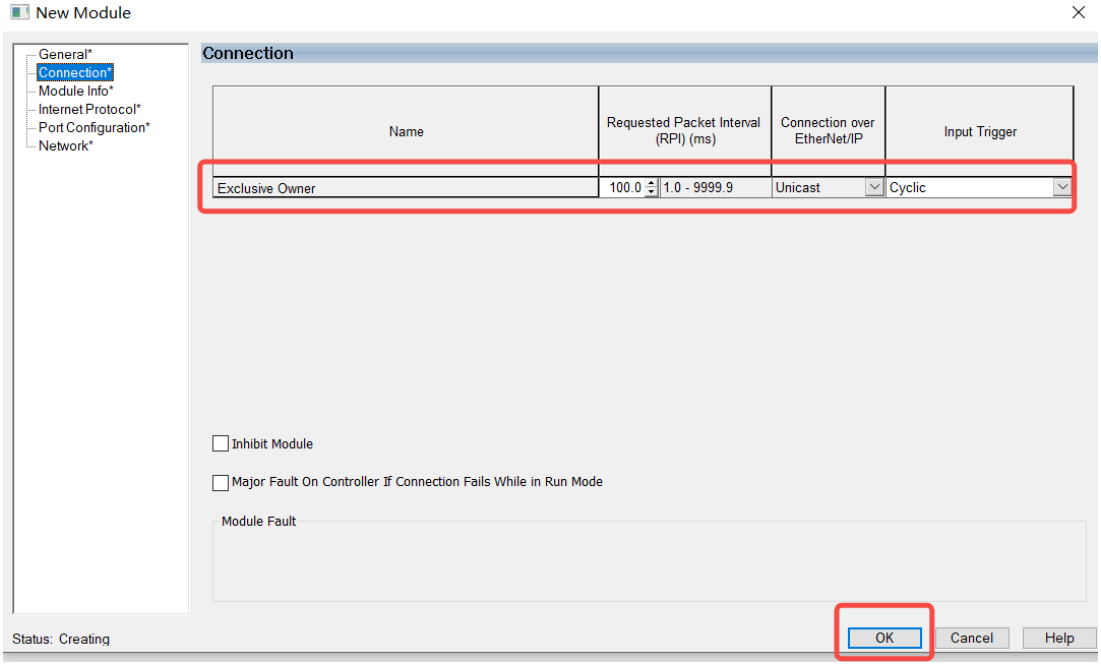
d. Set "Size" to "INT" and click "OK".



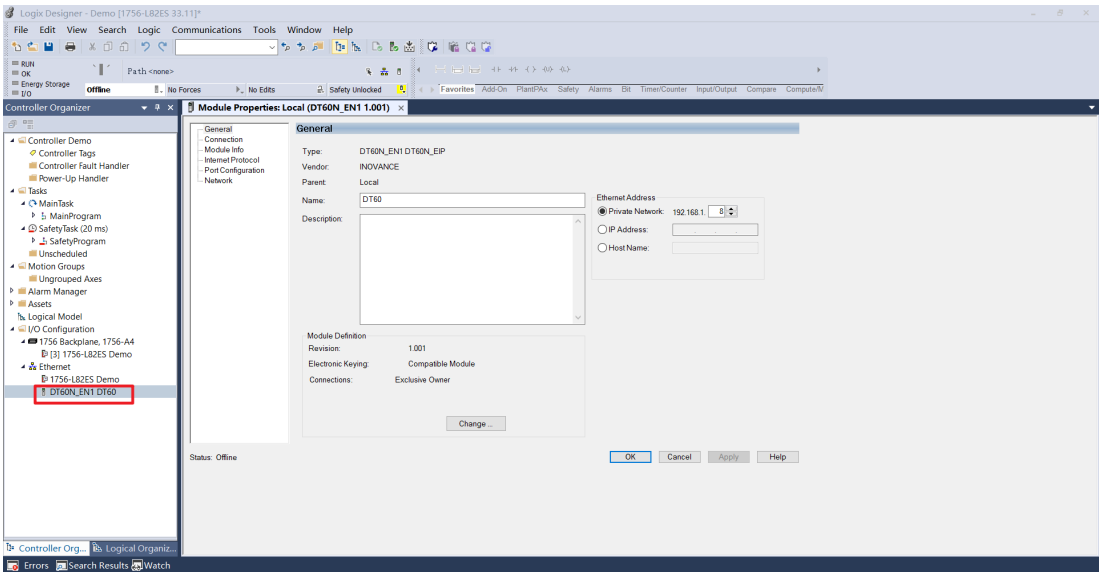
e. Click "Yes".



f. Click "Connection" on the left to set the connection parameters. Set the parameters according to the actual project requirements, and click "OK".

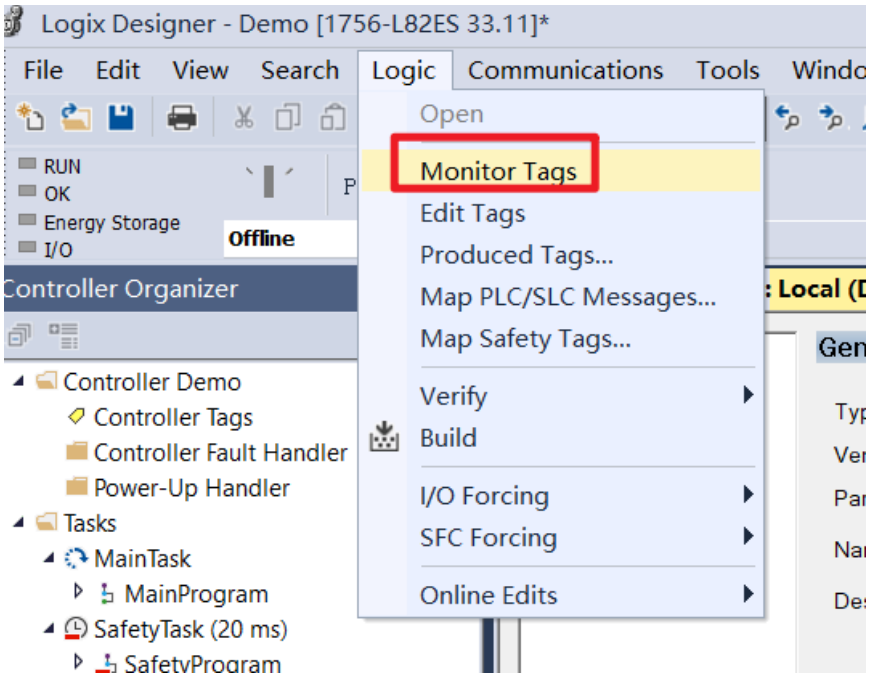


The device is added, and the device is visible in the project status bar.

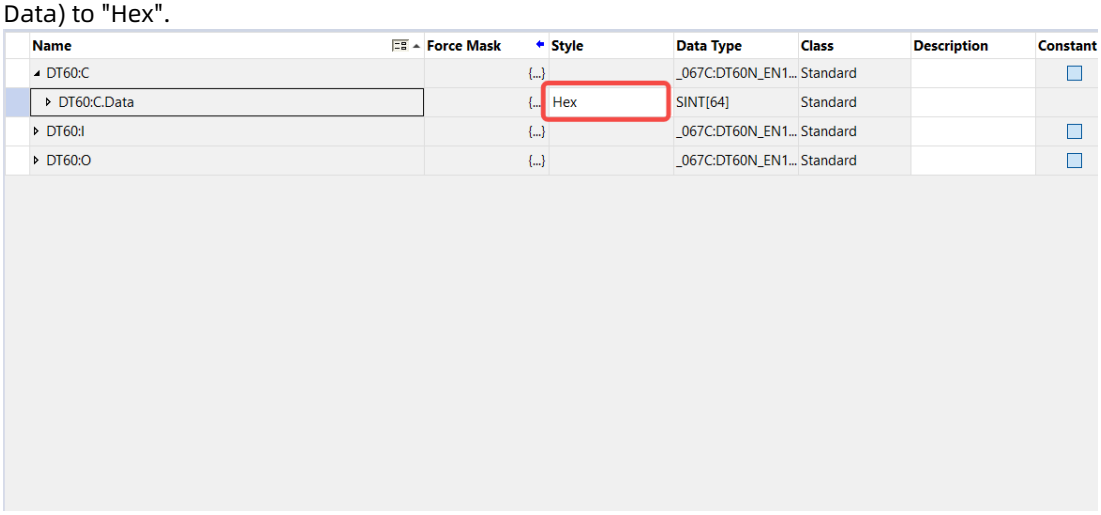


7. Configure the mapping data.

a. Click "Logic > Monitor Tags" in the menu.



b. Select current project and set the data format in the configuration data (that is, Device_1: C_Data) to "Hex".



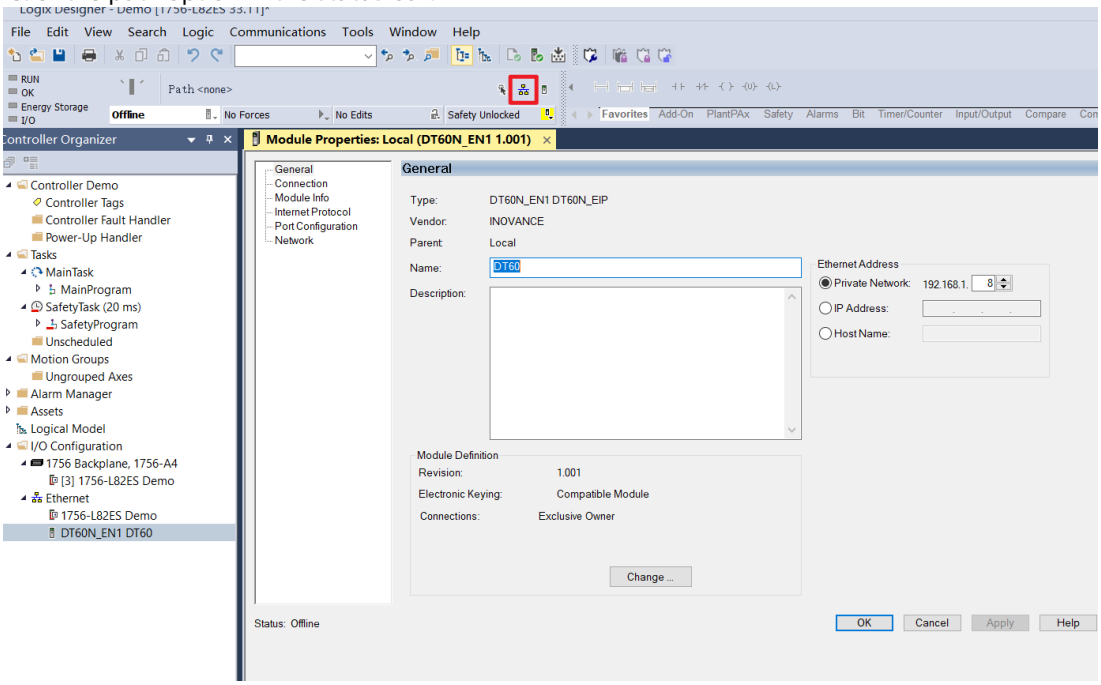
c. Expand the configuration data and fill in the table with the control word and status word addresses that need to be mapped.

Each of the two parameters form a group of addresses. The high address is followed by the low address. In the example for getting the power-on time of the drive, the address is 0xad03, so the status word mapping C: Data[36] = 0x03. C: Data[37] = 0xad.

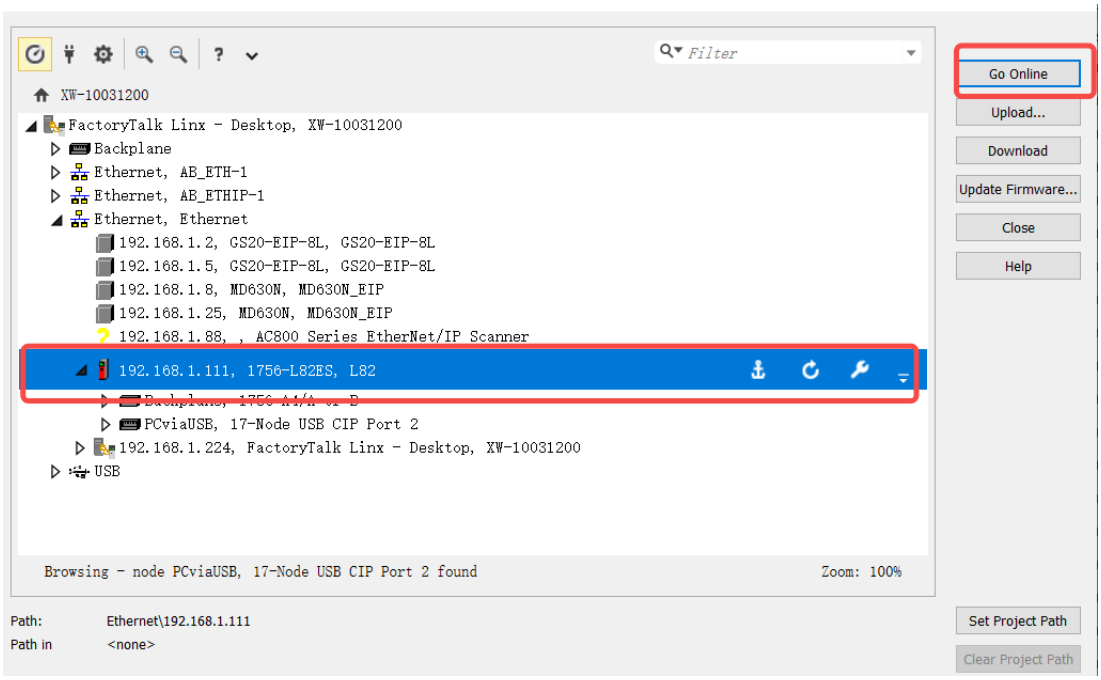
Name	Value	Force Mask	Style	Da
DT60:C.Data[25]	16#00		Hex	SIN
DT60:C.Data[26]	16#00		Hex	SIN
DT60:C.Data[27]	16#00		Hex	SIN
DT60:C.Data[28]	16#00		Hex	SIN
DT60:C.Data[29]	16#00		Hex	SIN
DT60:C.Data[30]	16#00		Hex	SIN
DT60:C.Data[31]	16#00		Hex	SIN
DT60:C.Data[32]	16#44		Hex	SIN
DT60:C.Data[33]	16#70		Hex	SIN
DT60:C.Data[34]	16#45		Hex	SIN
DT60:C.Data[35]	16#70		Hex	SIN
DT60:C.Data[36]	16#03		Hex	SIN
DT60:C.Data[37]	16#ad		Hex	SIN
DT60:C.Data[38]	16#00		Hex	SIN
DT60:C.Data[39]	16#00		Hex	SIN
DT60:C.Data[40]	16#00		Hex	SIN
DT60:C.Data[41]	16#00		Hex	SIN

8. Download the project to the PLC.

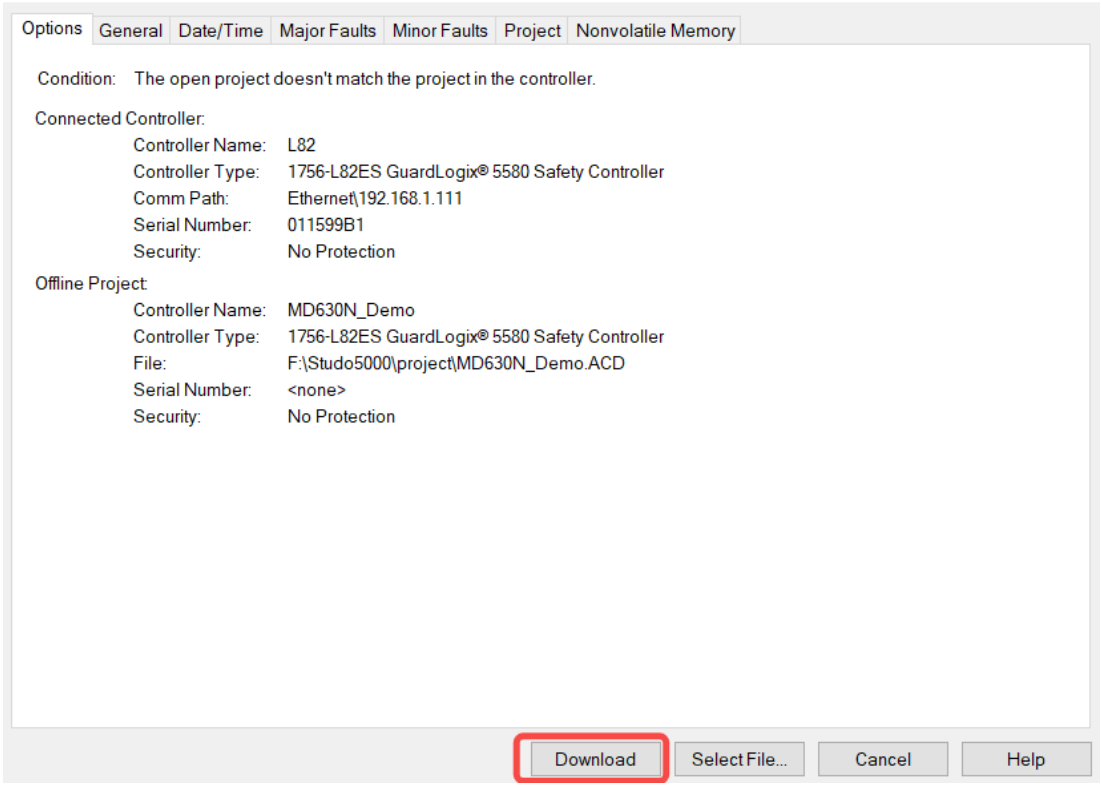
a. Click the path option in the status bar.



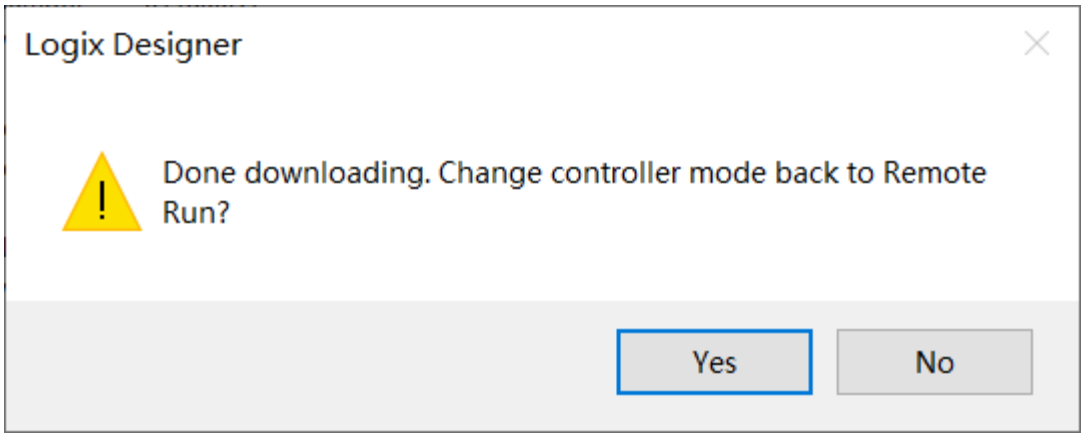
b. Select the master to download to and click "Go Online".



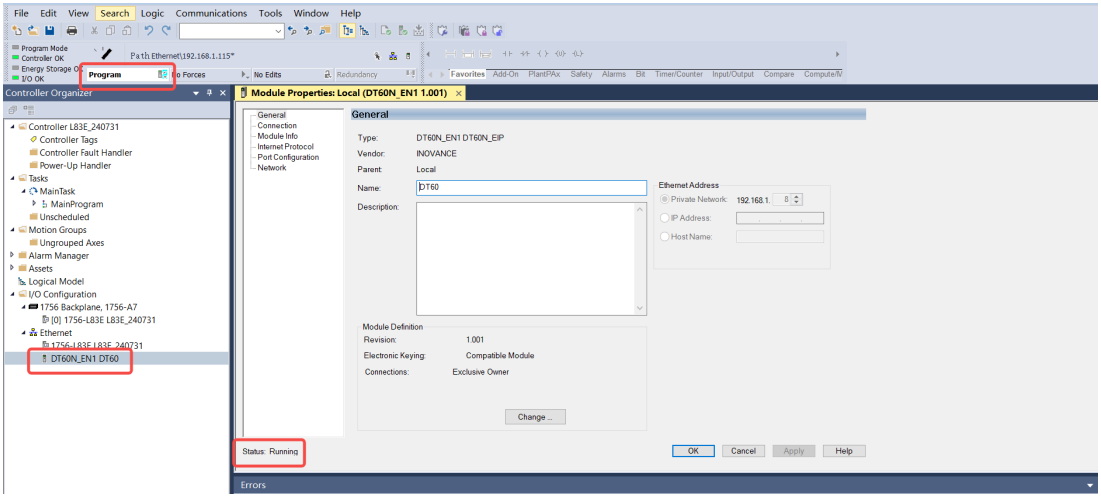
c. Select "Download".



d. Select "Yes".

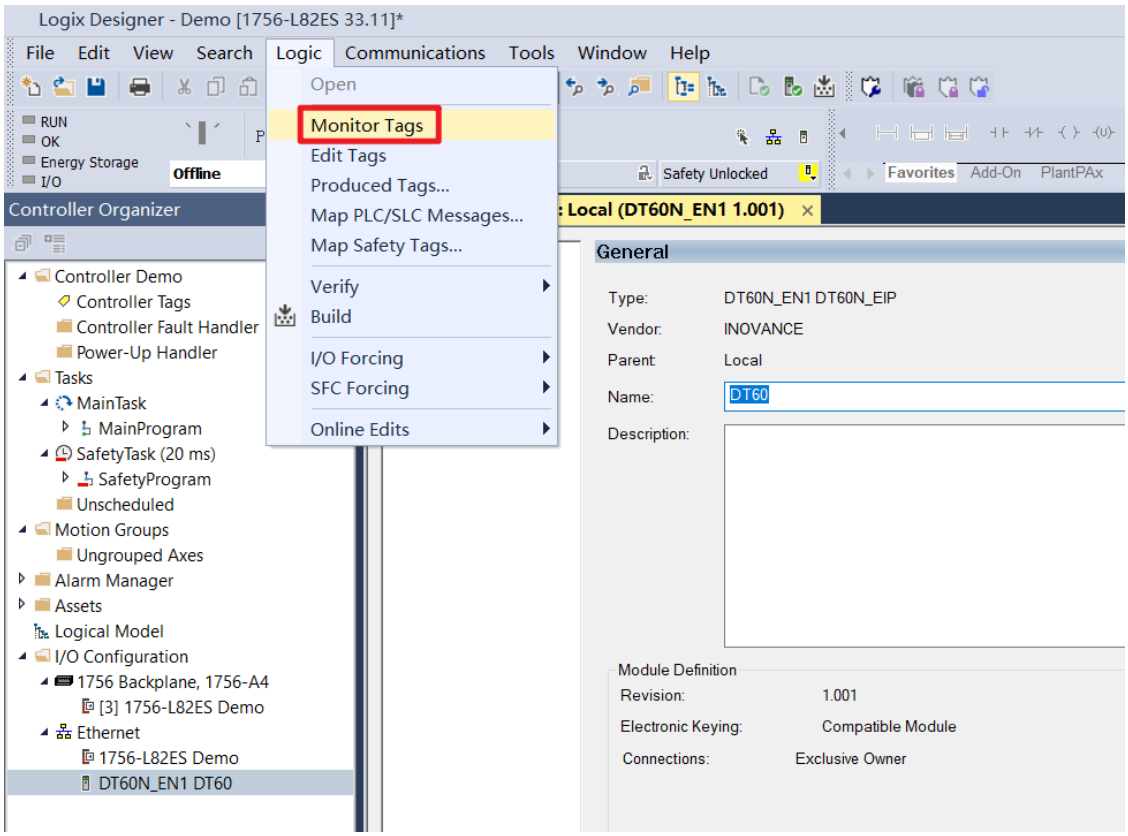


As shown in the following figure, the master is online and device interaction is normal.

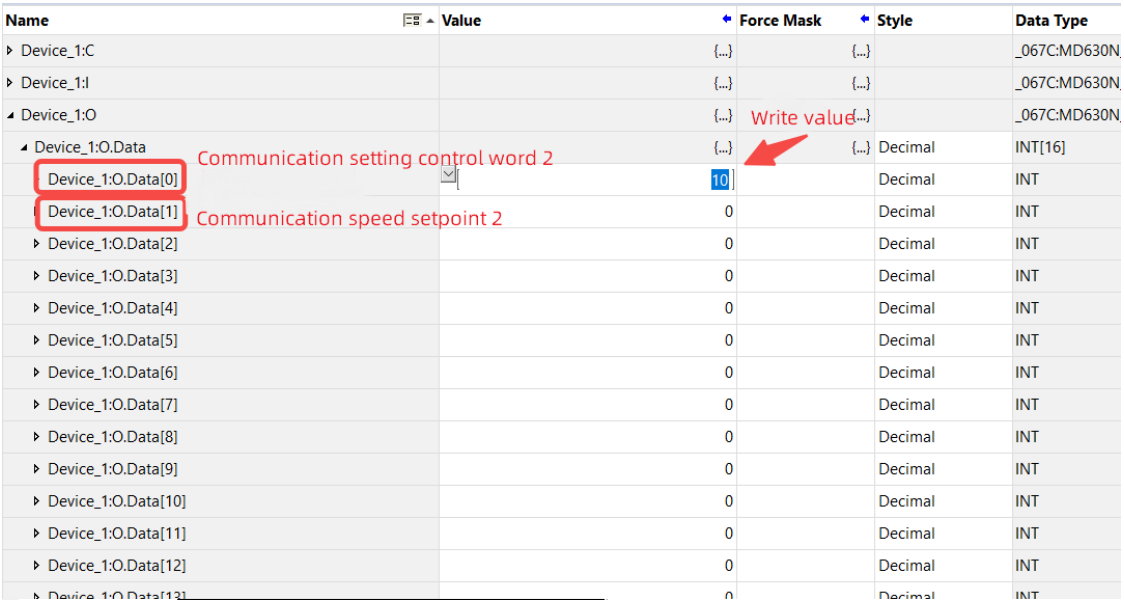


Step 4: Control the drive through communication.

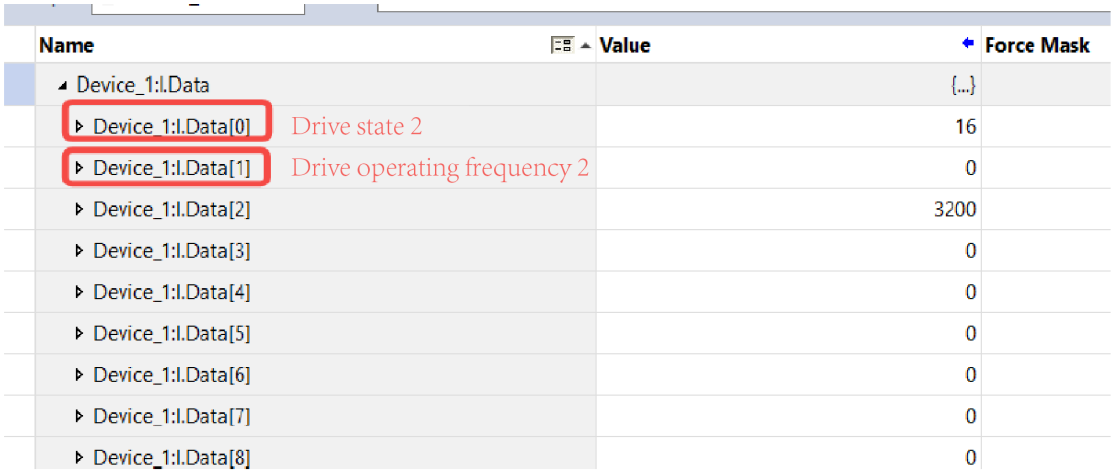
1. To control the motor, set the corresponding I/O mapping variable value according to the mapping address of the communication data.
   Click "Logic > Monitor Tags" in the menu, and the communication data mapping table appears.



Write the reference parameters as shown in the following figure.



The following figure shows the communication feedback data.



2. For start/stop control and frequency/torque reference through EtherNet/IP communication, read and write specific communication addresses of the drive. In other words, the specific addresses need to be mapped to the PDO data of EtherNet/IP.
   For simple start/stop control and frequency/torque reference, 7311H and 7310H need to be mapped to the PDO data.

   7311H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop as defined by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop as defined by F2-17 7: Reset fault 8: Emergency stop

   For example, writing 1 to 7311H activates forward run. Writing 0 to 7311H stops the drive as defined by F2-17 [OFF1 stop mode].

   7310H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this address. The property of values written by this address is switched by n0-14 [7310H Speed reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

In default settings, when n0-14 [7310H Speed reference selection] is set to 1 [Frequency (signed 16-bit)], writing 1000 to 7310H sets the main frequency to 10.00 Hz. Writing -1000 sets the main frequency to -10.00 Hz.

The corresponding feedback states are defined in the following table.

Comm. address		Description
Drive state 2	7044H	The status value of 7044H is hexadecimal. The drive states corresponding to bit values are as follows. bit0: Operation status - 0: Stop; 1: Run bit1: Operating direction - 0: Forward; 1: Reverse bit2: Fault state - 0: No fault; 1: Faulty bit3: Frequency arrival state - 0: Not reached; 1: Reached bit4: Reserved bit5: Reserved bit6: Reserved bit7: Reserved bit8 to bit15: Fault code. For details, see specific fault descriptions.
Operating frequency 2 of the drive	7045H	Default: 2 decimal places, signed number, in units of Hz. The decimal places are switchable.

8.5.11 Replacing the Faulty Device

When using EtherNet/IP, the drive supports direct replacement of a faulty device without reconfiguration or reassignment of the device.

The following conditions must be met when replacing a faulty device.

The new device and the device being replaced must be of the same model.

Replacement procedure:

1. Record the communication-related parameters of the faulty device, unplug the cables from the faulty device, and remove the faulty device from the network.
2. Connect the new device of the same model to the network using the original physical connection method.
3. Configure communication parameters of the new device based on *"8.5.6 Connecting the Drive To Bus System" on page 207*. The communication parameters of the new device must match those of the faulty device.

8.6 PROFINET Drive Control

8.6.1 Introduction

PROFINET communication is a real-time industrial fieldbus communication protocol based on EtherNet, which features high performance, flexible topology, low cost, high precision, and simple application.

8.6.2 Communication Specifications

Table 8–11 PROFINET protocol communication specifications

Item	Content
Communication protocol	PROFINET protocol
Services available	Cyclic data exchange Acyclic data exchange Media redundancy protocol (MRP) Discovery and basic configuration protocol (DCP) Link layer discovery protocol (LLDP) Prioritized startup (FSU)
Physical layer	100BASE-TX
Duplex mode	Full duplex
Topology	Linear, star, tree, ring
Transmission rate	100 Mbps (100Base-TX)
Transmission medium	Shielded cables of Cat 5e or higher
Communication port	M12
Communication type	RT Class1
PROFINET frame length	40 bytes to 1440 bytes
Cyclic data	A maximum of 1440 bytes per node (a maximum of 32 bytes for this series of drives)
Acyclic data	Up to 24 bytes
Communication cycle	≥ 1 ms
Maximum cable length	< 100 m (with proper cables and environment)
Maximum number of slaves	65535 (depends on master performance)
Number of request messages that can be received at the same time	1

8.6.3 Communication System Connection

PROFINET networks support three basic topologies: bus, star, and ring, and also support a hybrid topology known as tree.

Bus topology

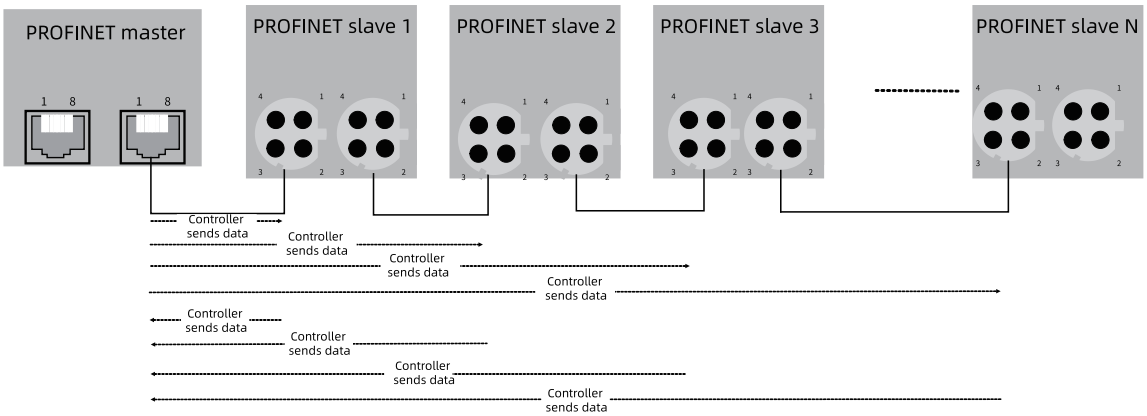


Figure 8-15 Bus topology diagram

In bus topology, the cable is routed out from the PROFINET master and connected to any M12 communication port on the drive, then routed out from another M12 communication port and connected to the next drive.

PROFINET does not distinguish between IN and OUT ports. Any network port can serve as the port connected to the master. In general applications, the master does not check the specific network connection. However, if specific ports are configured in the topology, the connection must follow the sequence specified in the topology diagram. Otherwise, an error can be reported by the master.

The bus topology features simple wiring and low coast. However, if an upstream device fails (for example communication interruption or power loss), all the downstream devices cannot communicate normally.

The PN master-slave interaction uses a peer-to-peer communication method. Regardless of the topology used, devices exchange data only with the master. See the format of the PN data exchange frame in *"8.6.4.1 Message Structure" on page 236*.

Star topology

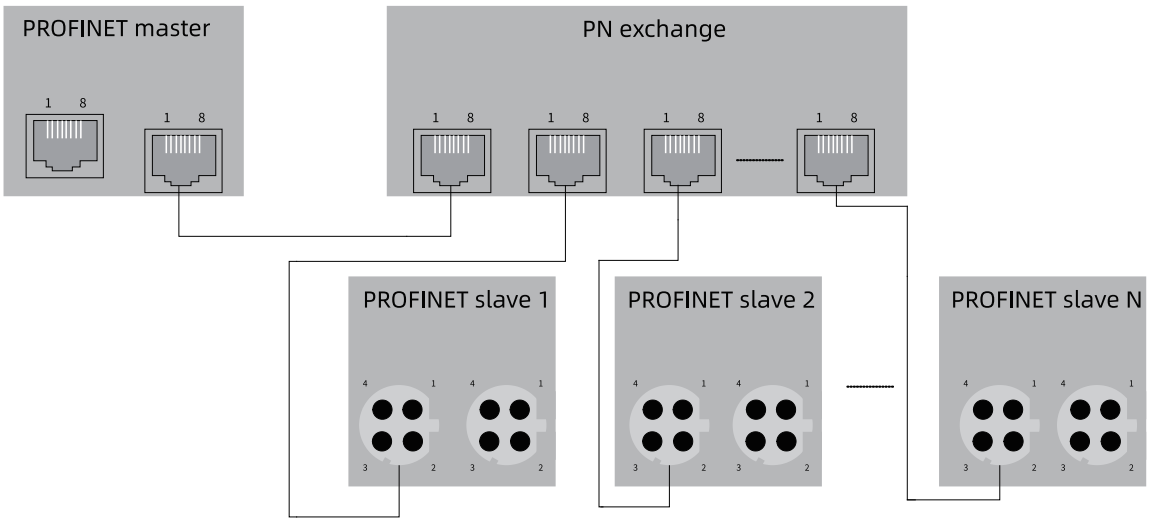


Figure 8-16 Star topology diagram

In star topology, the network cable is routed out from the master to a PN switch, and then to each slave. In a star topology, a failure of a single slave node does not affect communication of other slave nodes. However, this increases the cost of the switch, and if the switch fails, communication of all nodes will be interrupted.

Ring topology

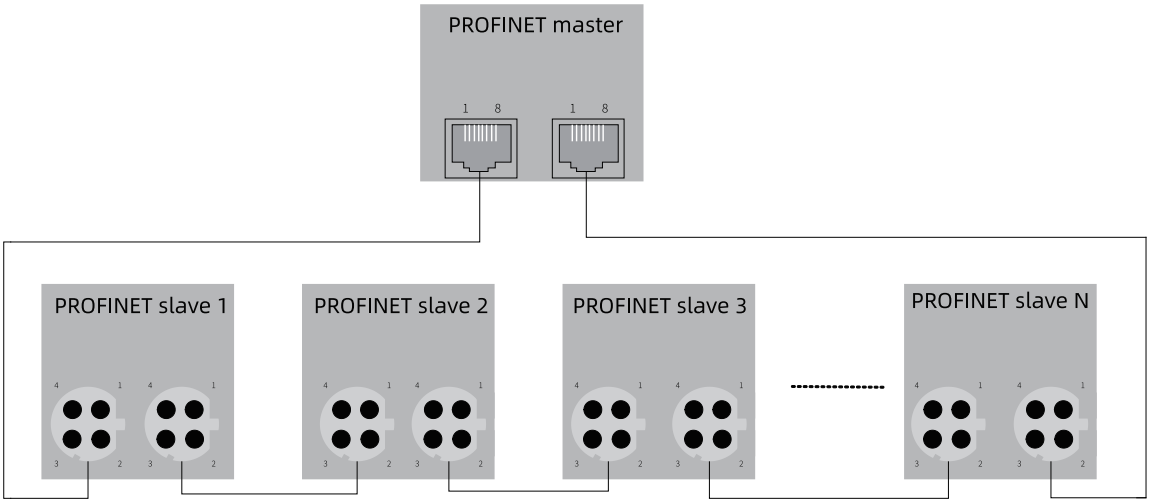


Figure 8-17 Ring topology diagram

The ring topology is derived from the bus topology. A network cable is routed out from the spare port of the last device and connected to an idle port on the PLC to form a loop.

The ring topology avoids the issue in the bus topology where a single node failure interferes with other nodes. However, it requires that both the PN master and all slave in the topology support the MRP function.

Tree topology

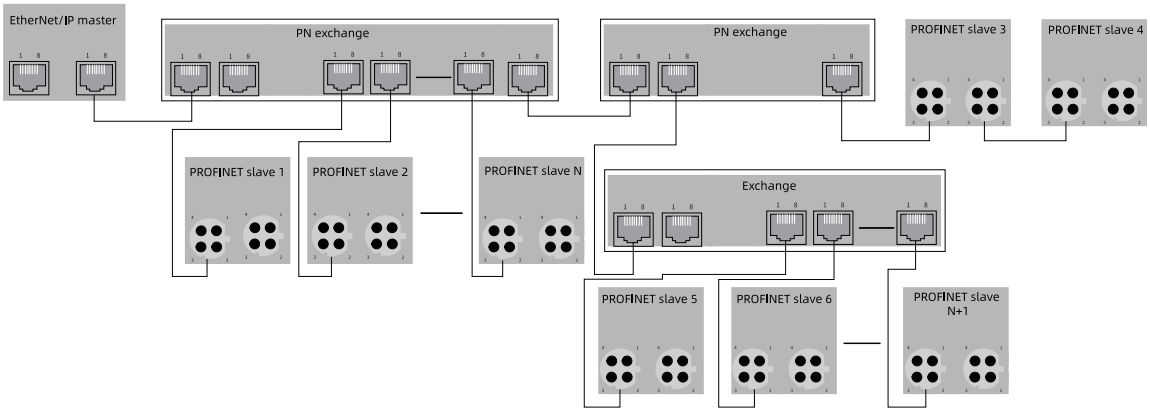


Figure 8-18 Tree topology diagram

The tree topology combines the bus and star topologies, allowing for more flexible networking configurations.

8.6.4 Message

8.6.4.1 Message Structure

PROFINET data is transmitted in the form of EtherNet frames, following the IEEE 802 standard, as shown in the figure below. See the following table for definition of the PROFINET data frame structure.

Figure 8-19 PROFINET message structure

Table 8–12 PROFINET frame structure definition

Field	Definition
Preamble	Used for time synchronization between transmitter and receiver. All the 7 bytes are fixed to 10101010.
Frame start flag (SFD, StartFrame Delimiter)	EtherNet frame start flag, fixed at 10101011
Destination MAC	MAC address of receiver
Source MAC	MAC address of transmitter
Type and VLAN_ID	TYPE: 0x8100 Priority: 3 bits Preserve (0): 1 bit VLAN_ID: 12 bits
EtherNet type (EtherNet TYPE)	IP: 0x0800 ARP: 0x0806 VLAN: 0x8100 PN: 0x8892
Frame ID (Frame ID)	0x0000 to 0x00FF: Reserved 0x0100 to 0x7FFF: RT Class 3 Frames (namely IRT frames) 0x8000 to 0xBFFF: RT Class 1 Frames (namely RT frames) 0xC000 to 0xFBFF: RT Class UDP 0xFC00 to 0xFCFF: High-priority acyclic transmission 0xFE00 to 0xFEFC: Low priority acyclic transmission 0xFEFC to 0xFEFF: DCP
Data	Data area
APDU (Application protocol data unit) status	Cycle counter: 2 bytes Data status: 1 byte Transmission status: 1 byte
Verification	FCS (Frame check sequence)

8.6.4.2 Process Data Interconnection

The master achieves real-time read/write of the drive data and acyclic data exchange through the data in PDO area. The data communication addresses are directly configured by the drive. The following content is included:

- Control word set through communication and communication speed setting word of the drive
- Drive state and actual motor frequency

- Function parameter data are exchanged in real time between the drive and PROFINET master.

The PDO is used for periodic data exchange between the master and drive, as described in the following table.

Table 8–13 PDO exchange data

PDO area for transmission by master		
Default PZD		Variable PZD
Control word 2 set through communication (7311H)	Speed reference set through communication (7310H)	Real-time change of function parameter
PZD1	PZD2	PZD3 to PZD16
Response data PDO of the drive		
Default PZD		Variable PZD
Drive state 2 (7044H)	Actual motor frequency (7045H)	Real-time readout value of function parameter
PZD1	PZD2	PZD3 to PZD16

8.6.4.3 Message Application Instance

8.6.4.3.1 Cyclic Process Data Communication

Cyclic process data is transmitted through RT Class 1 Frames. The frames transmitted from the master to the slave contain all written PZD data (out_data) for the node, while the frames transmitted from the slave to the master contain all PZD data (in_data) required by the master to read. The frame structure is shown in the table below (EtherNet header and trailer fields are omitted).

The cyclic communication frame structure is shown in the table below.

Table 8–14 Cyclic data transmission frame structure from controller to device

VLAN	EtherNet TYPE	Frame ID	IOCS	Data	IOPS	…	Data	IOPS	APDU
4 bytes	2 bytes	2 bytes	xx bytes	xx bytes	1 byte	…	xx bytes	1 byte	4 bytes
-	0x8892	-	-	Submodule 1		-	Submodule N		-

Table 8–15 Cyclic data transmission frame structure from device to controller

VLAN	EtherNet TYPE	Frame ID	Data	IOPS	…	Data	IOPS	IOCS	APDU
4 bytes	2 bytes	2 bytes	xx bytes	1 byte	…	xx bytes	1 byte	1 byte	4 bytes
-	0x8892	-	Submodule 1		-	Submodule N		-	-

IOPS: Input Output Object Provider Status

IOCS: Input Output Object Consumer Status

8.6.4.3.2 Acyclic Mailbox Data Communication

Acyclic mailbox data communication is initiated by the PN master, conducted in a request-response manner, and transmitted using UDP packets. The frame structure for acyclic transmission is shown in the following table (EtherNet frame header part omitted).

See the following table for the acyclic communication frame structure.

Table 8–16 Read request

…	EtherNet Type	IP/UDP	RPC	NDR	Read block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	-	-	-	-

Table 8–17 Read response

…	EtherNet Type	IP/UDP	RPC	NDR	Read block	Read data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	xx bytes	4 bytes
-	0x0800	-	-	-	-	-	-

Table 8–18 Write request

…	EtherNet Type	IP/UDP	RPC	NDR	Write block	Write data	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	xx bytes	4 bytes
-	0x0800	-	-	-	-	-	-

Table 8–19 Write response

…	EtherNet Type	IP/UDP	RPC	NDR	Write block	FCS
-	2 bytes	28 bytes	80 bytes	20 bytes	64 bytes	4 bytes
-	0x0800	-	-	-	-	-

Field	Description
EtherNet Type	EtherNet type, acyclic and fixed at 0x0800
IP/UDP	Standard IP/UDP segment (See IPv4 protocol for detailed meaning.)
RPC	RPC (Remote Procedure Call) specifies the data format used for data transmission and identifies the target object accurately.
NDR	Specifies the size of the addressed data block.
Read block	Contains the ARUUID, API, slot number, sub-slot number, and index of the device to be read.
Read data	Data being read
Write block	Contains the ARUUID, API, slot number, sub-slot number, and index of the device to be written.
Write data	Data being written
FCS	FCS (Frame check sequence)

8.6.4.3.3 Control Word and Status Word

For details, see *" Control Word and Status Word" on page 239*.

8.6.4.3.4 Mapping Table (AC Drive Data)

For details, see *"8.4.3 Mapping Table (AC Drive Data)" on page 197*.

8.6.4.4 Control Word and Status Word

8.6.4.4.1 Control Word

The control word setting range for communication is 0 to 8, with the following options.

Comm. address	Description
0x7311H	0: Stop (the drive stops according to the OFF1 stop mode)
	1: Forward run
	2: Reverse run
	3: Jog 1
	4: Jog 2
	5: Coast to stop
	6: Stop (the drive stops according to the OFF1 stop mode)
	7: Reset fault
	8: Emergency stop (the drive performs emergency stop according to the OFF3 stop mode)

The control word setting is active only after the main command source (b1-00/F0-03, or b3-00) in the currently set control channel (b0-02) is set to 2 [Communication].

The meaning of the communication target frequency (address 7310H) is as follows:

Param.	Description
Target frequency	You can set the target frequency of the drive through this data during communication. The data format of this address is defined by n0-14 [7310H Speed setting selection].

The setting is active only after the main frequency source (F0-29/b5-00 or b6-00) in the active setting channel is set to 9 [Communication].

The data format of the frequency reference is determined by the setting of n0-14 [7310H Speed setting Selection], as shown below.

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
0 [Frequency (unsigned 16-bit)]	Hz	Unsigned 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				2000	20.00 Hz
1 [Frequency (signed 16-bit)] (Default)	Hz	Signed 16-bit	A0-70 [Number of frequency decimal places], 2 by default	1000	10.00 Hz
				-1000	-10.00 Hz
2 [Speed (signed 16-bit)]	rpm	Signed 16-bit	No decimal places	1500 (2 pairs of motor poles)	1500 rpm (50.00 Hz)
				-1500 (2 pairs of motor poles)	1500 rpm (-50.00 Hz)

Options of n0-14	Unit	Data format	Number of decimal places	Example of communication value	Actual value
3 [Percentage (corresponds to rated frequency/signed 16-bit/ 2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (Rated frequency:50.00 Hz)	10.00 % (5.00 Hz)
				-1000 (Rated frequency:100.00 Hz)	-10.00 % (-10.00 Hz)
4 [Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)]	%	Signed 16-bit	Two decimal places	1000 (maximum frequency: 50.00 Hz)	10.00 % (5.00 Hz)
				-5000 (maximum frequency: 100.00 Hz)	-50.00 % (-50.00 Hz)

8.6.4.4.2 Status Word

The meaning of each bit of the status word of communication is shown below.

Comm. address	bit	Definition	Description
0x7044H	0	0 = Stop	Stop state of the drive
		1 = Running	Operating state of the drive
	1	0 = Motor rotating forwardly	Actual motor speed > 0
		1 = Motor rotating reversely	Actual motor speed < 0
	2	0 = No fault	No fault occurred on the drive
		1 = Fault occurred	Fault occurred on the drive Reset the fault by writing 7 to the control word.
	3	0 = Frequency not reached	The operating frequency of the drive does not reach the target frequency detection range.
		1 = Frequency reached	The operating frequency of the drive has reached the target frequency detection range (target frequency ±per-unit frequency A2-04 x frequency arrival detection window P0-38).
	4 to 7	Reserved	-
	8 to 15	Fault code	Current fault code of the drive

The meaning of the communication target frequency is as follows.

Param.	Description
Operating frequency	Indicates the operating frequency of the drive. Data format is signed 16-bit with 2 decimal places.

8.6.5 Communication Port

PROFINET bus uses standard M12 network ports. Use shielded twisted pair cables of CaT 5e or higher, with metal-shielded molded connectors. When using the PROFINET bus, the cable length between devices cannot exceed 100 m, exceeding of which can result in signal attenuation and communication failure.

PROFINET does not distinguish between IN and OUT. That is, the master can be routed in from any LIN port of the drive and routed out to the next slave through another LIN port.

In the topology view or port configuration, the drive provides Port1 and Port2 for configuration. However, the DT60 series drive is integrated with PROFINET and EtherNet/IP protocols, so the terminal marks cannot reflect the PROFINET-specific information. In actual use, Port1 corresponds to LIN1 (terminal mark IN), and Port2 corresponds to LIN2 (terminal mark OUT), as shown in the figure below.

When the topology view is not configured (namely whether the corresponding ports are connected during configuration is not specified), you can insert into any port. However, when the topology view is configured, the ports must be connected according to the configured connection relationship. Otherwise, the PLC can report a fault without affecting communication.

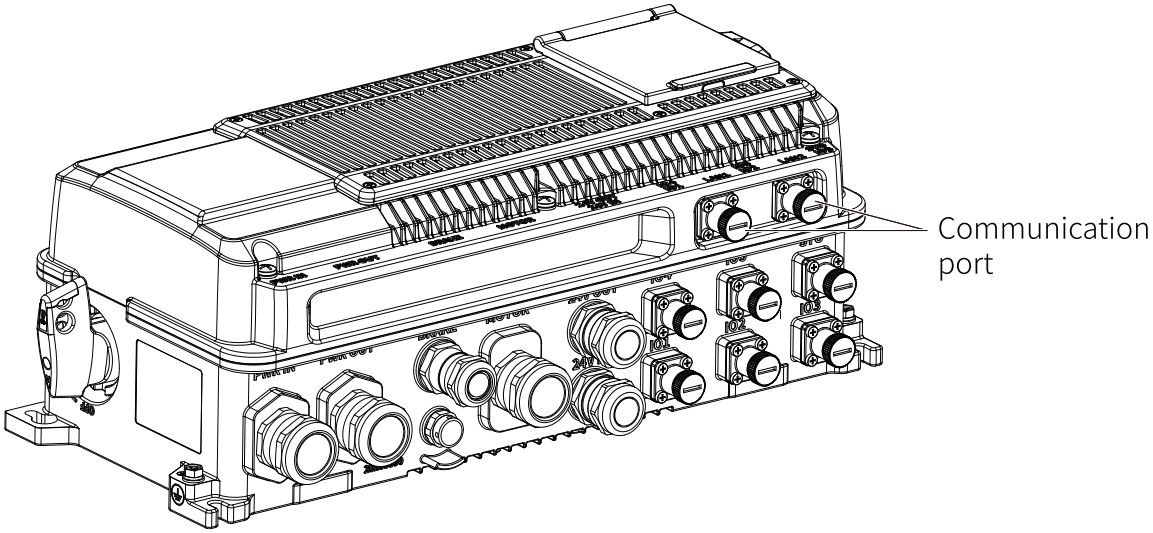


Figure 8-20 Position of PROFINIT communication port

Table 8–20 Description of PROFINET communication port

External port	Type	Type of information transmitted	Mark	Name	Function
LIN1	M12	100 M bus	LIN1	100 M bus cascading port	Supports two communication protocols: EIP/PN, which can be selected through n0-10. EIP/PN is direction-insensitive.
LIN2	M12	100 M bus	LIN2	100 M bus cascading port	Supports two communication protocols: EIP/PN, which can be selected through n0-10. EIP/PN is direction-insensitive.

8.6.6 Connecting the Drive To Bus System

Connect the PROFINET network cable to the shielded network port. The maximum cable length between two devices is 100 m, with a theoretical maximum number of 65535 stations supported. Common connection topologies are shown in *"8.6.3 Communication System Connection" on page 233*.

Connection procedure

1. Switch off the system power supply.

2. Use a shielded network cable to connect the PROFINET master to the PROFINET drive slave. See the communication network topology shown in *"8.6.3 Communication System Connection" on page 233*, and connect the network cable to the shielded network port. The IN and OUT ports of the drive are direction-insensitive. For communication interface specifications, see *"8.6.2 Communication Specifications" on page 233*.

Note

For PROFINET communication, IN and OUT of the communication port are not directional-sensitive.

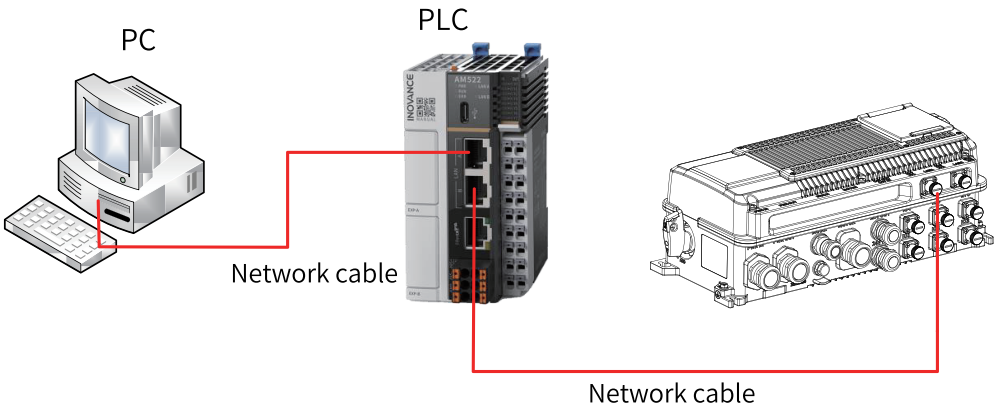


Figure 8-21 PROFINET communication connection

3. Power on the system after ensuring all connections (including communication connection) are correct.
4. Restart the power supply.

8.6.7 Configuring Communication Between the Drive and Controller

The drive supports standard PROFINET master devices, which includes Siemens S7-1200, S7-1500, S7-300, S7-400, and SMART200.

The following basic operations are required to perform PROFINET communication.

1. Perform wiring according to *"8.6.6 Connecting the Drive To Bus System" on page 241*.
2. Switch the device communication mode to PROFINET communication (n0-10 = 3), set communication as the active command source (F0-03 = 2), and select communication as the main frequency command source for setting channel 1 (b0-03 = 0, b5-00 = 9). (This operation can be performed through the operating panel or software tool.)
3. Wait for a few seconds. When the Link1/2 indicator turns on, the EtherNet link has been successfully established.
4. Configure communication between the master (controller) and slave (drive) as shown in *"8.6.10.1 Example for Communicating with TIA Portal" on page 244*.

8.6.8 Communication Parameters

Parameter group n6 defines PROFINET communication parameters.

Table 8–21 Parameters related to PROFINET communication

Param.	Name	Default value	Value range	Change mode	Description
n6-01 (Fd-76)	Most significant byte of the IP address	0	0 to 255	At stop	Indicates the highest byte of the IP address. For example, if the IP address is 192.168.0.2, this parameter displays 192. Note: It is displayed only after the PN slave and master are connected properly. The setting range is 0 to 255. It is automatically set after the PN master configures and assigns the device name.
n6-02 (Fd-77)	Second most significant byte of the IP address	0	0 to 255	At stop	Indicates the second most significant byte of the IP address. For example, if the IP address is 192.168.0.2, this parameter displays 168. Note: Same as n6-01
n6-03 (Fd-78)	Third byte of the IP address	0	0 to 255	At stop	Indicates the third byte of the IP address. For example, if the IP address is 192.168.0.2, this parameter displays 0. Note: Same as n6-01
n6-04 (Fd-79)	Least significant byte of the IP address	0	0 to 255	At stop	Indicates the lowest byte of the IP address. For example, if the IP address is 192.168.0.2, this parameter displays 2. Note: Same as n6-01
n6-05 (Fd-80)	Most significant byte of the subnet mask	0	0 to 255	At stop	Indicates the highest byte of the subnet mask. For example, if the subnet mask is 255.255.255.0, this parameter displays 255. Note: Same as n6-01
n6-06 (Fd-81)	Second most significant byte of the subnet mask	0	0 to 255	At stop	Indicates the second most significant byte of the subnet mask. For example, if the subnet mask is 255.255.255.0, this parameter displays 255. Note: Same as n6-01
n6-07 (Fd-82)	Third byte of subnet mask	0	0 to 255	At stop	Indicates the third byte of the subnet mask. For example, if the subnet mask is 255.255.255.0, this parameter displays 255. Note: Same as n6-01
n6-08 (Fd-83)	Least significant byte of the subnet mask	0	0 to 255	At stop	Indicates the lowest byte of the subnet mask. For example, if the subnet mask is 255.255.255.0, this parameter displays 0. Note: Same as n6-01
n6-09 (Fd-84)	Most significant byte of the gateway	0	0 to 255	At stop	Indicates the highest byte of the gateway address. For example, if the gateway address is 192.168.0.1, this parameter displays 192. Note: Same as n6-01

Param.	Name	Default value	Value range	Change mode	Description
n6-10 (Fd-85)	Second most significant byte of the gateway	0	0 to 255	At stop	Indicates the second most significant byte of the gateway address. For example, if the gateway address is 192.168.0.1, this parameter displays 168. Note: Same as n6-01
n6-11 (Fd-86)	Third byte of gateway	0	0 to 255	At stop	Indicates the third byte of the gateway address. For example, if the gateway address is 192.168.0.1, this parameter displays 0. Note: Same as n6-01
n6-12 (Fd-87)	Least significant byte of the gateway	0	0 to 255	At stop	Indicates the lowest byte of the gateway address. For example, if the subnet mask is 192.168.0.1, this parameter displays 1. Note: Same as n6-01
n6-20	Message number	-	0 to 65535	Read only	Displays communication messages. Note: Same as n6-01

8.6.9 Communication Fault Diagnosis

When communication errors occur, the operating panel of the drive displays the corresponding fault code. See the following table for descriptions and diagnosis methods of PROFINET-related communication faults.

Table 8–22 Diagnosis method for PROFINET communication fault

Fault code	Fault name	Cause	Verification method	Solution
E166.1	PROFINET communication timeout	The master or slave is disconnected during communication.	The operating panel displays the fault code.	Check the communication circuit between the master and slave.
E166.3	PROFINET mapping address error	The mapping configured during configuration is invalid.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the invalid mapping address.

8.6.10 Communication Configuration Instance

8.6.10.1 Example for Communicating with TIA Portal

The following shows how to control the drive through TIA Portal and S7-315.

Prerequisites

Connect the drive to the bus system, as shown by *"8.6.6 Connecting the Drive To Bus System" on page 241*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Speed reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to rated frequency/signed 16-bit/2 decimal places); 4: Percentage (corresponding to maximum frequency/signed 16-bit/2 decimal places)

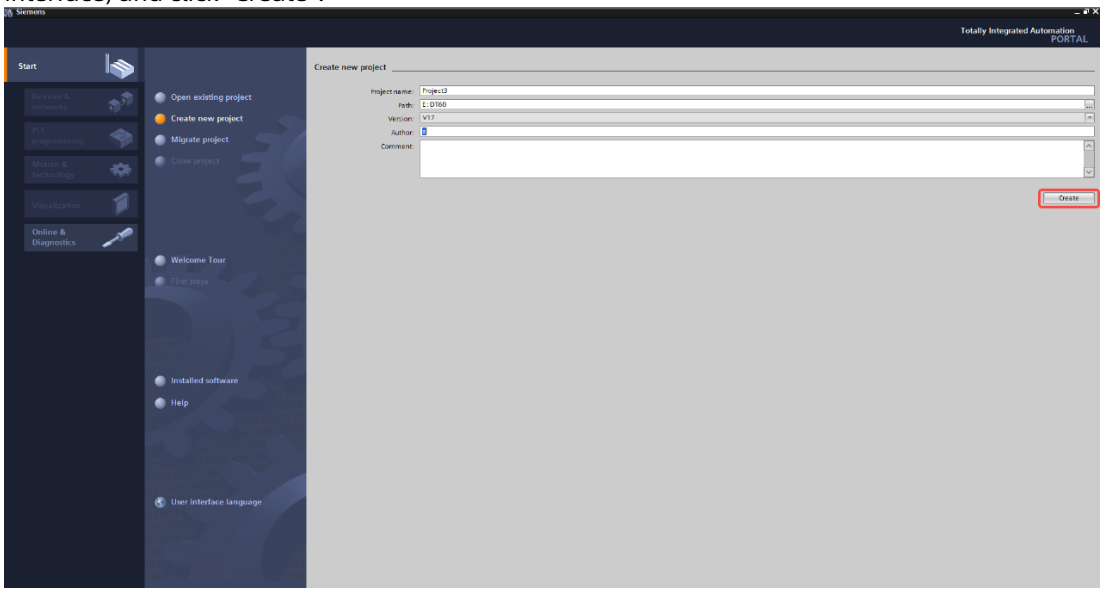
Set the torque as follows:

1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. It is recommended to set n0-14 [7310H Speed reference selection] to 2 [Speed (signed 16-bit)].

Step 3: Establish PROFINET communication.

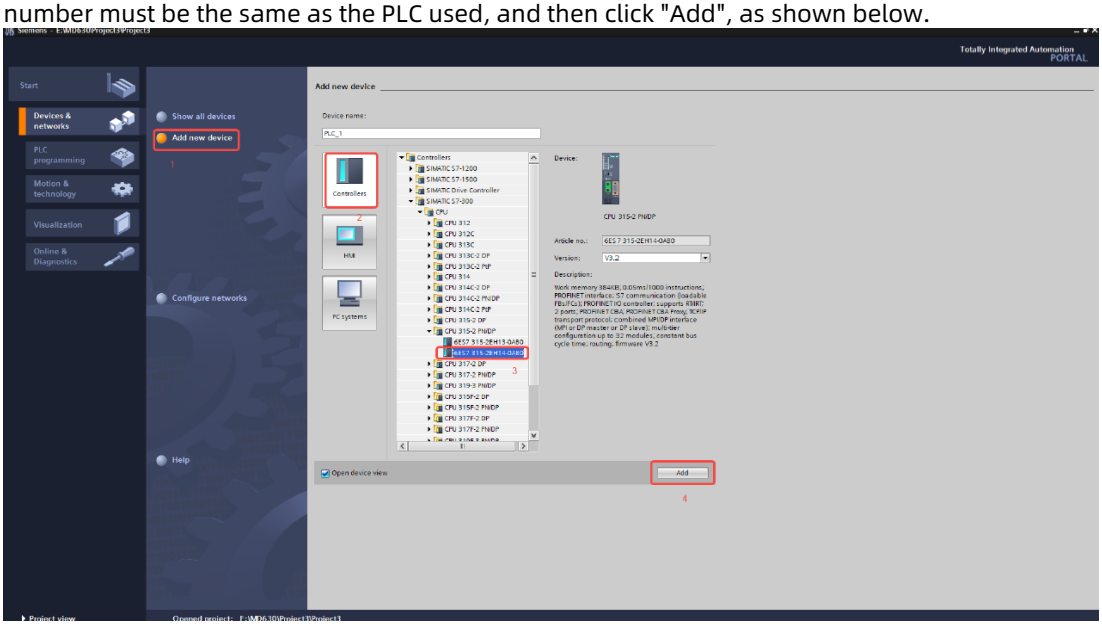
1. Set n0-10 to 3 (through the operating panel or software tool). Switch the device communication mode to PROFINET.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.

   a. Open the TIA PORTAL software, modify the project name and storage path on the "Create" interface, and click "Create".



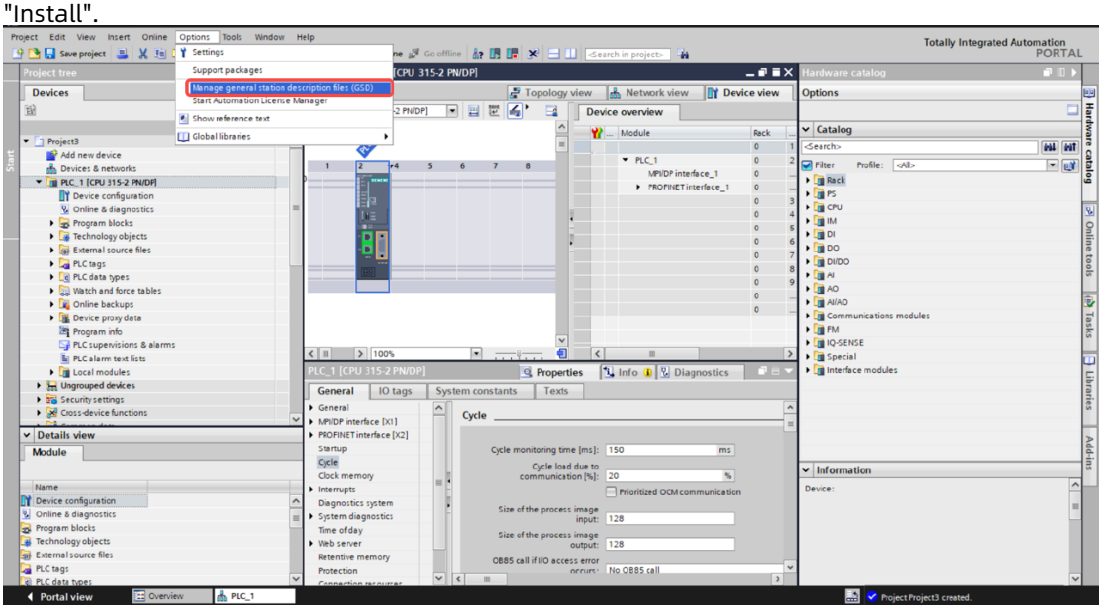
   b. Click "Configure device".

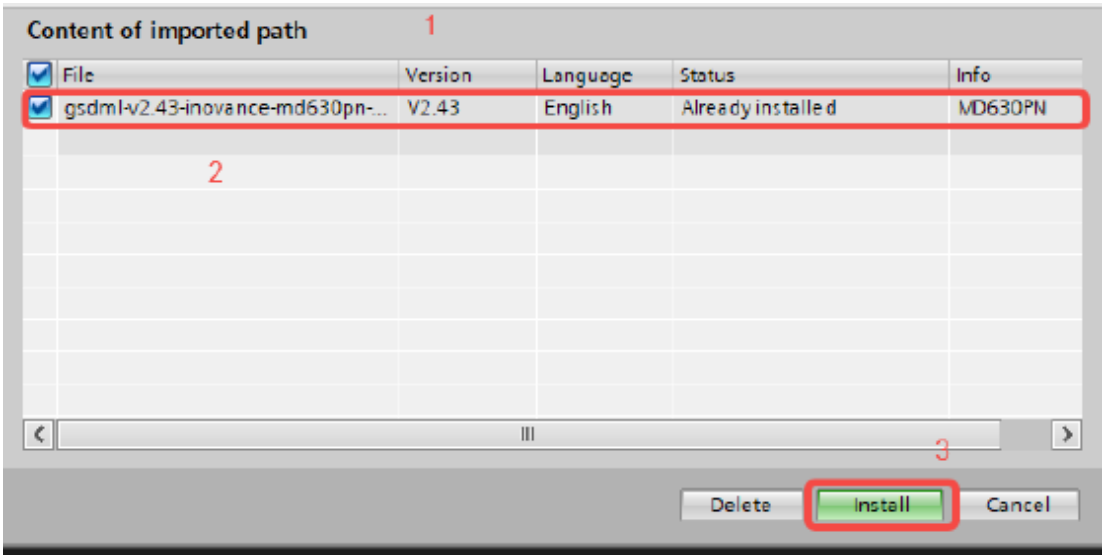
c. Click "Add new device", select the correct PLC model in the "Controller". Note that the order number must be the same as the PLC used, and then click "Add", as shown below.



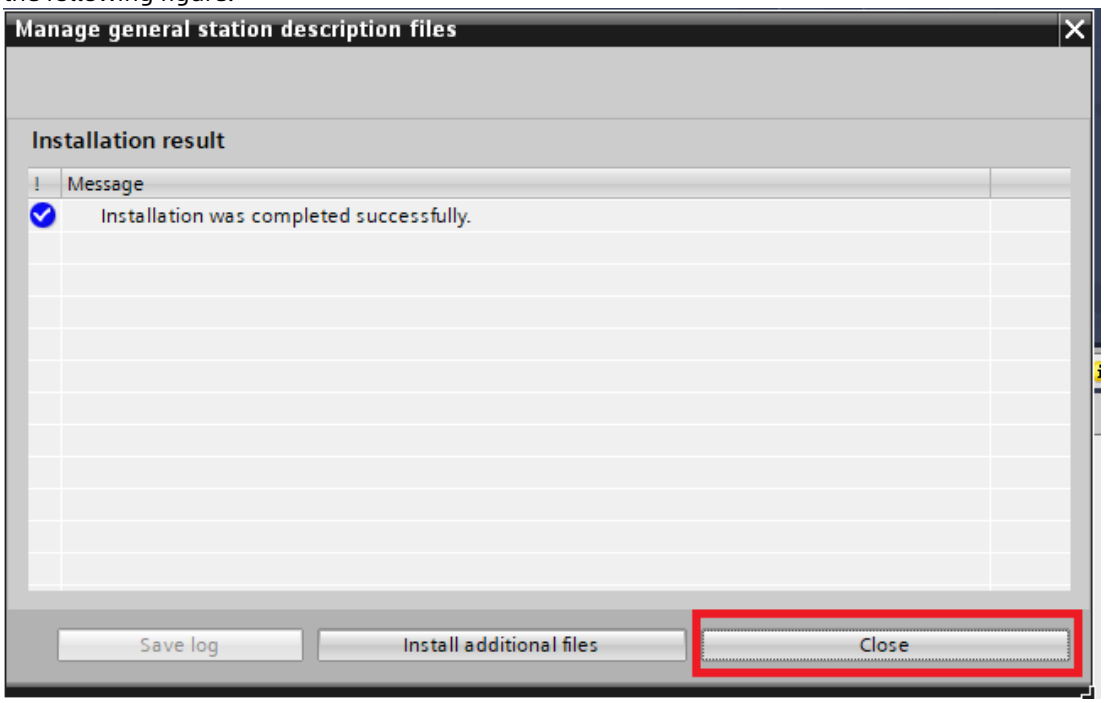
4. Import the device description file (XML) of the drive. Otherwise, the drive cannot be added.

a. Select "Options" in the toolbar, click "Manage general station description file (GSD)", and then select the path where the current XML file is saved and check the XML file to be installed. Click "Install".



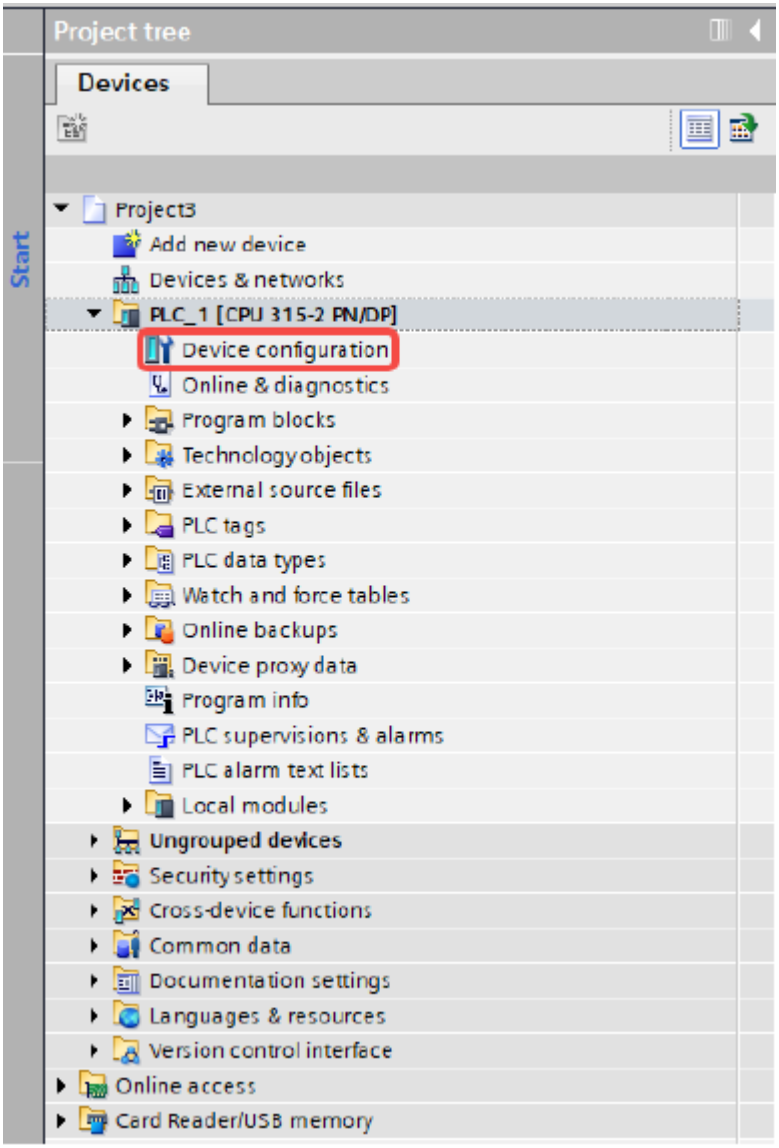


b. Click "Close" when the message "Installation completed successfully" is displayed, as shown in the following figure.

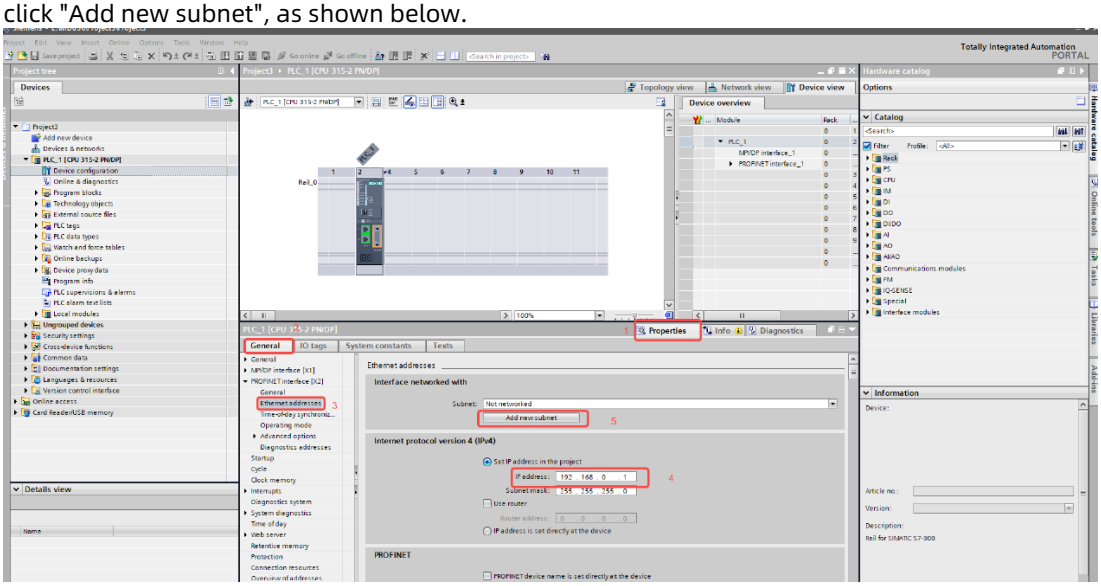


5. Set the device configuration.

a. When the XML file is installed, the TIA PORTAL software automatically closes the current configuration to update the hardware directory. After you close the "Manage general station description file", double-click "Device configuration" at the location shown in the following figure.

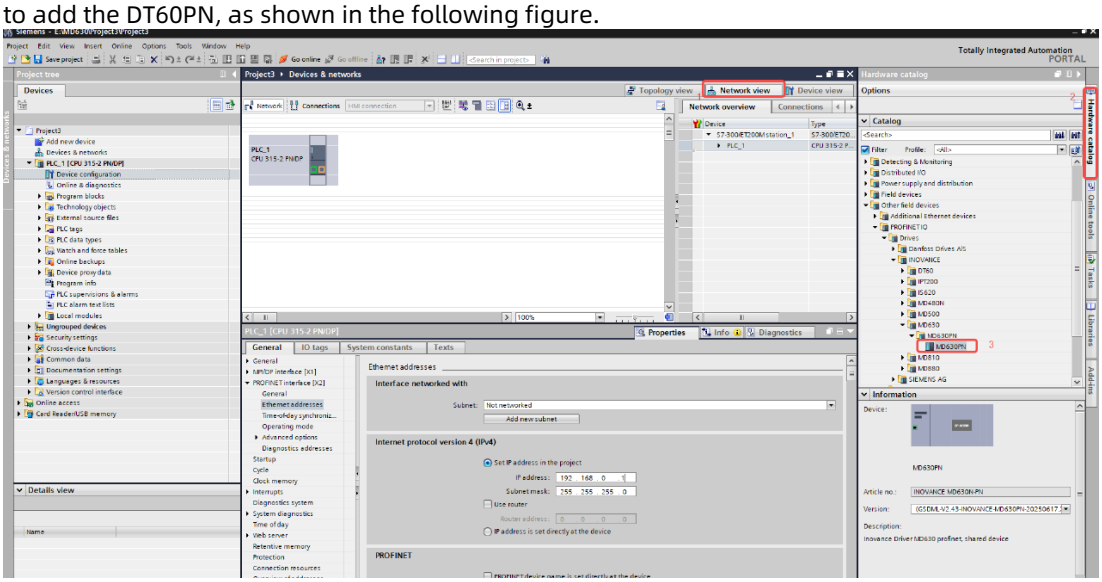


b. In "Property" > "General", select "EtherNet address", set the IP address of the master PLC, and click "Add new subnet", as shown below.

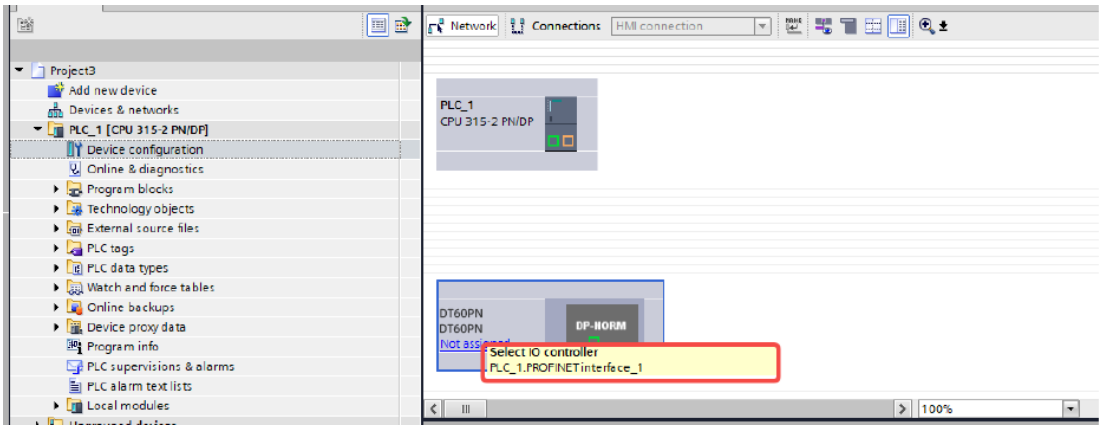


6. After adding the PN network, you can add the slave device.

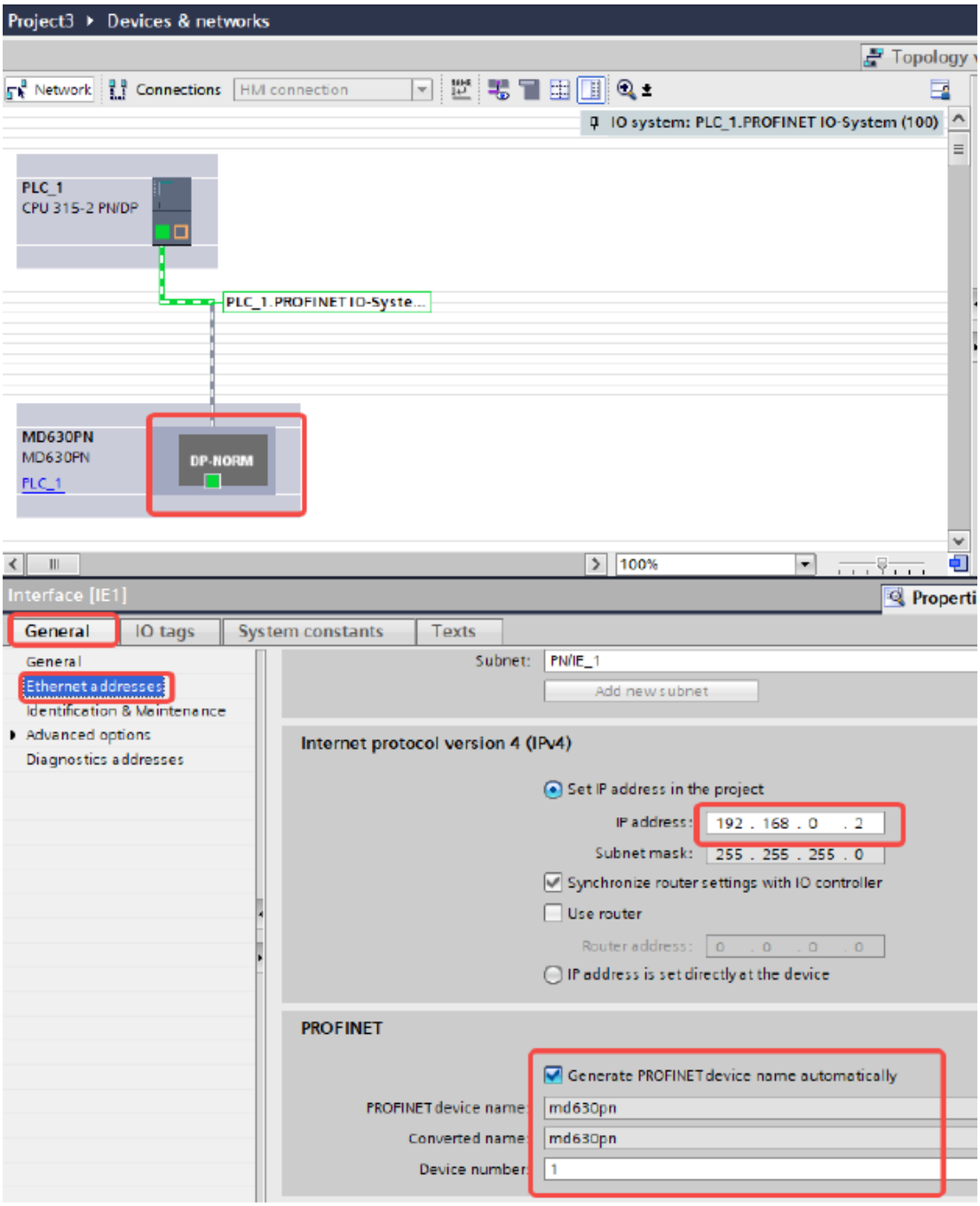
a. Click "Network view" and locate the DT60PN in the "Hardware catalog" on the right. Double-click to add the DT60PN, as shown in the following figure.



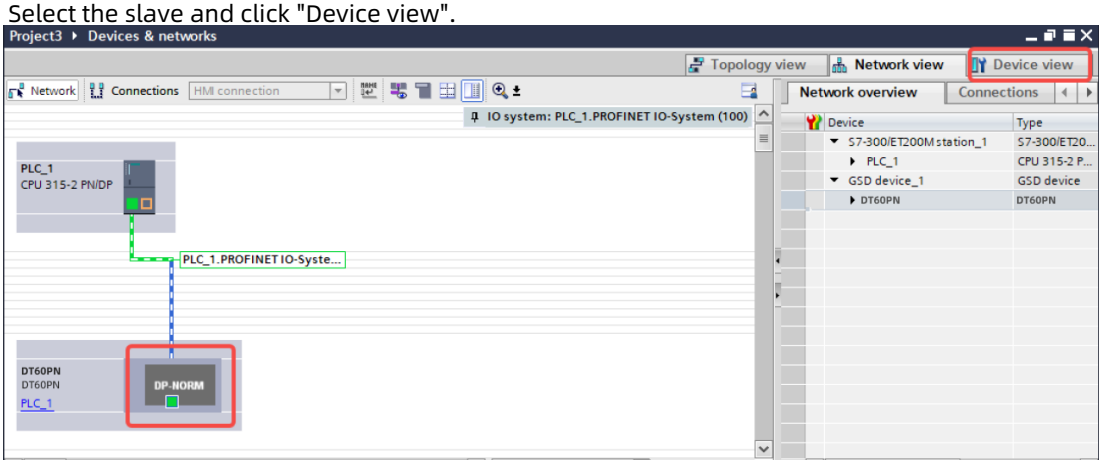
b. In this case, the slave is still in the "unassigned" state, and the master cannot control it. Click "Unassigned", the words "Select I/O controller" will pop up, and the available Profinet network list is displayed. Click this network to add the device to the master PN network.



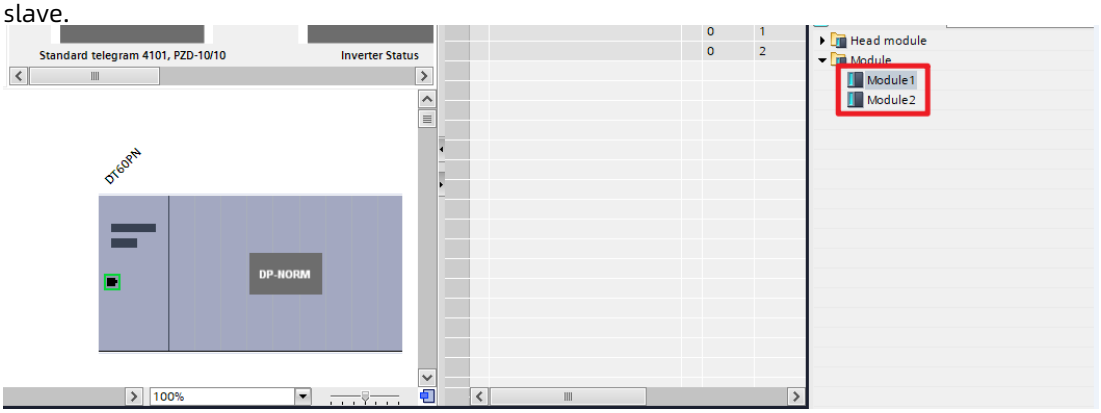
c. Select the slave. You can modify the IP address and device name in the "EtherNet address" under "General". (To modify the device name, de-select "Generate Profinet device name automatically".)



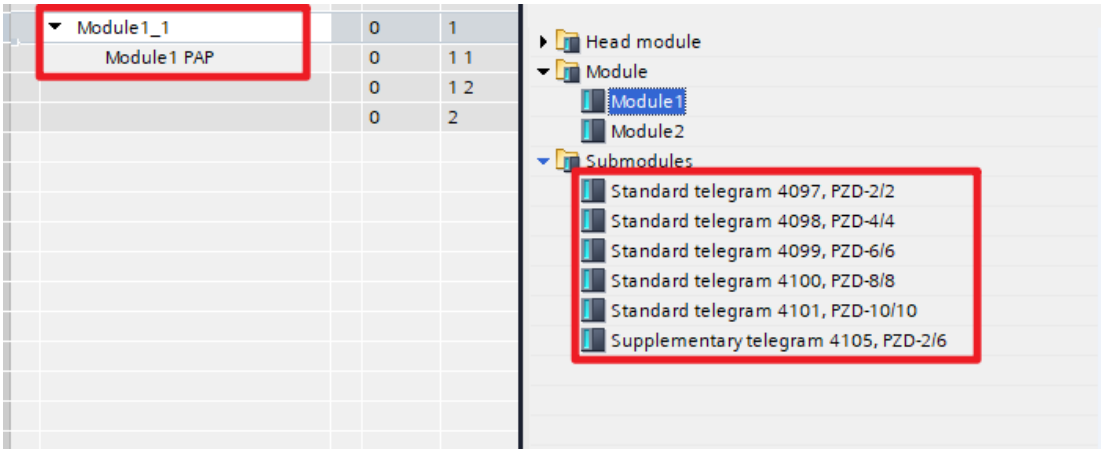
d. Select the slave and click "Device view".



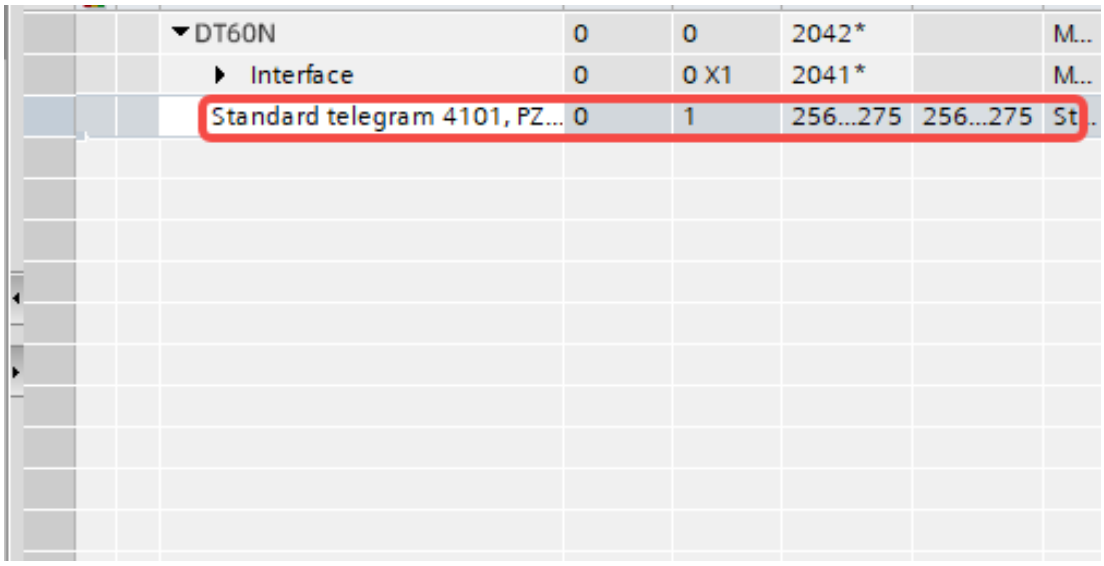
e. In the "Hardware catalog", select the module type needed and double-click to add it to the slave.



Two modules, Module1 and Module2, are present. Module1 supports flexible configuration of cyclic data mapping addresses. Module2 does not support flexible configuration of cyclic data mapping addresses, and its mapping addresses are fixed, which is suitable for applications requiring fast motor control. First, use Module1 for flexible configuration (if you need to use Module2 for configuration, skip to step 10 to view the introduction). After double-clicking Module1, selectable submodules will appear. You can choose the corresponding submodule as needed. The number after PZD indicates the number of words written/read (calculated in words). For example, "PZD-2/2" means this module has 2 words of write data and 2 words of read data. The number before PZD indicates the message number, such as "4097". If a communication error occurs, check whether the message number is consistent with the message number of the parameter.



f. Then the I/Q address assigned by the master to cycle data of this station will be displayed.

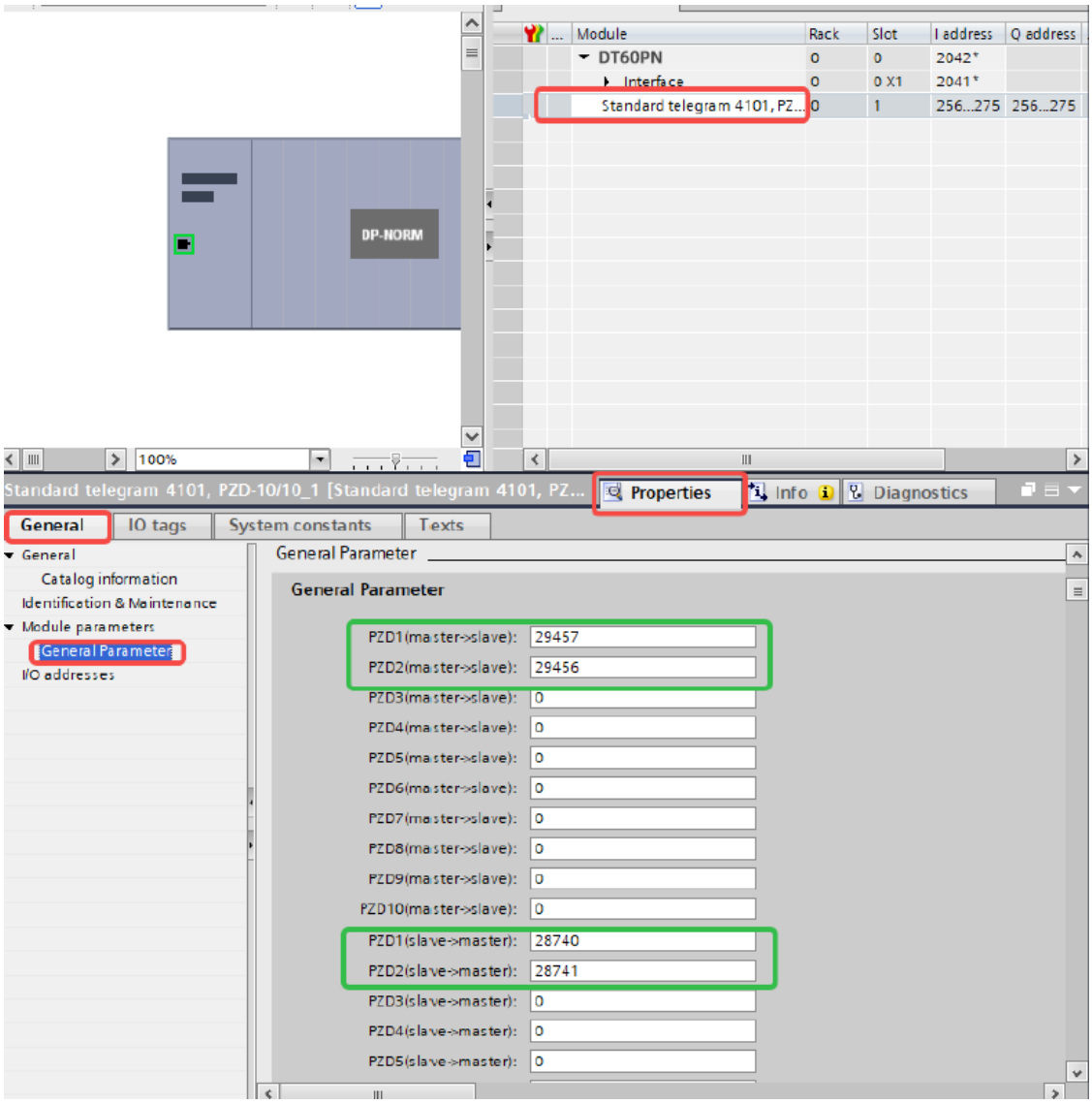


7. After adding a module, you can configure the module to set the corresponding parameter of each PZD.

   As shown in the following figure, PZDx (master->slave) indicates the PZD (out-data) written by the master to the slave, and PZDx (slave->master) indicates the PZD (in-data) returned by the slave to the master. The initial values of PZD1 and PZD2 marked in green are preset. PZD3 written in the master is configured to 61488 (0xF030, ramp 1 ramp-up time) and PZD4 written in the master is configured to 61489 (0xF031, ramp 1 ramp-down time). PZD3 read by the master is configured to 28674 (0x7002, bus voltage), PZD4 read by the master is configured to 28675 (0x7003, output voltage), and PZD4 read by the master is configured to 28676 (0x7004, output current).

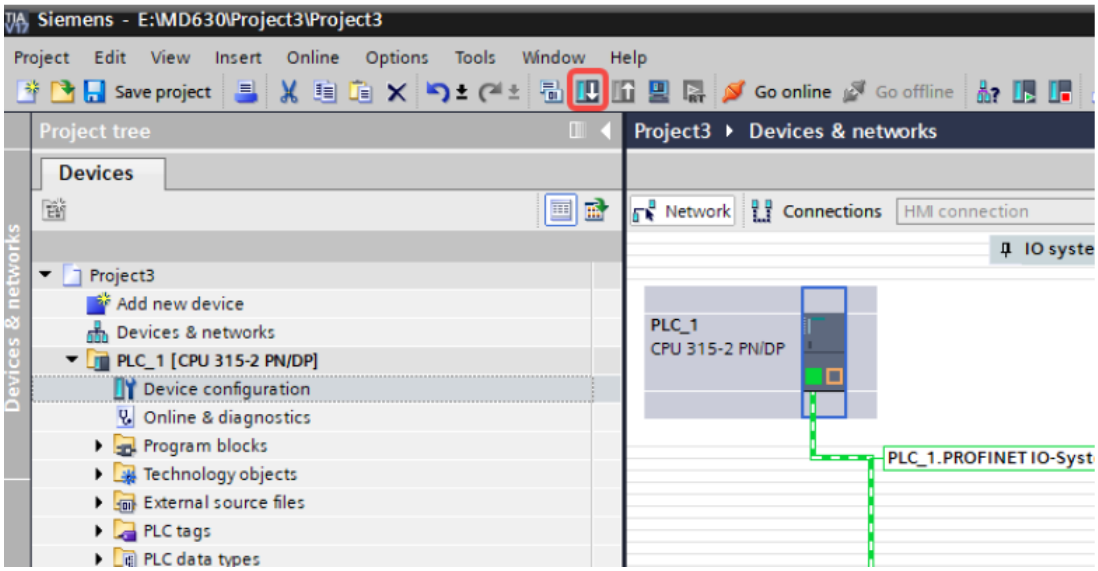
Caution

PZD configuration needs to be continuous. For example, if PZD1-4 and PZD6 are configured but PZD5 keeps the original value 0, this case is not allowed. This will prevent the mapping of PZD6 from taking effect.

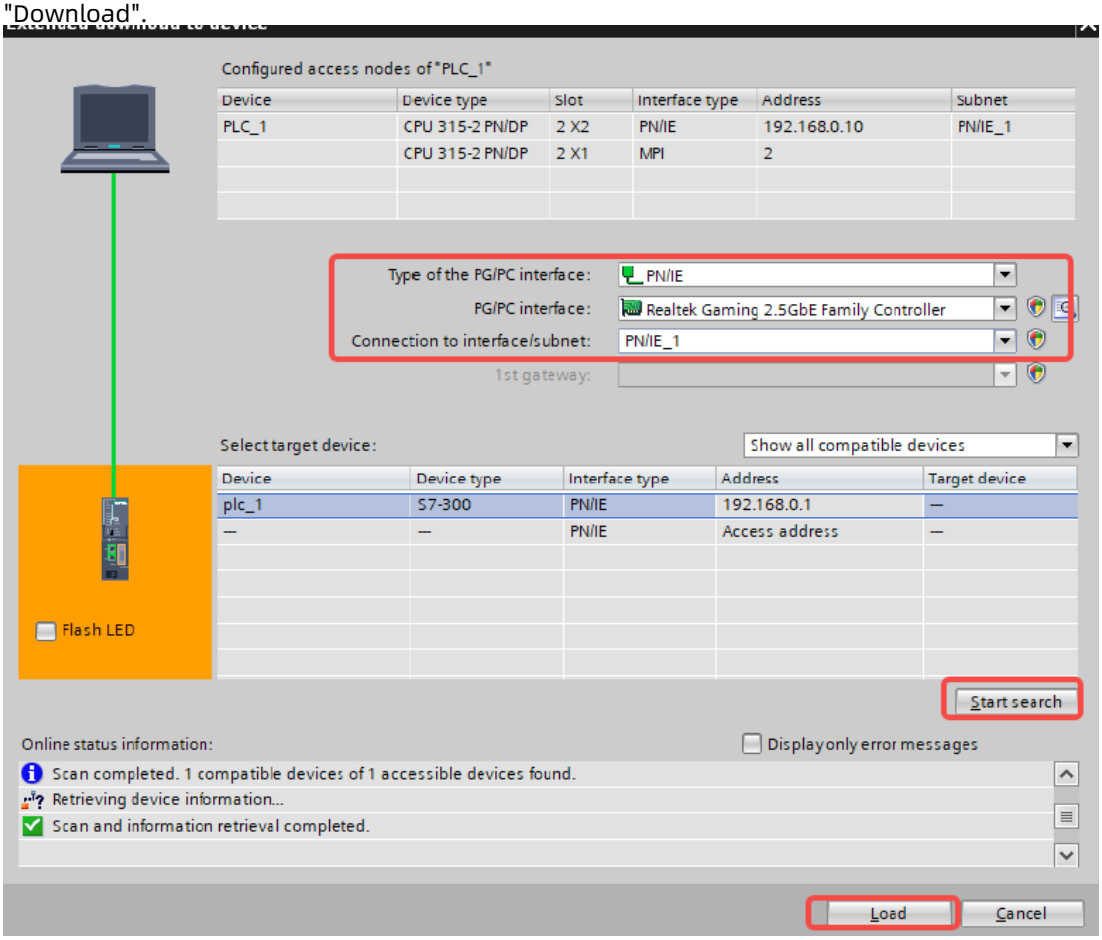


8. After the configuration is done, download the configuration to the PLC.

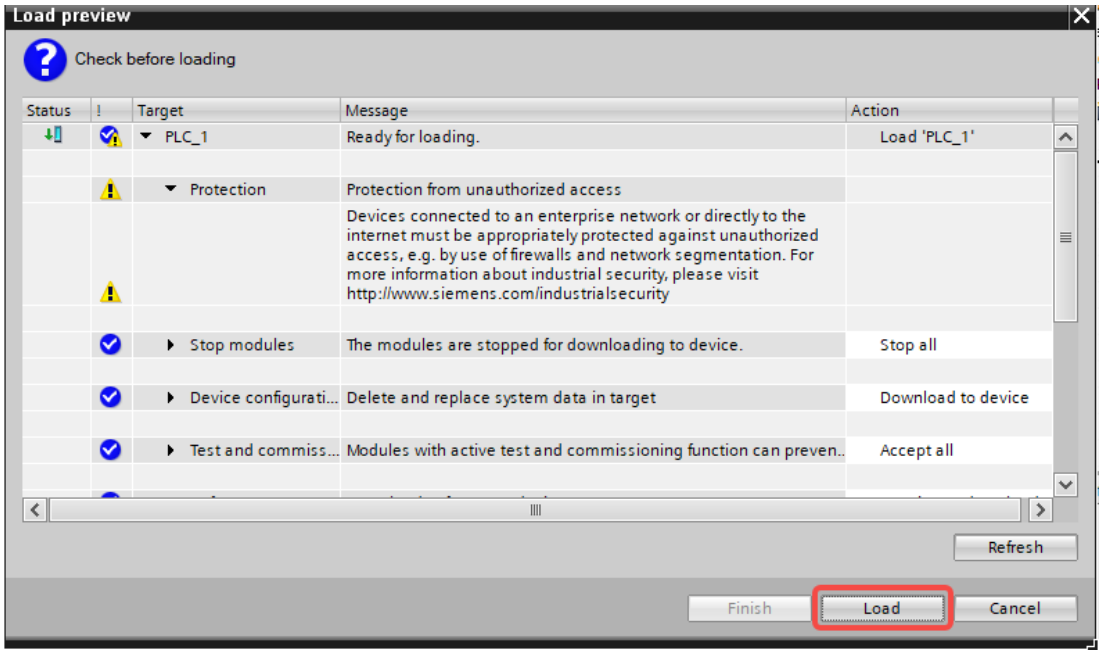
   a. Click the download icon, as shown in the following figure.



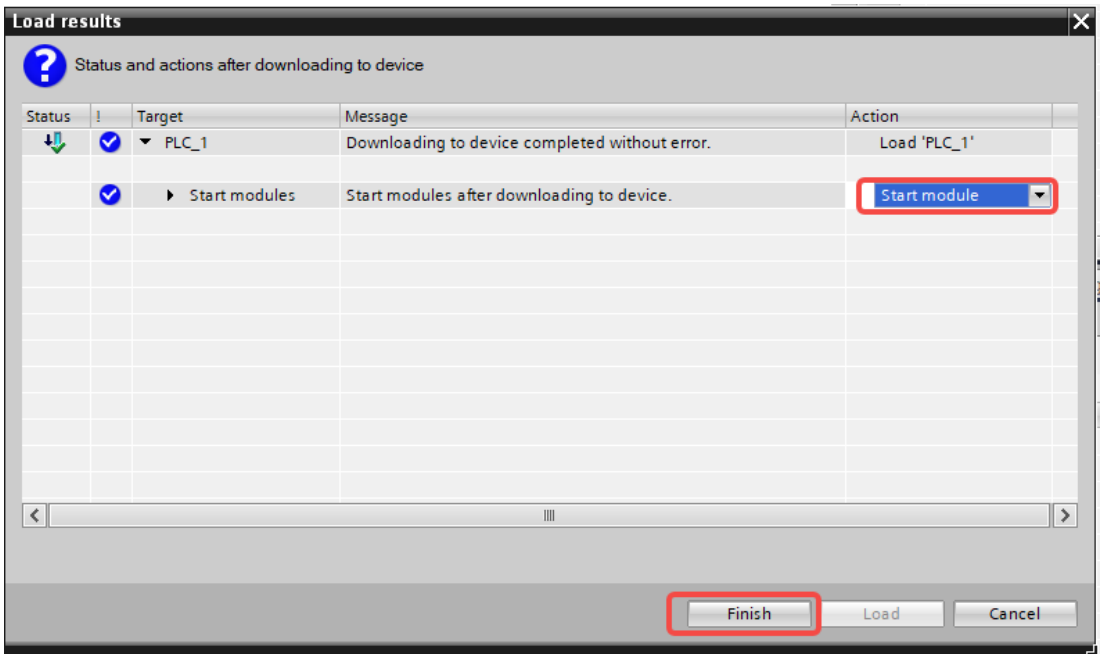
b. In the interface displayed, set the terminal parameters according to the terminals connected between the PC and the PLC. Click "Start searching", select the PLC to be downloaded, and click "Download".



On the "Download preview" page, click "Load".

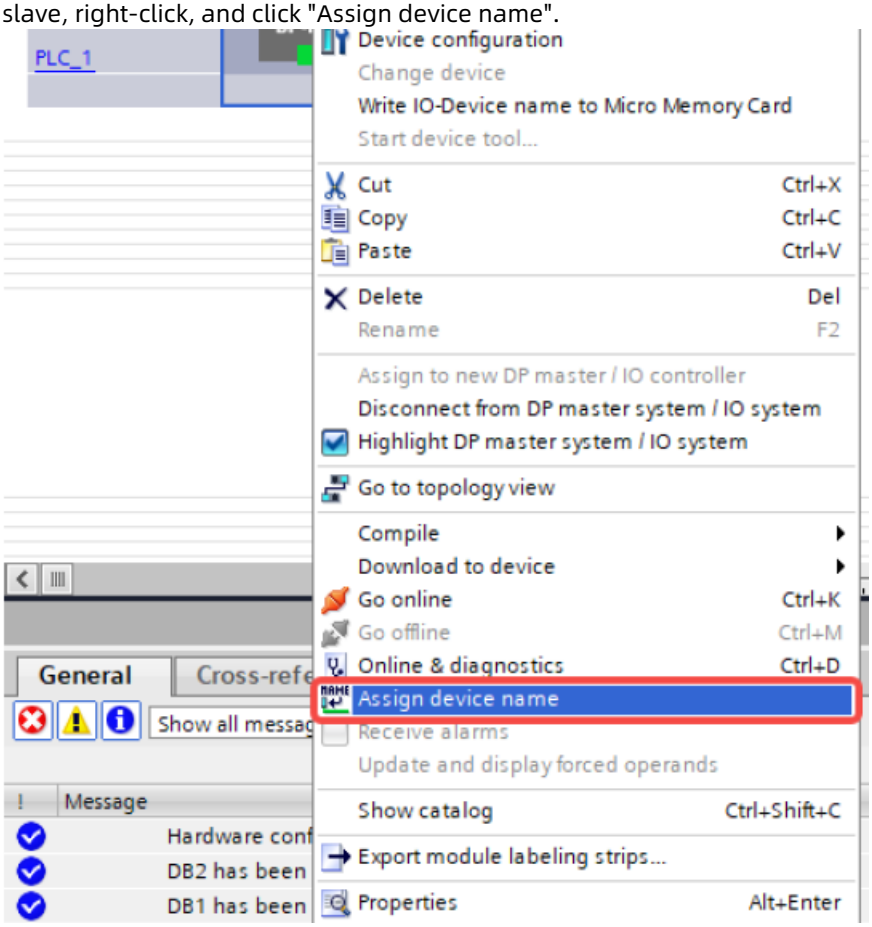


c. Select "Start module" and "Finish" on the interface that prompts download completion.

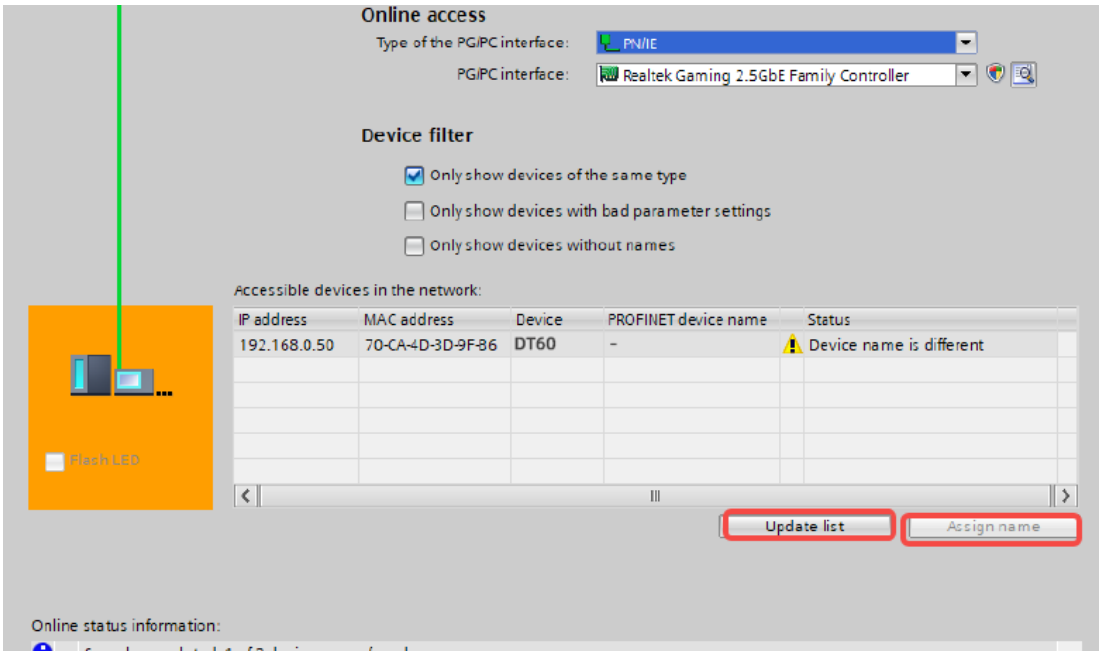


9. After the download is done, assign the device name to the slave.

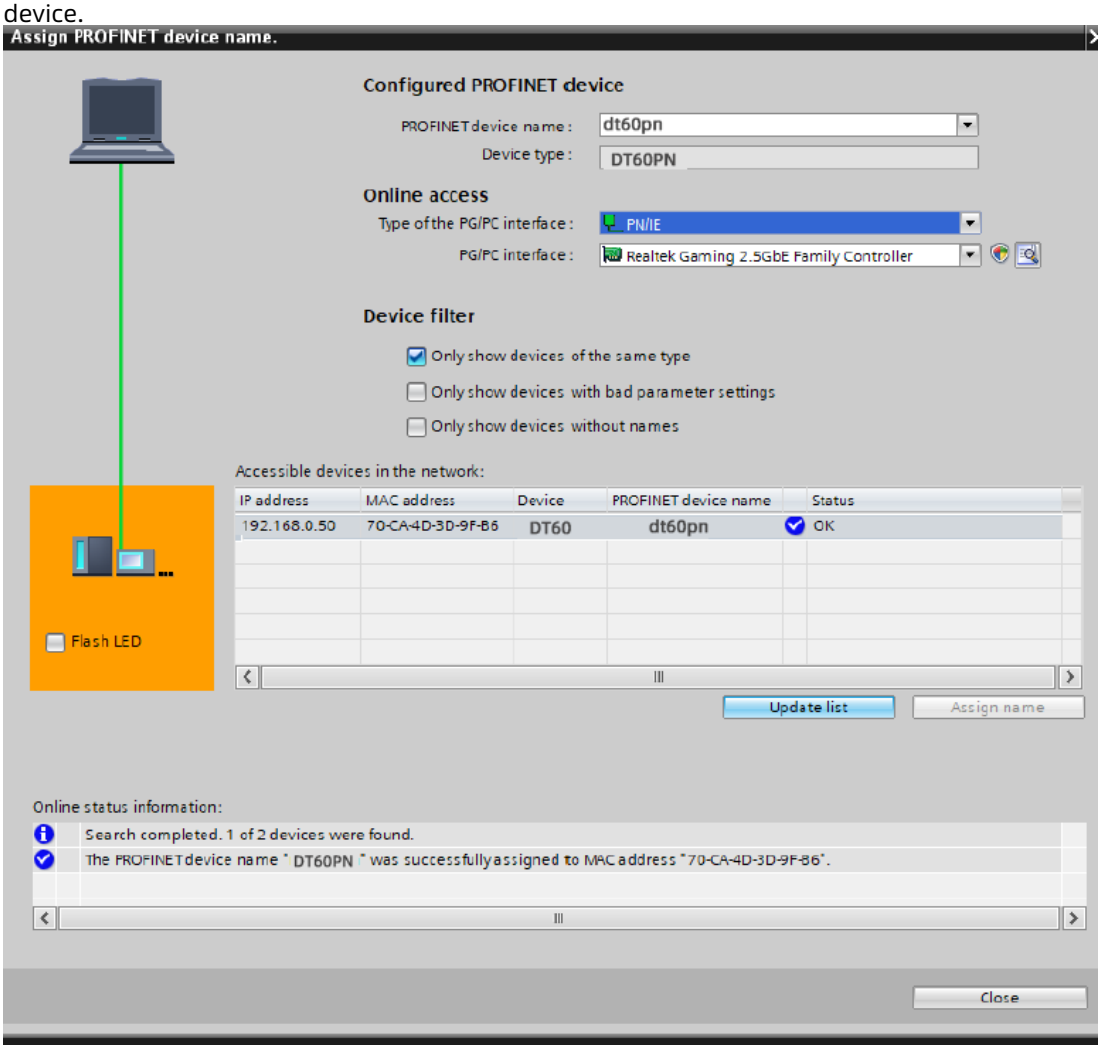
a. Select the slave, right-click, and click "Assign device name".



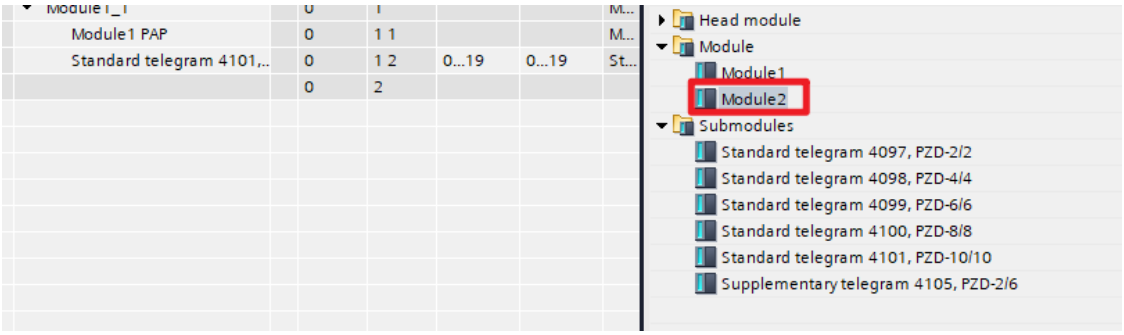
b. After selecting the correct PC interface, click "Update list" and select the device to be assigned from the scanned devices (distinguished by MAC address or by checking "flashing LED"). After being checked, the device panel of the corresponding MAC flashes. After determining the device to be assigned, click "Assign name".



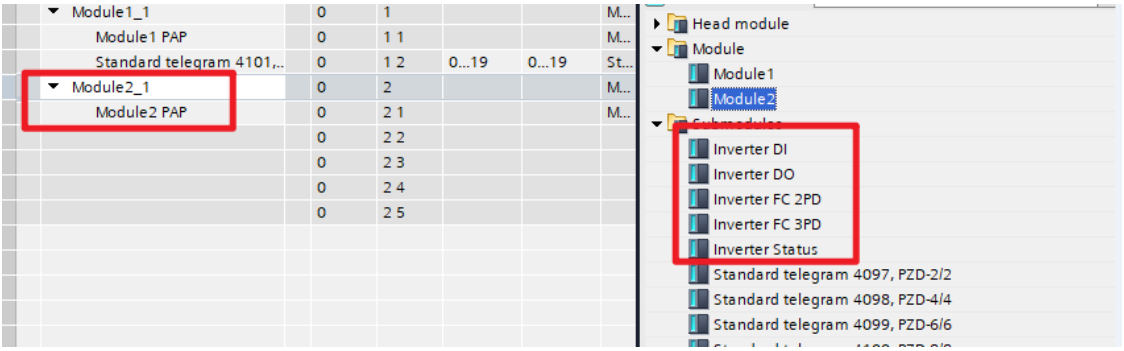
c. After the assignment is done, the word "OK" is displayed in the status bar of the corresponding device.



10. If using Module2 for configuration, double-click Module2 to display the selectable submodules.



Five selectable submodules will appear.



Module Inverter_DI

This module contains one TPDO: 0x7007 (see function description in *"8.4.3 Mapping Table (AC Drive Data)" on page 197*).

Module Inverter_DO

This module contains one RPDO: 0x7312 (see function description in *"8.4.2.3 Other Commonly-Used Special Addresses" on page 195*).

Module Inverter_FC_2PD

This module contains two RPDOs and two TPDOs.

RPDO: 0x7319, 0x731A (See function description in *"8.4.2.1 Special Communication Control Word" on page 193*.)

TPDO: 0x705C, 0x705D (See function description in *"8.4.2.2 Special Communication Status Word" on page 194*.)

Module Inverter_FC_3PD

This module contains three RPDOs and three TPDOs.

RPDO: 0x7319, 0x731A, 0x731B (See function description in *"8.4.2.1 Special Communication Control Word" on page 193*.)

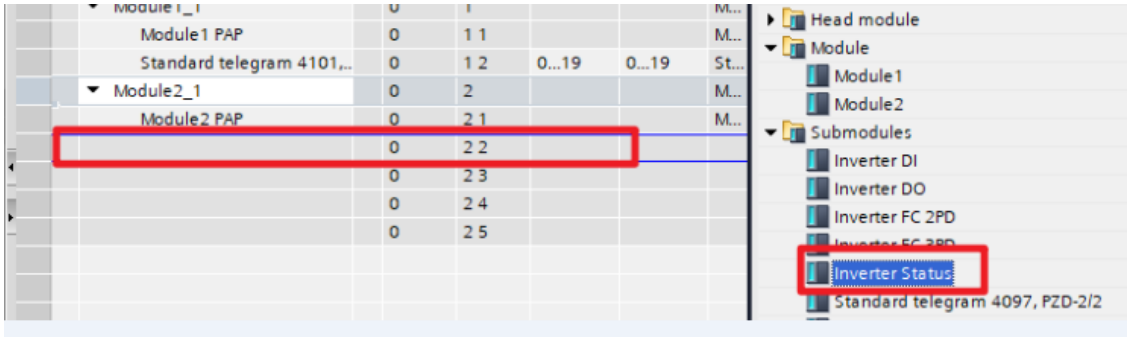
TPDO: 0x705C, 0x705D, 0x705E (See function description in *"8.4.2.2 Special Communication Status Word" on page 194*.)

Module Inverter_Status

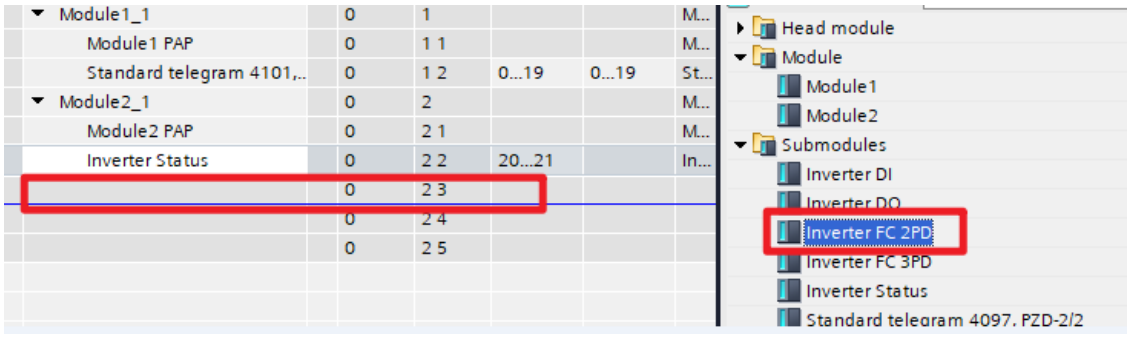
This module contains one TPDO: 0x705B (see function description in *"8.4.2.2 Special Communication Status Word" on page 194*).

Among these five submodules, submodules Inverter FC 2PD and Inverter FC 3PD cannot be loaded simultaneously. Only one of them can be loaded. Additionally, these five submodules are assigned with fixed slots.

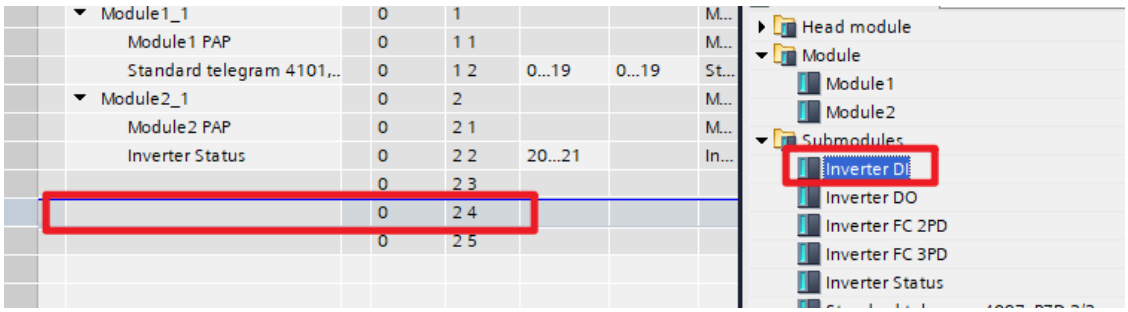
The submodule Inverter Status can only be installed to subslot 2:



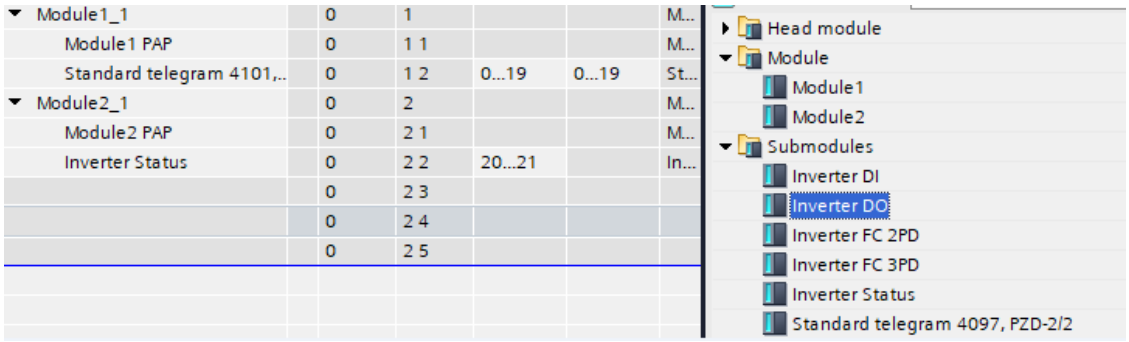
Inverter FC 2PD/Inverter The submodule FC 3PD can only be installed to subslot 3:



The submodule Inverter DI can only be installed to subslot 4:



The submodule Inverter DO can only be installed to subslot 5:



After all submodules needed are installed, no mapping configuration is needed. The bit meanings for each submodule are fixed, as described above.

Therefore, you can perform networking configuration by following the preceding steps. The DT60 Module2 (PQW20 to PQW27 in this example) can be controlled by modifying the values in the Q

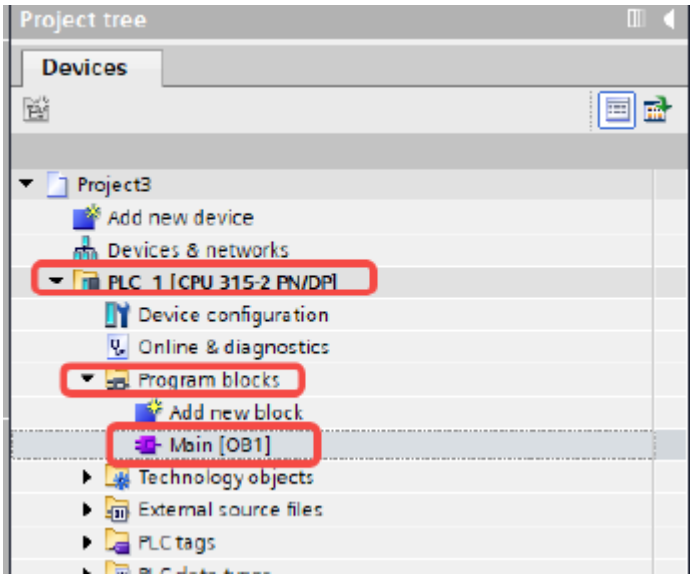
address, while the status and parameter values of the DT60 Module2 (PIW20 to PIW28 in this example) can be obtained by reading the values in address I.

In this case, you can control DT60 by modifying the value in the Q address (PQW0 to PQW19 in this example, which correspond to output PZD1 to 10), or read the value in address I to obtain the status and parameter values of the DT60 (PIW0 to PIW19 in this example, which correspond to input PZD1 to 10).

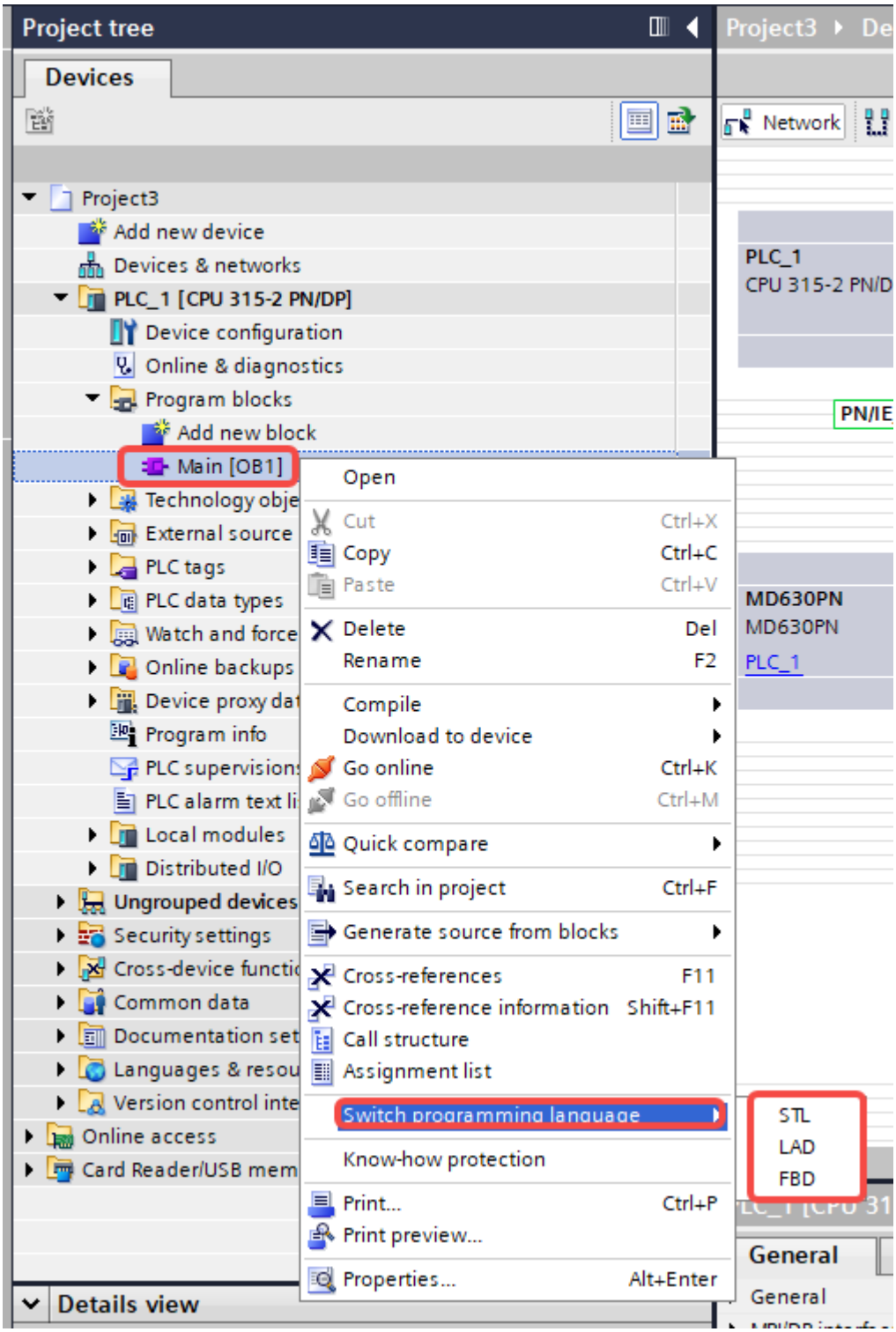
DT60PN	0	0			D...
Interface	0	0 X1			D...
Module1_1	0	1			M...
Module1 PAP	0	1 1			M...
Standard telegram 4101,..	0	1 2	0...19	0...19	St...
Module2_1	0	2			M...
Module2 PAP	0	2 1			M...
Inverter Status	0	2 2	20...21		In...
Inverter FC 3PD	0	2 3	22...27	22...27	In...
Inverter DI	0	2 4	28...29		In...
Inverter DO	0	2 5		20...21	In...

Step 4: Control the drive through communication.

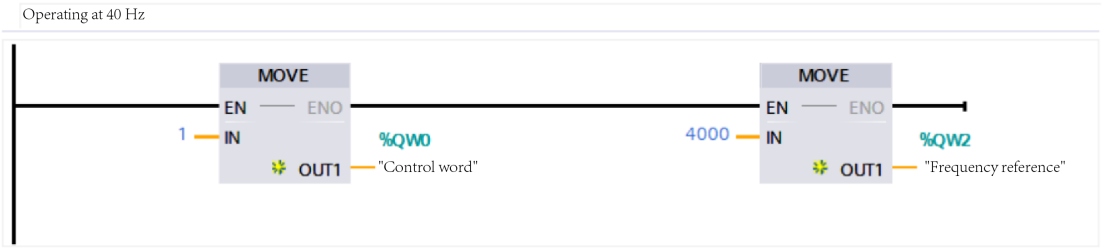
In the "Project tree" on the left, expand "PLC_1[CPU 1511T-1 PN]" and double-click "Main[OB1]" under "Program block" to open the PLC main function.



Select the program block and right-click to select the programming language through "Switch programming language". The LAD (ladder diagram) is used by default.



The value transmission is generally done through MOVE instruction or SFC14 and SFC15. Take MOVE instruction as an example. If SFC is used, you can select the SFC block and press F1 to shown the help information for the SFC function block.

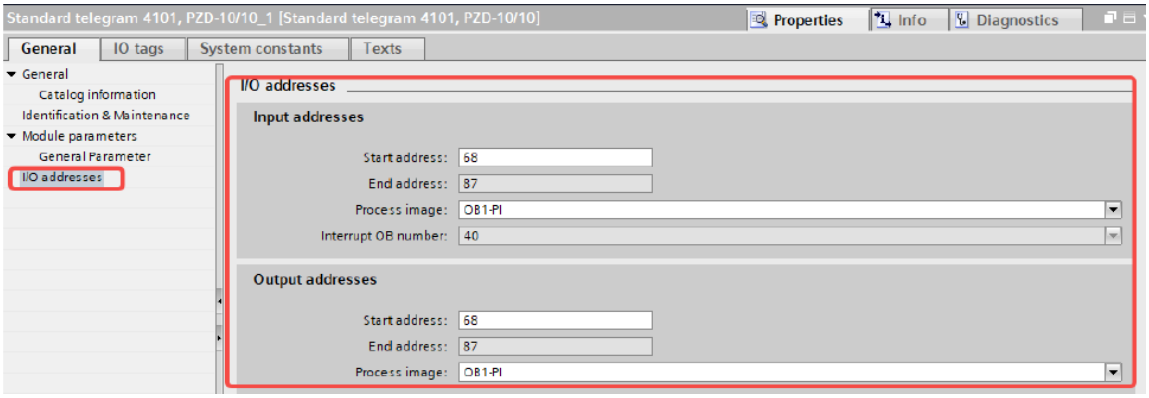


When "%M0.0 output switch value changed to 1 (closed)", the value 1 (Forward run command) is written to PZD1 (corresponding to PQW0, mapping relation 29457, hexadecimal 7311H), and the value 4000 (frequency, two decimal places) is written to PZD2 (corresponding to PQW2, mapping relation 29456, and hexadecimal 7310H) simultaneously.

Note:

- To control the drive through communication, you need to set the command source and frequency source as the communication source according to section *"8.6.6 Connecting the Drive To Bus System" on page 241*.
- PZD1 and PZD2 are already configured by default. You can also change the configuration and download it to the PLC.
- By default, the S7-300 PLC cannot perform write operations on addresses similar to QW0 through commands directly or perform read operations on the address of IW0.

PQW and PIW are external addresses. If you want to access them directly, you need to change them to process mirror addresses.



8.6.10.2 Communication Configuration Example for STEP7

The following shows how to control the drive through S7-315 with STEP7.

Prerequisites

Connect the drive to the bus system, as shown by *"8.6.6 Connecting the Drive To Bus System" on page 241*.

Procedure

Step 1: Start or stop the drive through remote communication.

1. Set F0-03 [Main command source of control channel 1] to 2 [Communication] to set communication as the command source.

Step 2: Set the frequency or torque through communication.

Set the frequency as follows:

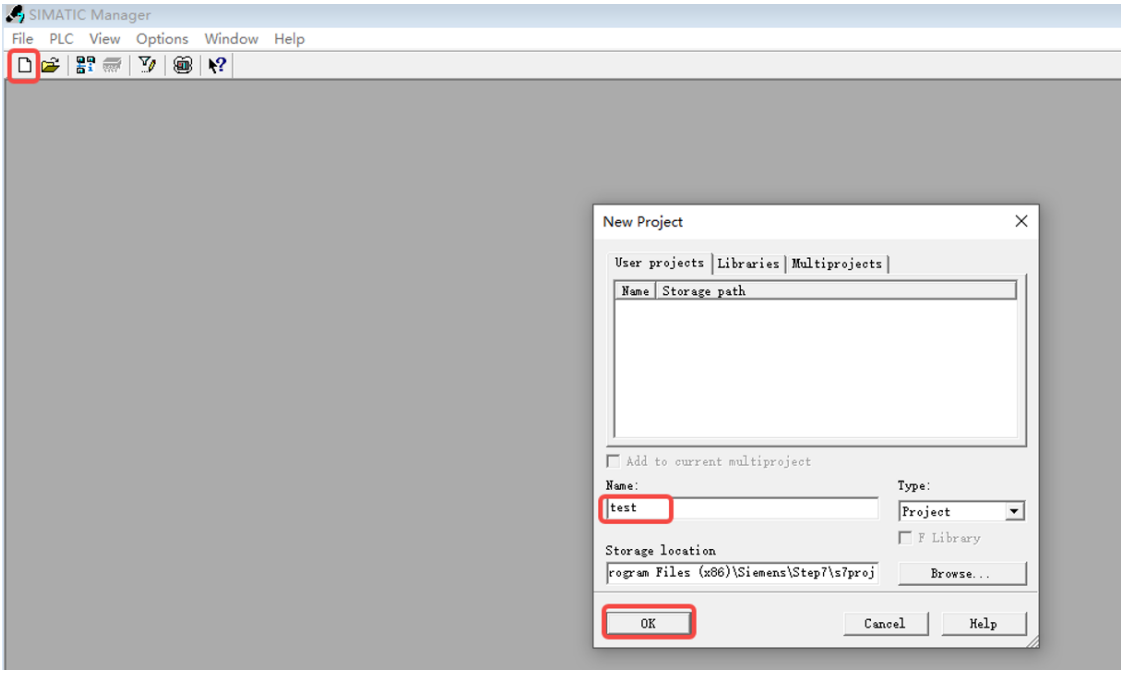
1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 [7310H Speed reference selection], and choose one of the following values as needed. 0: Frequency (unsigned 16-bit); 1: Frequency (signed 16-bit); 3: Percentage (corresponding to rated frequency/signed 16-bit/2 decimal places); 4: Percentage (corresponding to maximum frequency/signed 16-bit/2 decimal places)

Set the torque as follows:

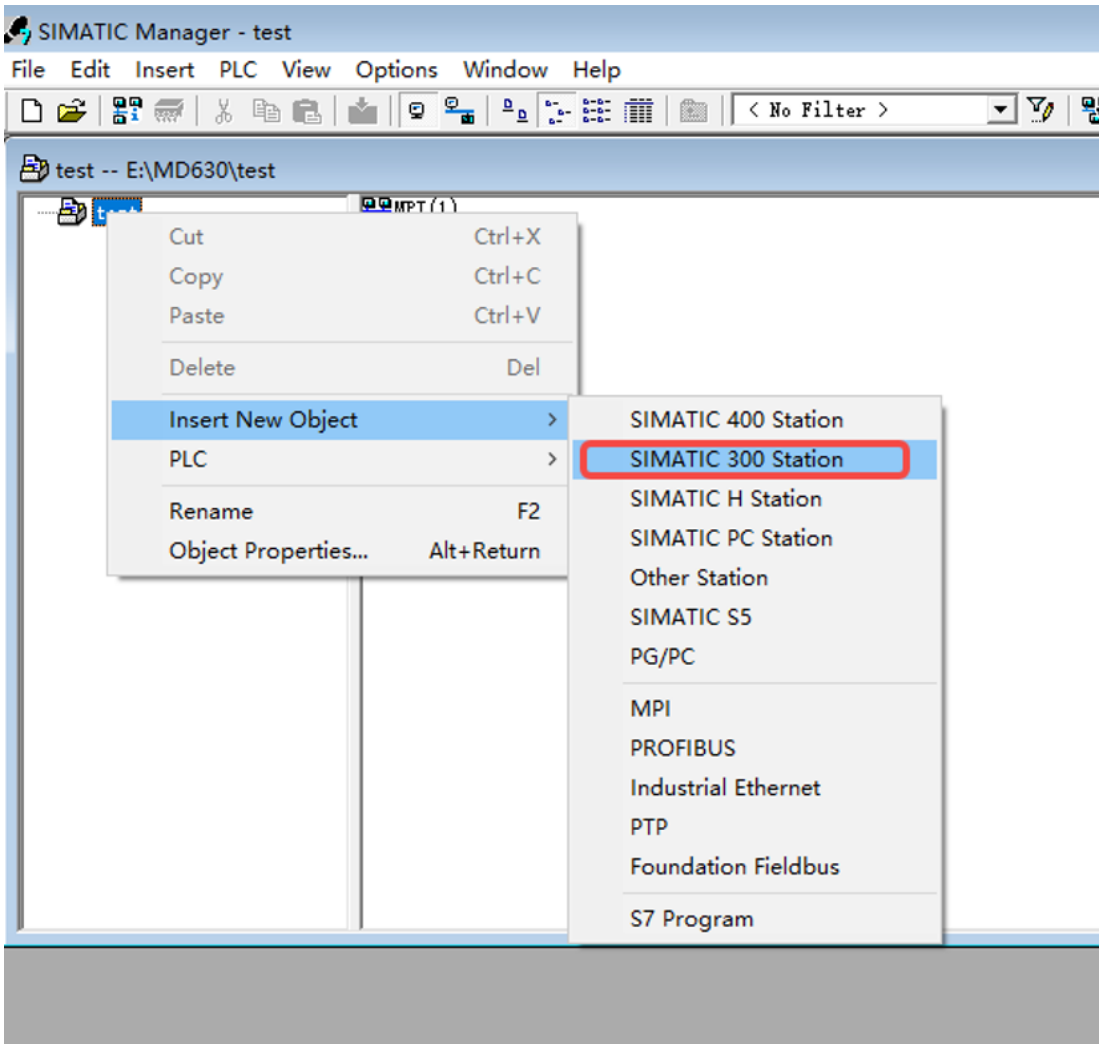
1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. It is recommended to set n0-14 [7310H Speed reference selection] to 2 [Speed (signed 16-bit)].

Step 3: Establish PROFINET communication.

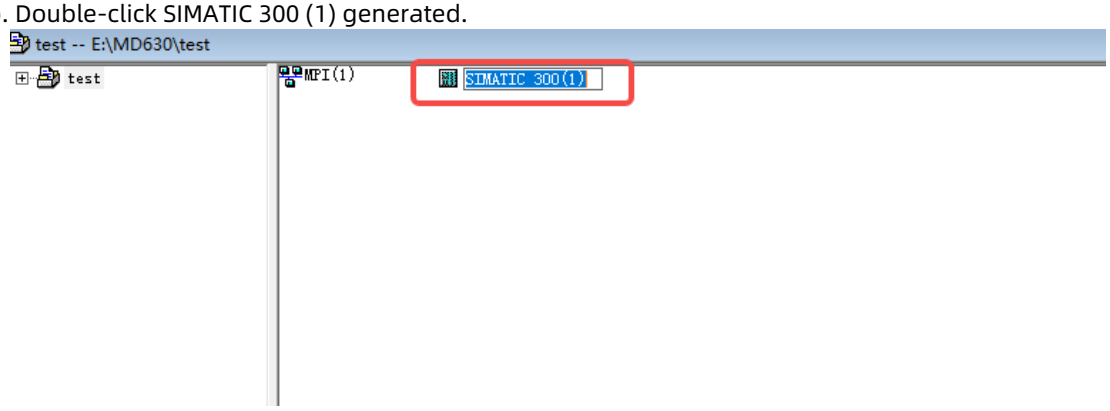
1. Set n0-10 to 3 (through the operating panel or software tool). Switch the device communication mode to PROFINET.
2. Wait for a few seconds until LED0 flashes green and LED1 turns yellow (steady). This indicates that the connection between slave and master is established successfully, and data exchange is available.
3. Create a project.
   Open STEP7 software, create a project, enter the project name, and click "OK".



a. Right-click "Insert new object" and select "SIMATIC 300 site" (S7-315 belongs to this category).



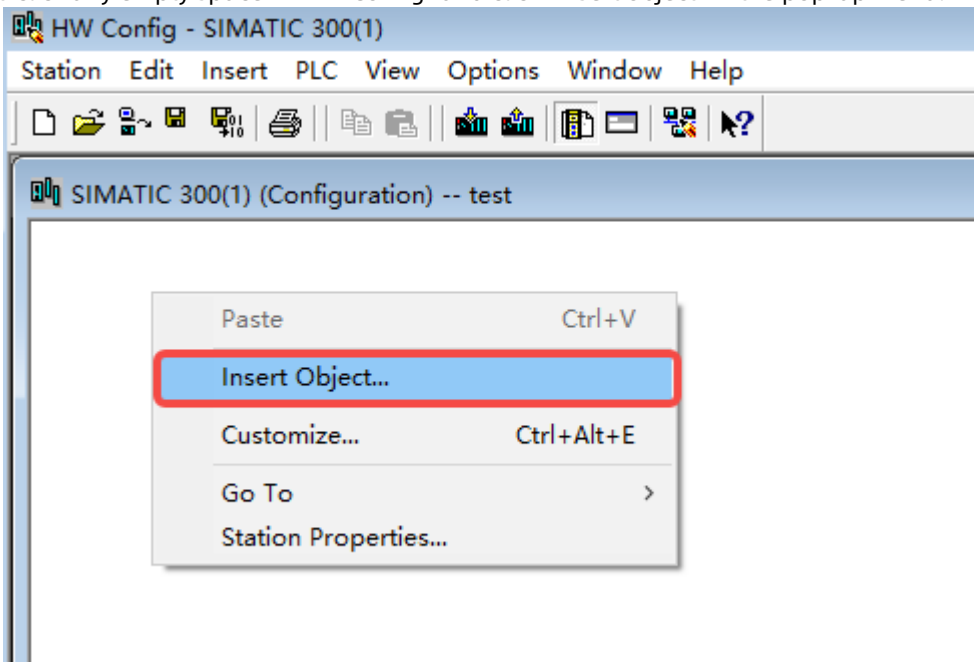
b. Double-click SIMATIC 300 (1) generated.



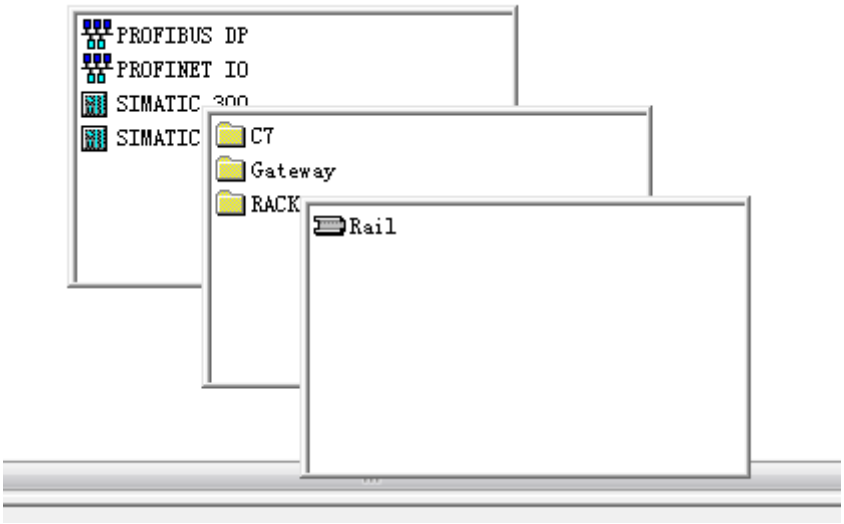
c. Double-click "Hardware" in the expanded interface to enter the hardware configuration interface.



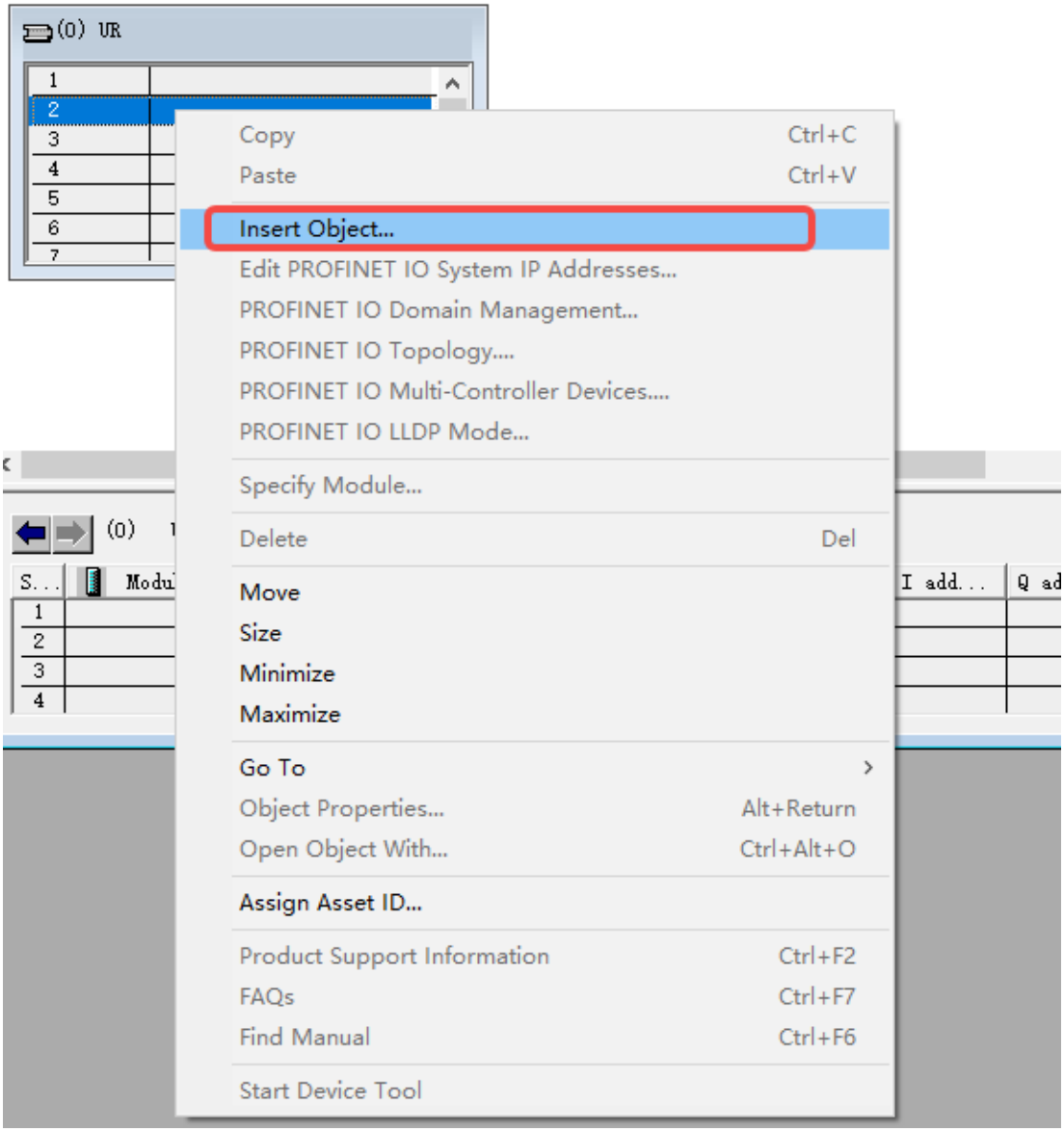
d. Right-click any empty space in "HW Config" and click "Insert object" in the pop-up menu.



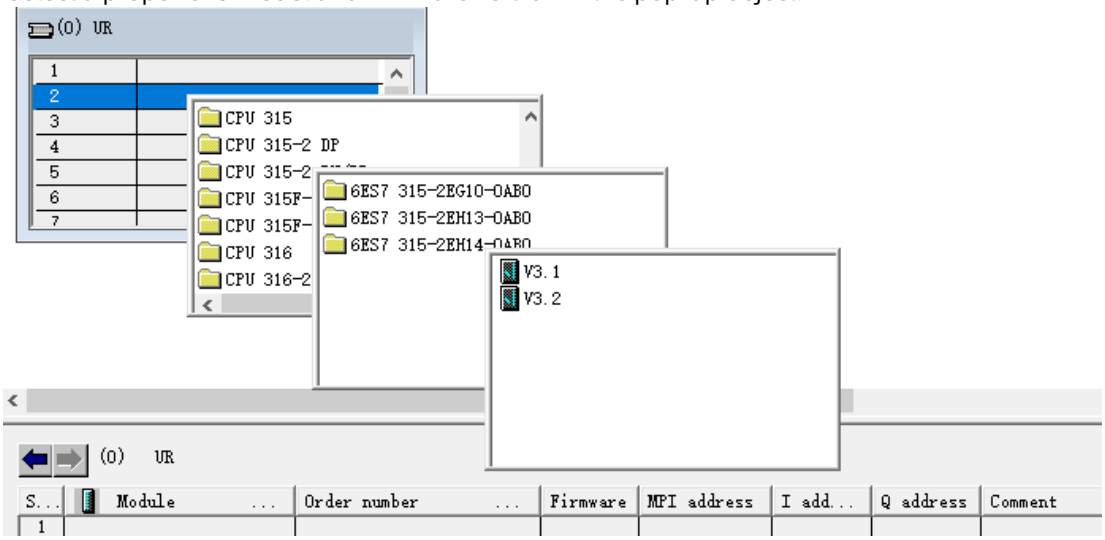
e. Click "SIMATIC 300", "RACK", and "Rail" in sequence.



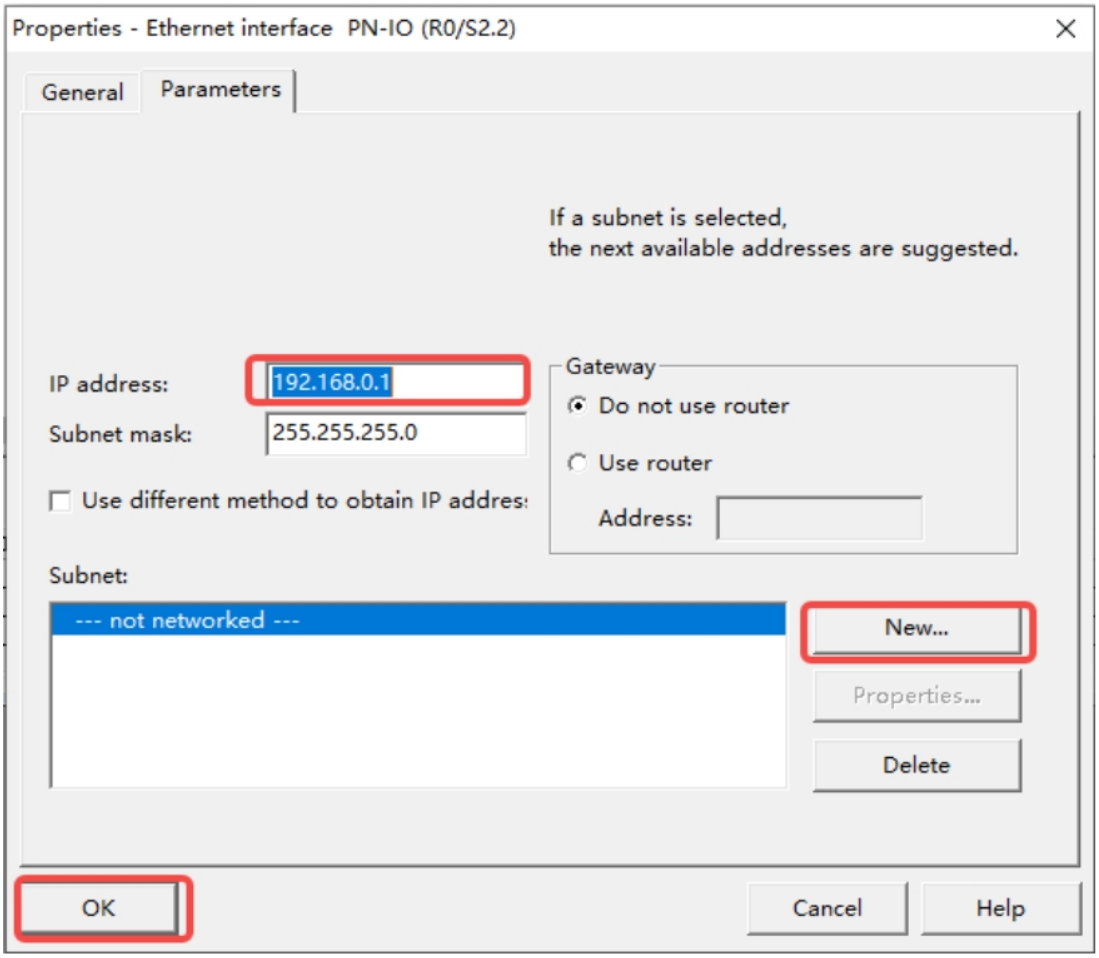
f. In this way UR is established. Then right-click on slot 2 (slot 1 can only be the power supply) and click "Insert object" in the right-click menu.



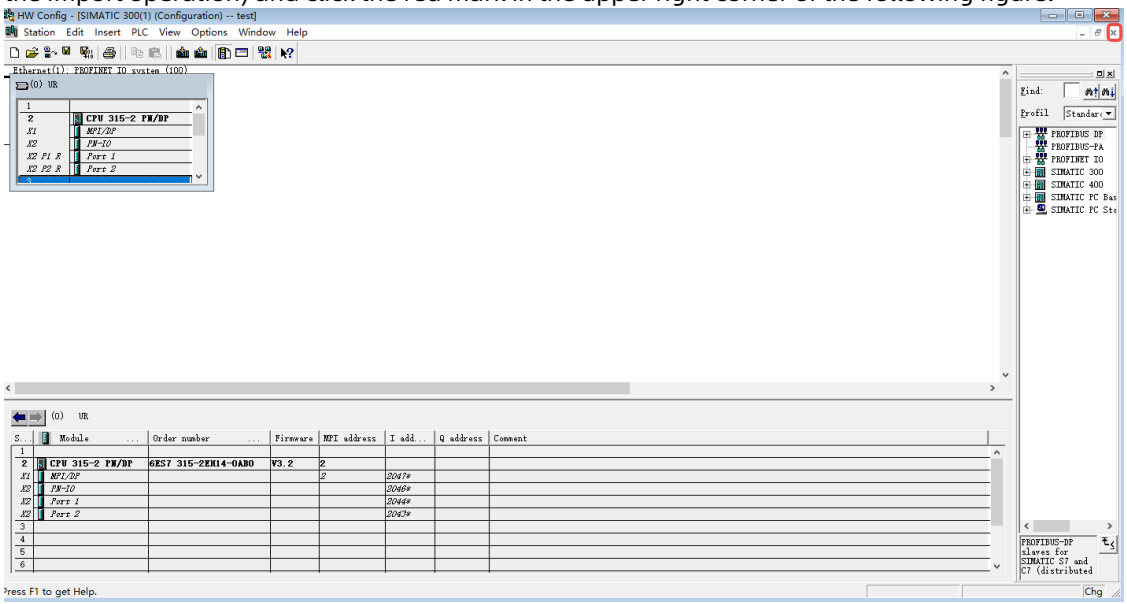
g. Select a proper CPU model and firmware version in the pop-up object.



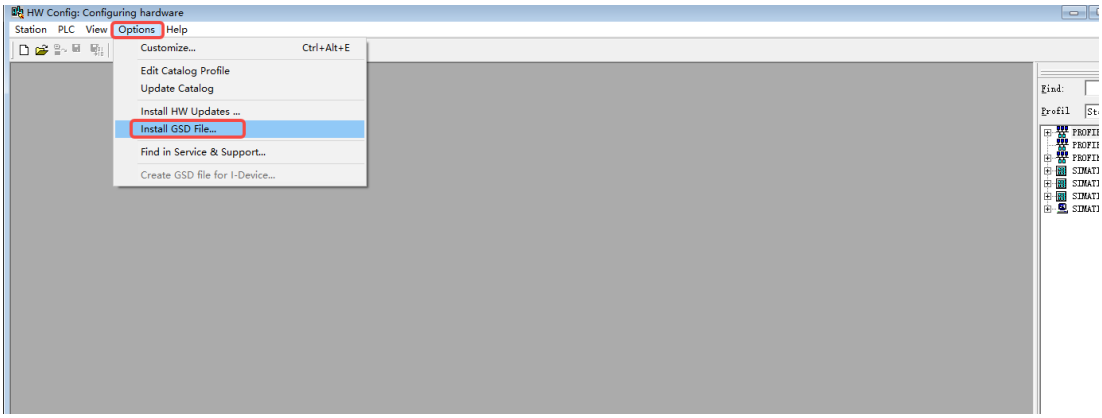
h. After you set the IP address, click "Create". After the EtherNet network is established, click "OK".



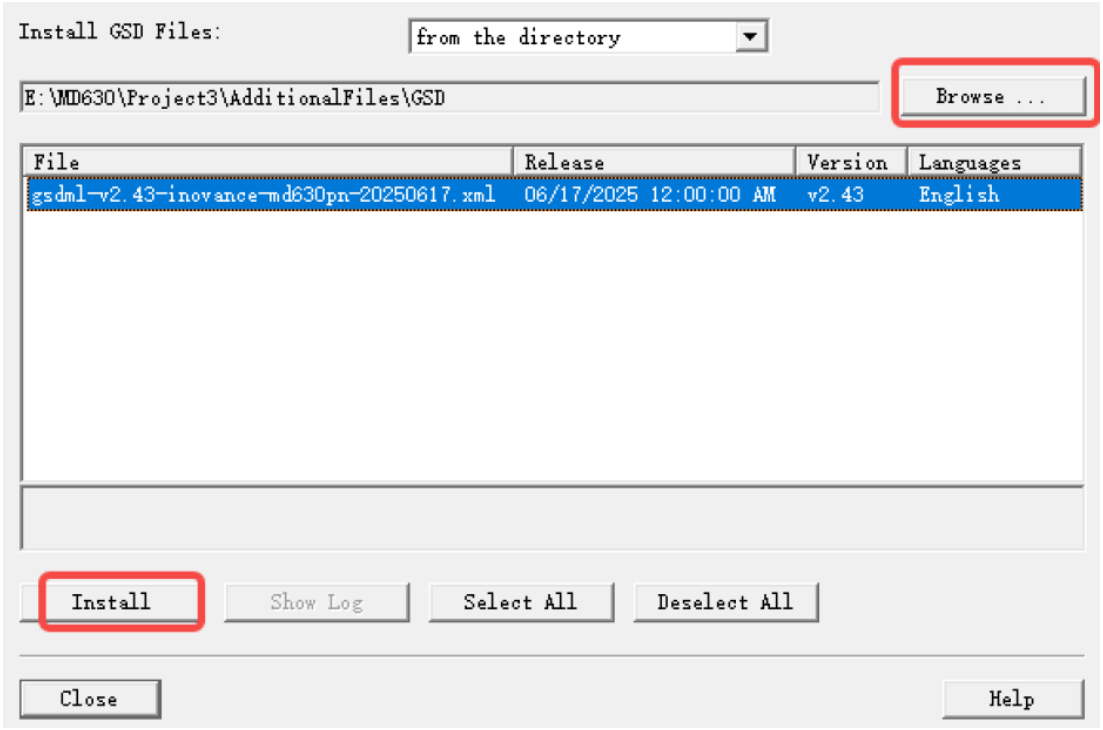
4. After the PLC master is configured, you need to import the XML file of the DT60 (you can skip this step if it is already imported). Close the current configuration file (otherwise, you cannot perform the import operation) and click the red mark in the upper right corner of the following figure.



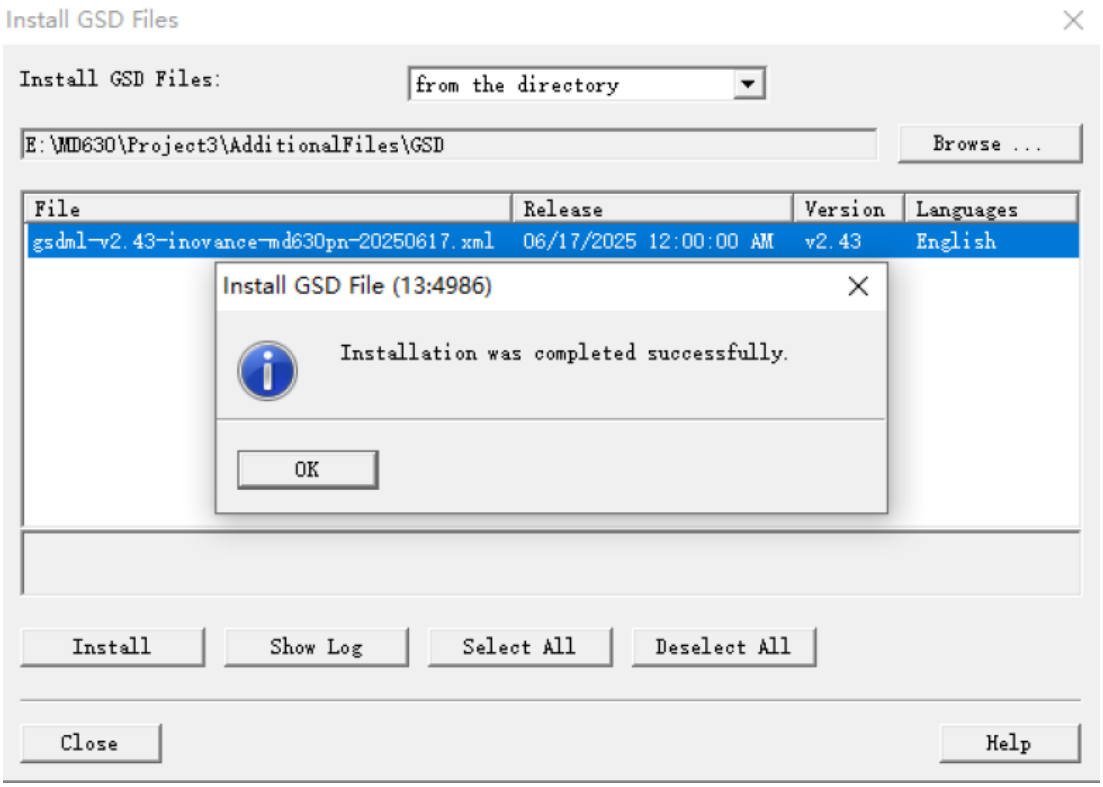
a. Select "Option" in the menu bar, and then click "Install GSD file".



b. Set the current GSD storage path, select the XML file to be imported, and click "Install".



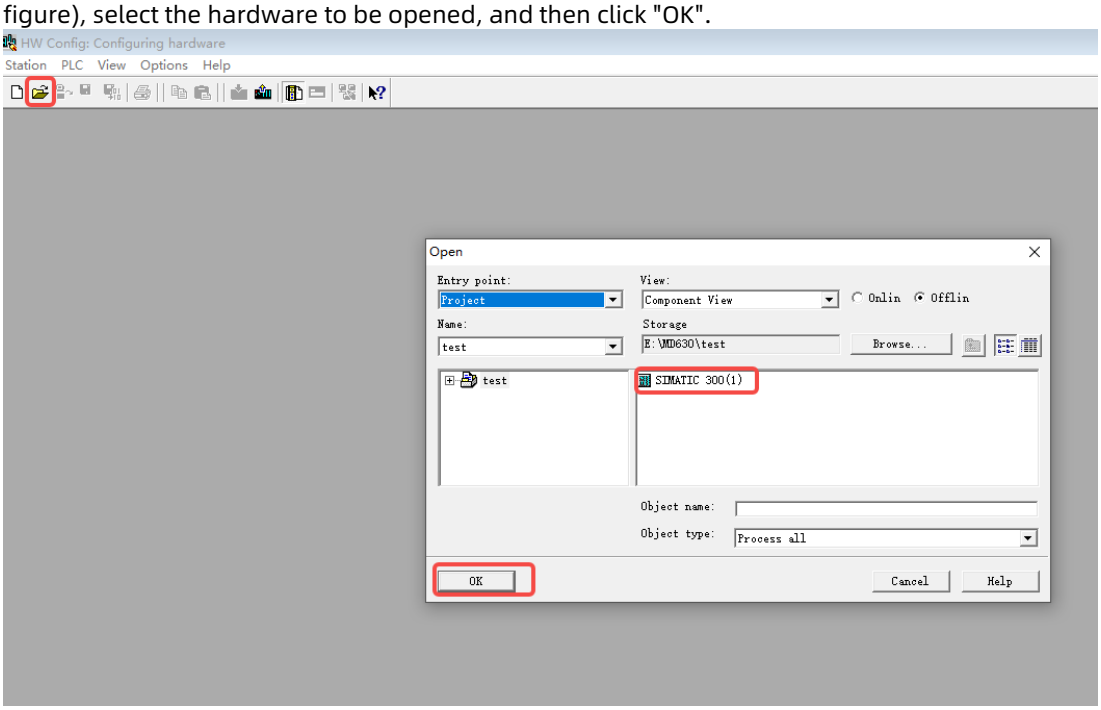
c. When the message indicating that Installation is done successfully is displayed, click "OK", and then click "Close".



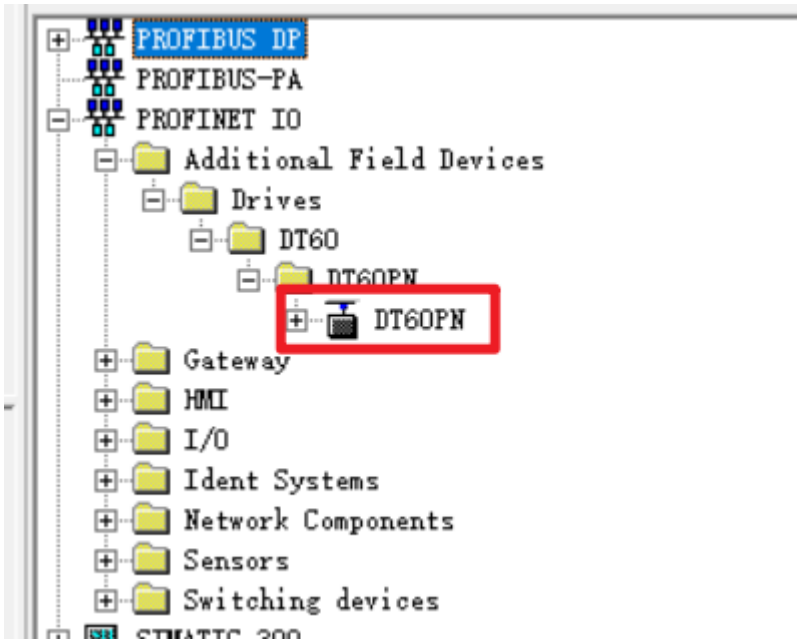
Caution

The XML file of this series of drives is version 2.42. When installing earlier versions of STEP7, an alarm may be reported, indicating that some functions are not available. This alarm can be ignored.

d. After the XML file is installed, click "Open" (marked in the upper left corner of the following figure), select the hardware to be opened, and then click "OK".



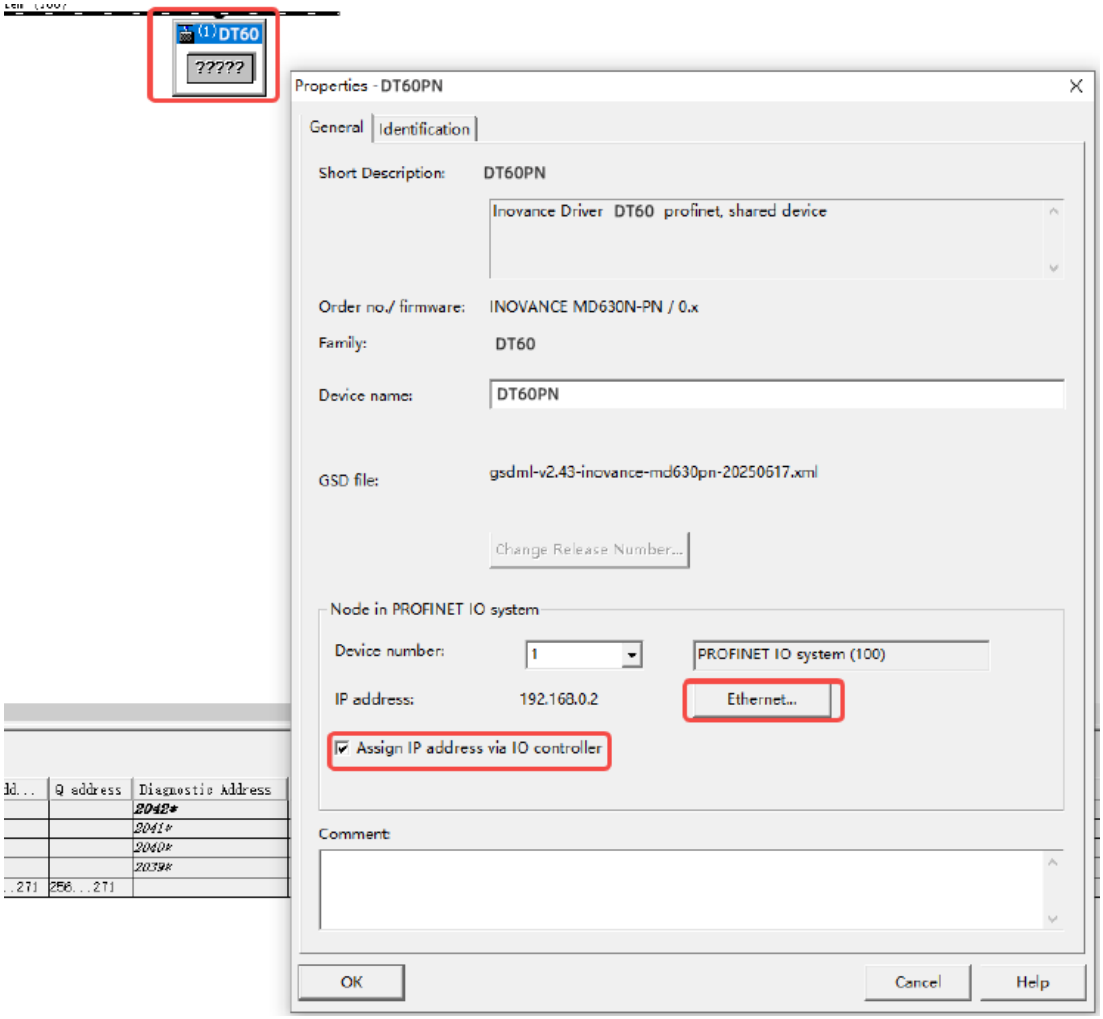
5. After installing XML, you can configure the slave. In the hardware directory, expand "PROFINET IO", "Additional Field Devices", "Drivers", and "DT60" in sequence to locate the PN device corresponding to DT60, then click the mouse and drag it under the left-side "PROFINET-IO-System".



a. Select the slave, then choose a message module in the right-side hardware directory and double-click to add it to the slave.

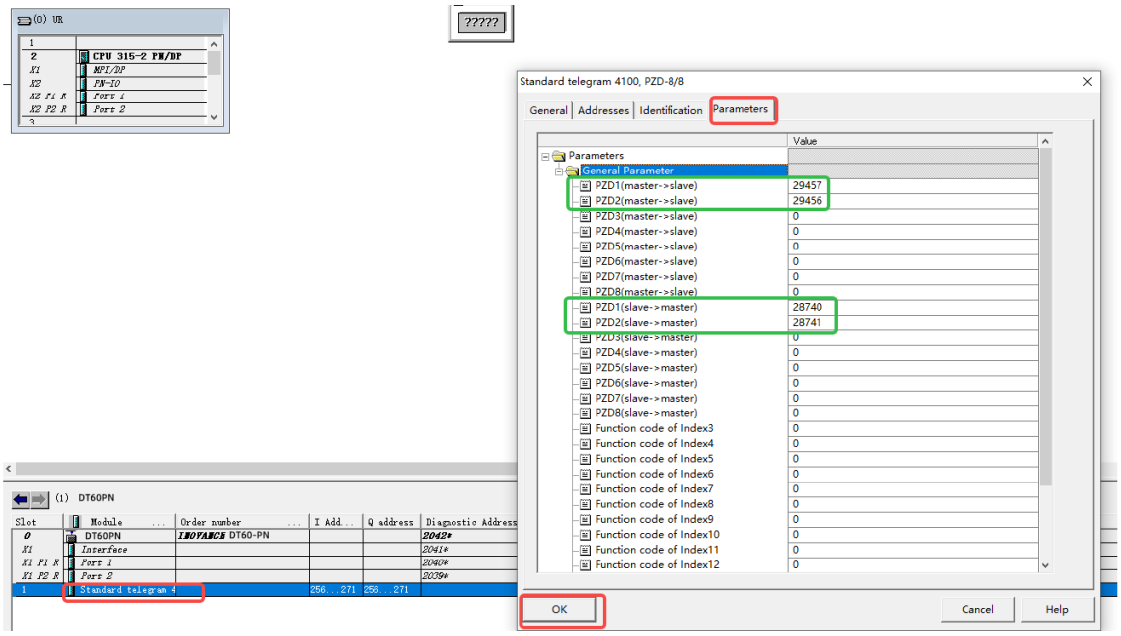


b. Double-click the slave, and in the pop-up screen, select "Assign IP address through the IO controller". Then the slave is automatically assigned with an IP address. If this IP is not suitable, click "EtherNet" on the right side of the IP address to modify it.



6. After adding the module, you can configure the module and set the parameter corresponding to each PZD. To do this, double-click the message module and select "Parameters" in the dialog box that appears.
   As shown in the following figure, PZDx (master->slave) indicates the PZD (out-data) written by the master to the slave, and PZDx (slave->master) indicates the PZD (in-data) returned by the slave to the master. The initial values of PZD1 and PZD2 in the green marked part of the figure are preset. PZD3 written in the master is configured to 61488 (0xF030, ramp 1 acceleration time) and PZD4 written in the master is configured to 61489 (0xF031, ramp 1 deceleration time). PZD3 read by the master is configured to 28674 (0x7002, bus voltage), PZD4 read by the master is configured to 28675 (0x7003, output voltage).

   Click "OK" to complete the configuration.

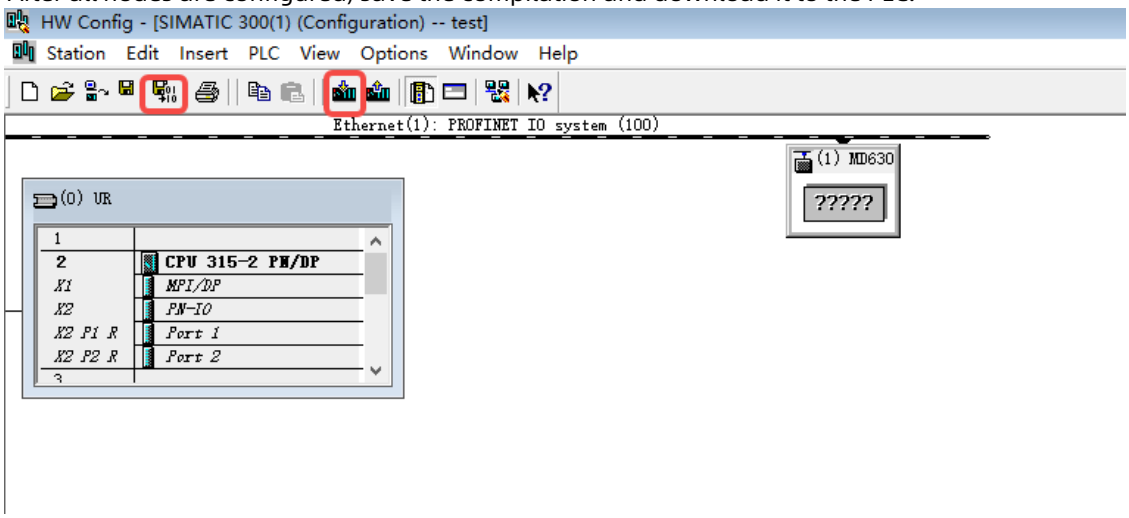


For details on each of the submodules of module2, see *"8.6.10.1 Example for Communicating with TIA Portal" on page 244*.

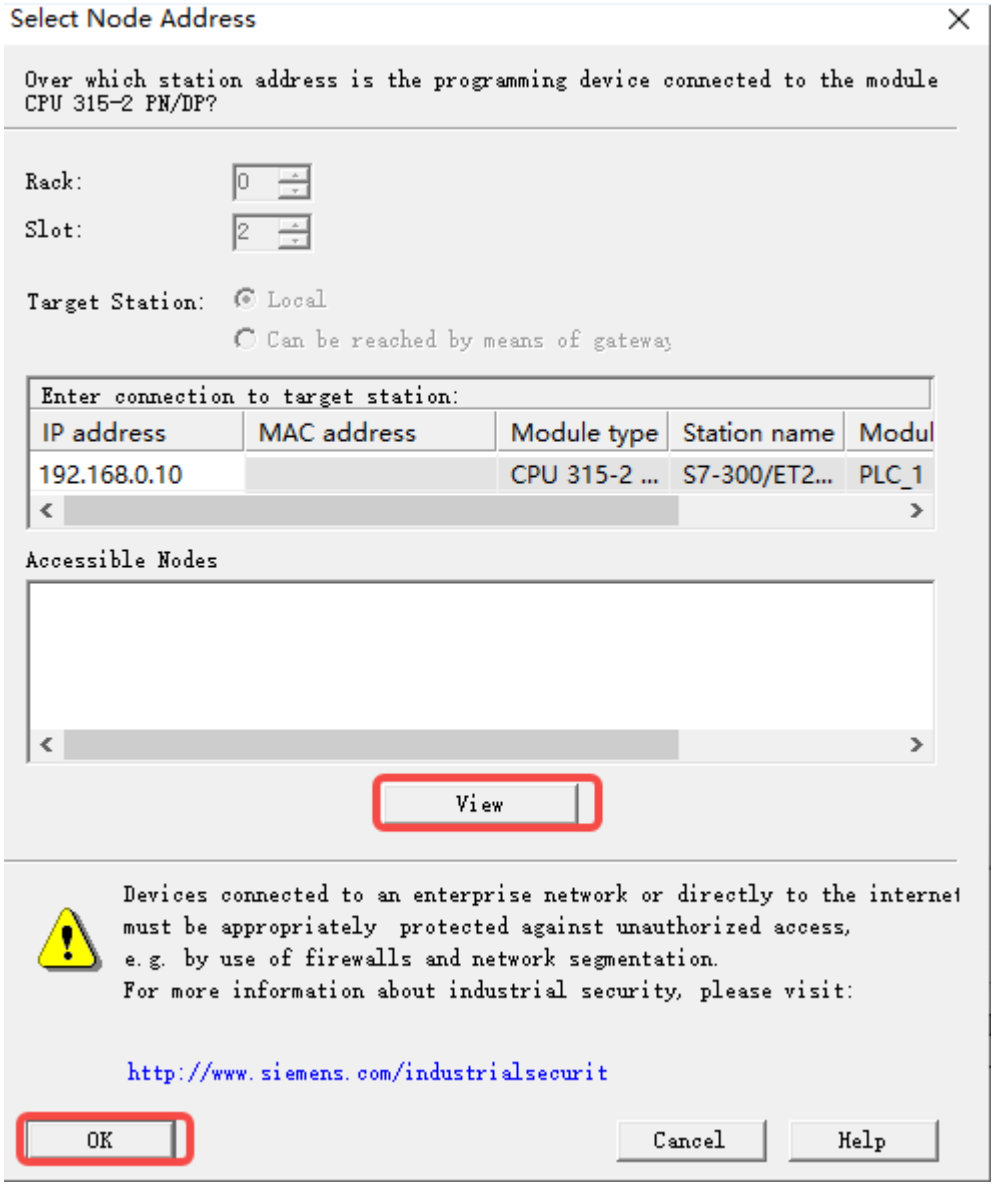
Caution

PZD configuration needs to be continuous, that is, PZD1-4 and PZD6 are not allowed, and PZD5 keeps the original value 0. This will prevent the mapping of PZD6 from taking effect.

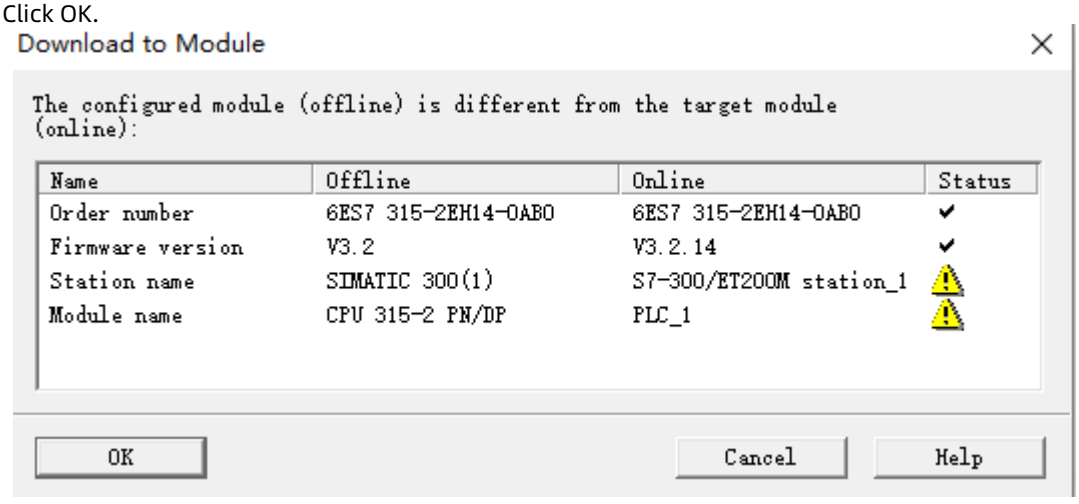
7. After all nodes are configured, save the compilation and download it to the PLC.



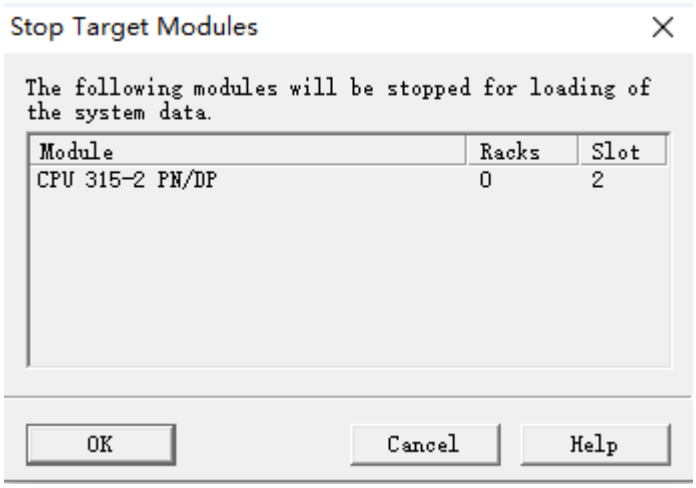
a. Click "Display" to refresh the master found in STEP7. Click "OK".



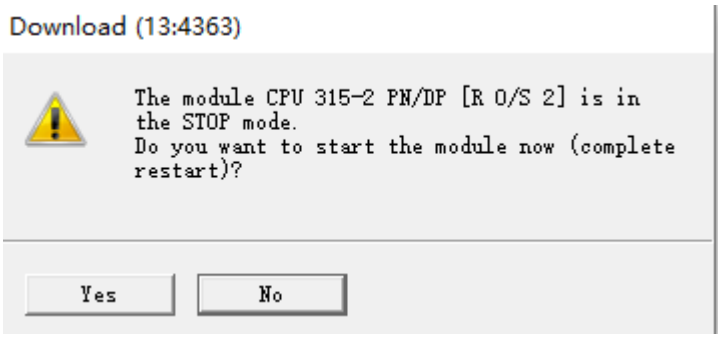
b. Click OK.



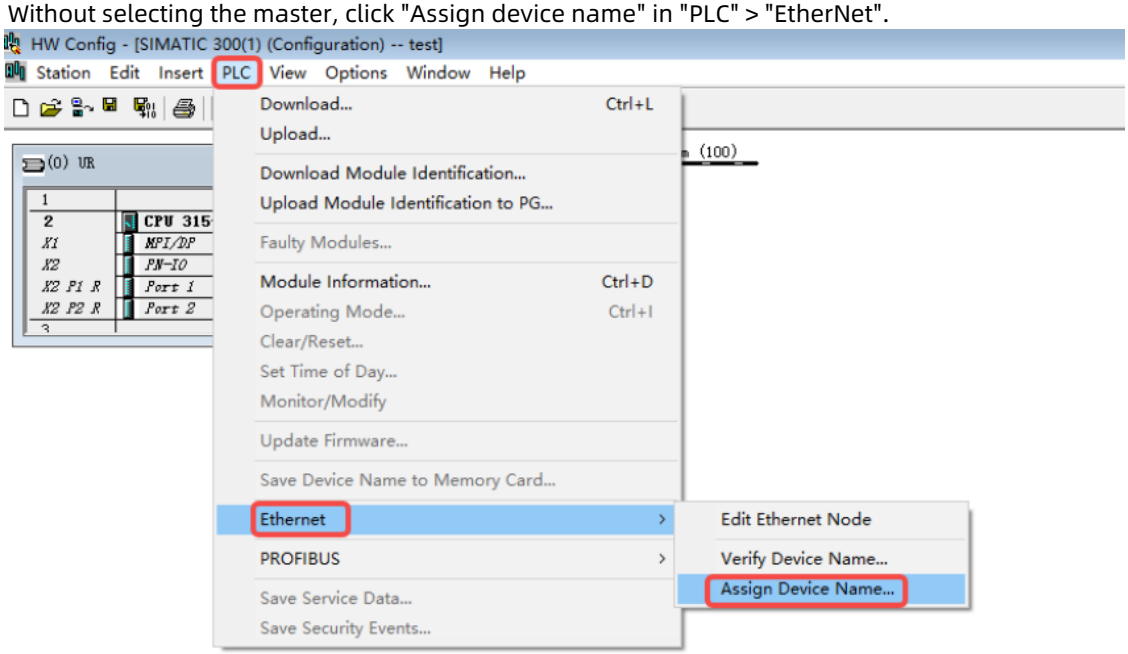
c. During download , click "OK" in the prompt that asks you whether to stop the target module.



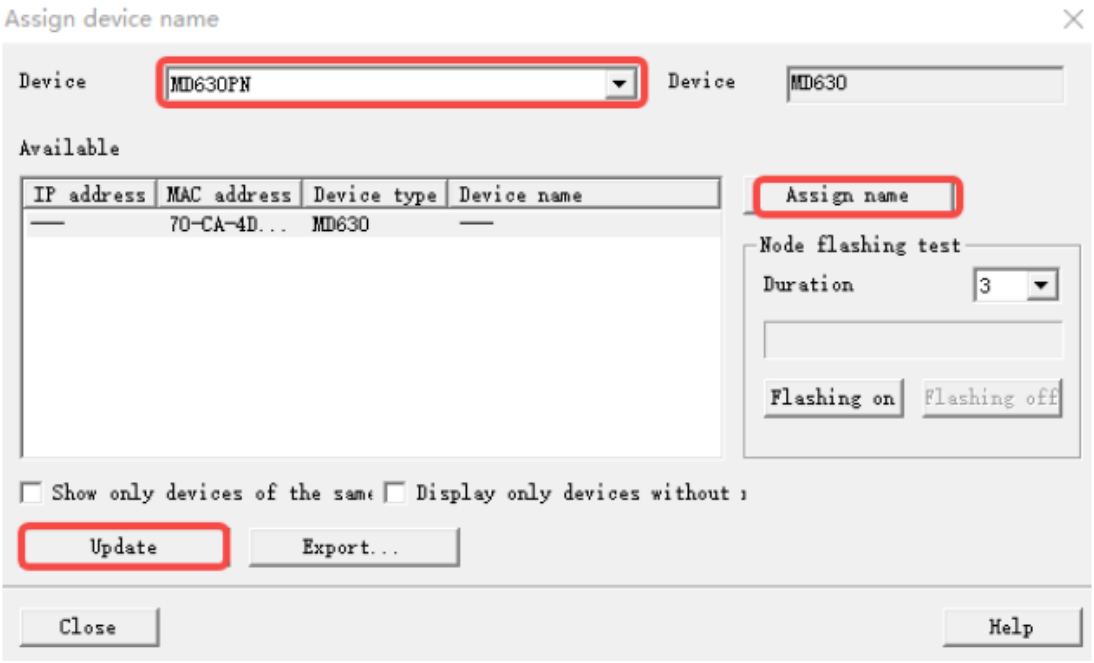
d. After download is down, click "Yes" in the prompt that asks you whether to start the module right now. If you select "No", the master remains in the STOP state until the master is manually started.



8. Without selecting the master, click "Assign device name" in "PLC" > "EtherNet".



a. Select the target "Device name," click "Update" to list all PN nodes in the current network. Select the node to be assigned (distinguished by MAC address). You may also check "Blink LED" to identify the specific device. After selection, the corresponding device panel blinks. Click "Assign name".



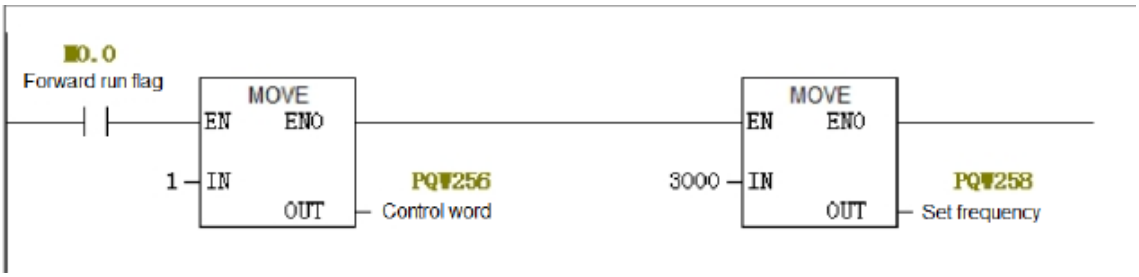
b. After assignment, click "Close".

After configuration is done, you can control the drive by modifying the value in the Q address (PQW256 to PQW267 in this example, which correspond to output PZD1 to PZD6). You can also read the value in address I to obtain the status and parameter values of DT60 (PIW256 to PIW267 in this example, which correspond to input PZD1 to PZD6).

Numerical data transfer is generally performed through the MOVE instruction or SFC14/SFC15.

Step 4: Control the drive through communication.

Data transfer is generally performed through the MOVE instruction or SFC14/SFC15. The following takes the MOVE instruction as an example. For SFC, see the help file of STEP7 help (press F1 after selecting the SFC block).



When M0.0 is set, the value 1 (Forward run) is written to PZD1 (corresponding to mapping relation 29457, hexadecimal 7311H) and the value 3000 (Frequency reference) is written to PZD2 (corresponding to mapping relation 29456, hexadecimal 7310H).

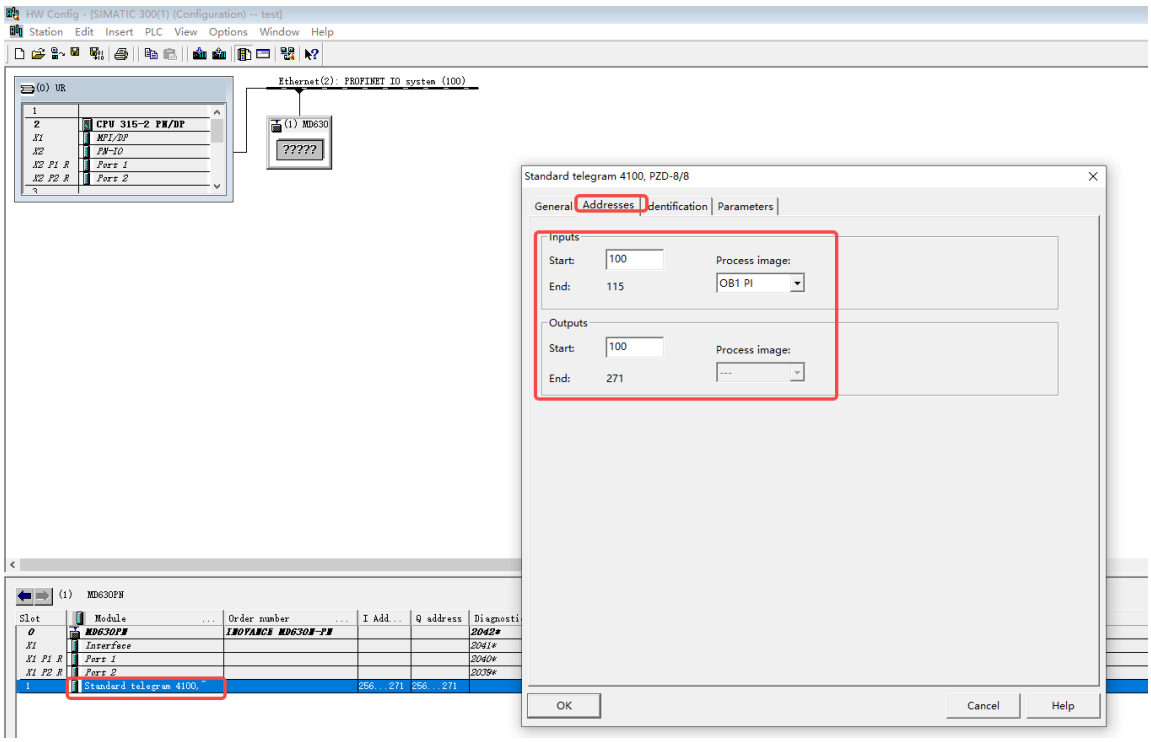
Similarly, the data returned by DT60N can be retrieved from the PIW (PIW256 corresponds to PZD1, mapping relation 28740, hexadecimal H7044; PIW258 corresponds to PZD2, mapping relation 28741, hexadecimal H7045, and so on).

Note:

- The command source and frequency source have been set to "Communication" according to *" Special Communication Address" on page 191*.

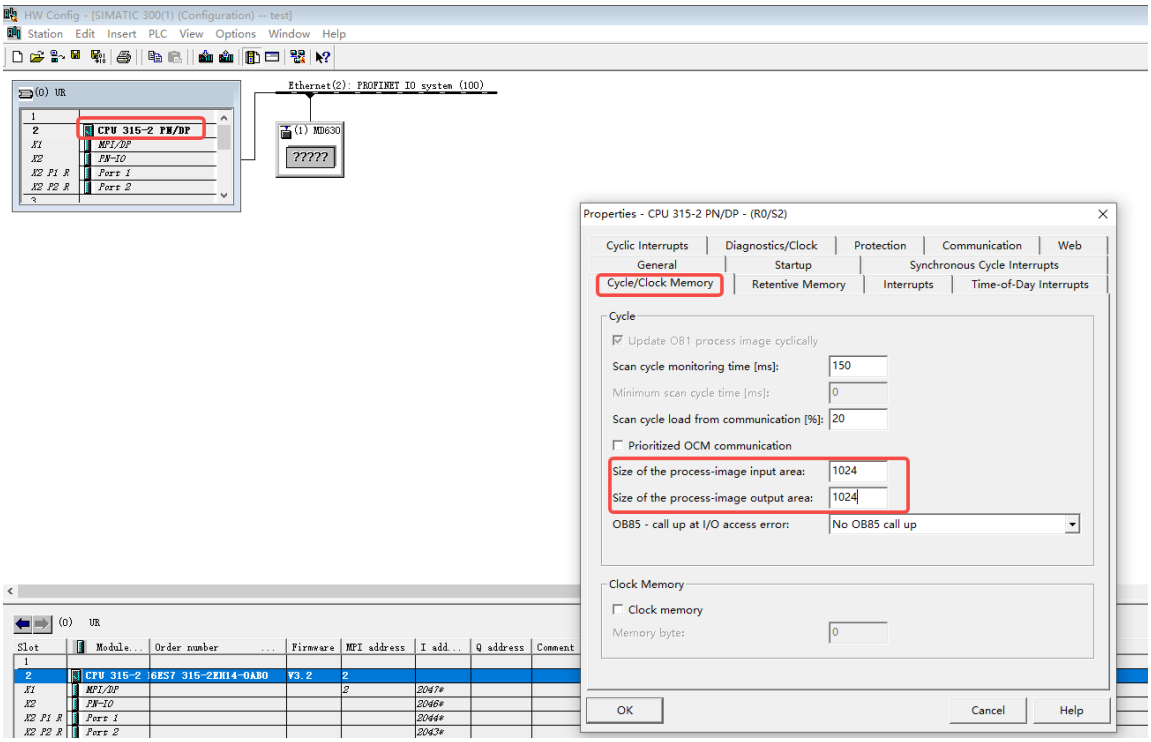
- PZD1 and PZD2 are already configured by default. You can also change the configuration and download it to the PLC.

By default, the S7-300 PLC cannot write to addresses similar to QW256 directly using commands or read addresses similar to IW256. If such operation is required, the I/O address of the slave needs to be modified to the process mirror area (the process mirror area of S7-300 is in addresses 0 to 127), as shown in the following figure.



If this address does not need to be modified by every station, you can also change the process mirror area size of the PLC (the default process mirror area size of S7-300 is 128 bytes for I and Q addresses respectively), as shown in the following figure.

After the modification is done, the input/output address of the slave is displayed in the process mirror area (grayed out when not in the process mirror area).



After modifying the input/output address or changing the process mirror area size, you need to recompile and download it to the PLC.

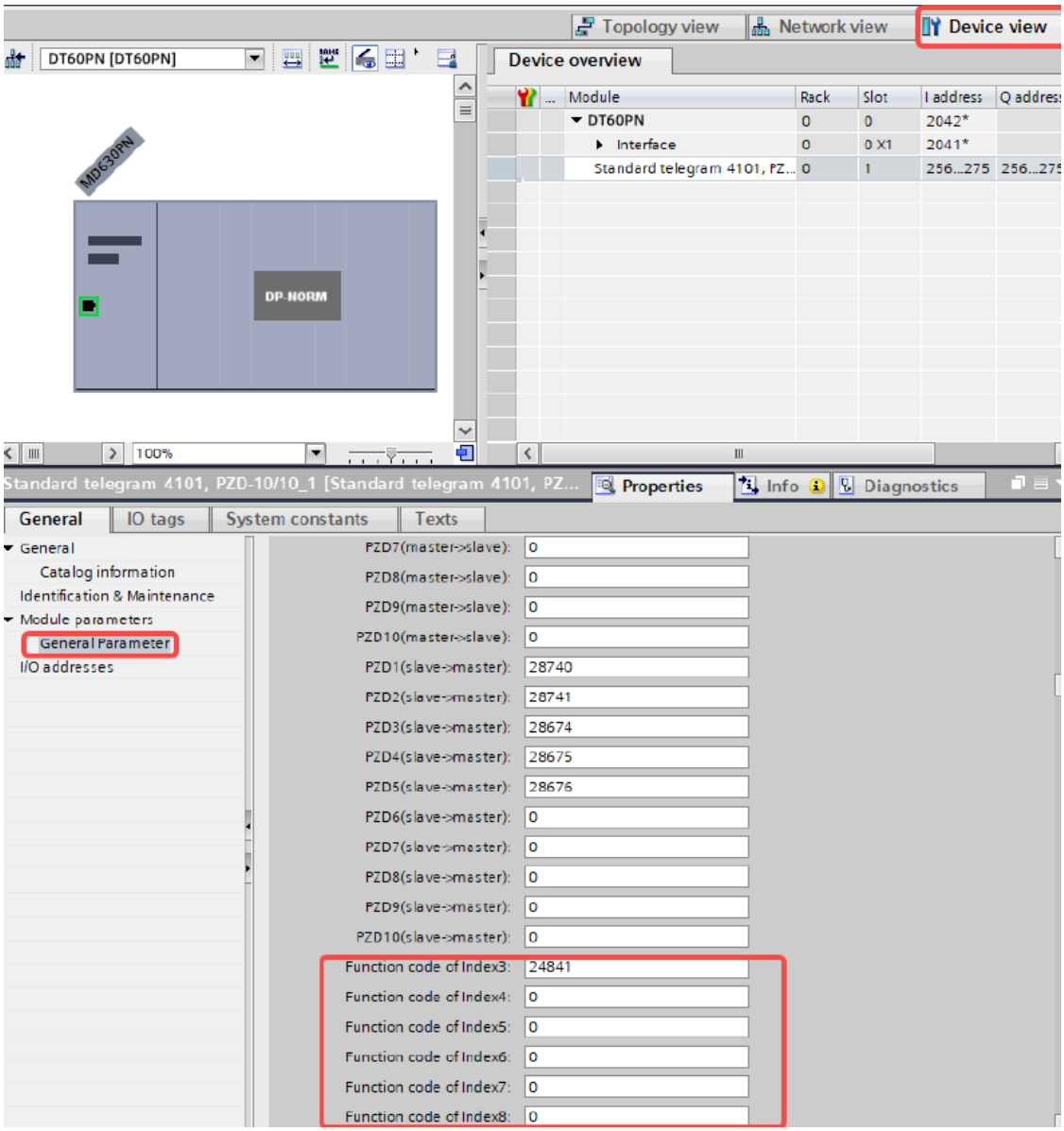
If the modified address is in the process mirror area, you can directly use IW and QW.

8.6.11 Acyclic Read-Write Operation Instance

The drive supports acyclic read/write operations via PROFINET, which can be performed through the corresponding function blocks.

8.6.11.1 Acyclic Read/Write in TIA Portal

1. Configure the corresponding Index parameter address before performing acyclic write/read operations.
   Select the slave, switch to "Device view", and select Module1 PAP ("Slot 11"). Enter the address required for acyclic access in "Function code of Index" (for example 24841 in the figure below corresponds to 0x6109, namely P1-09).

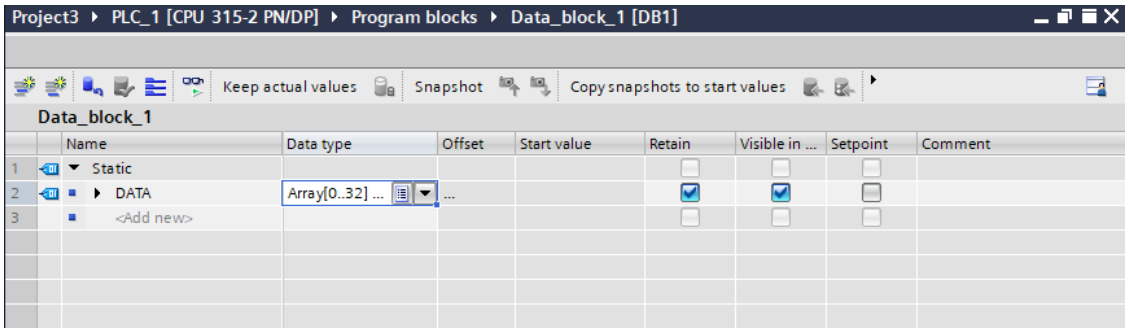


Note

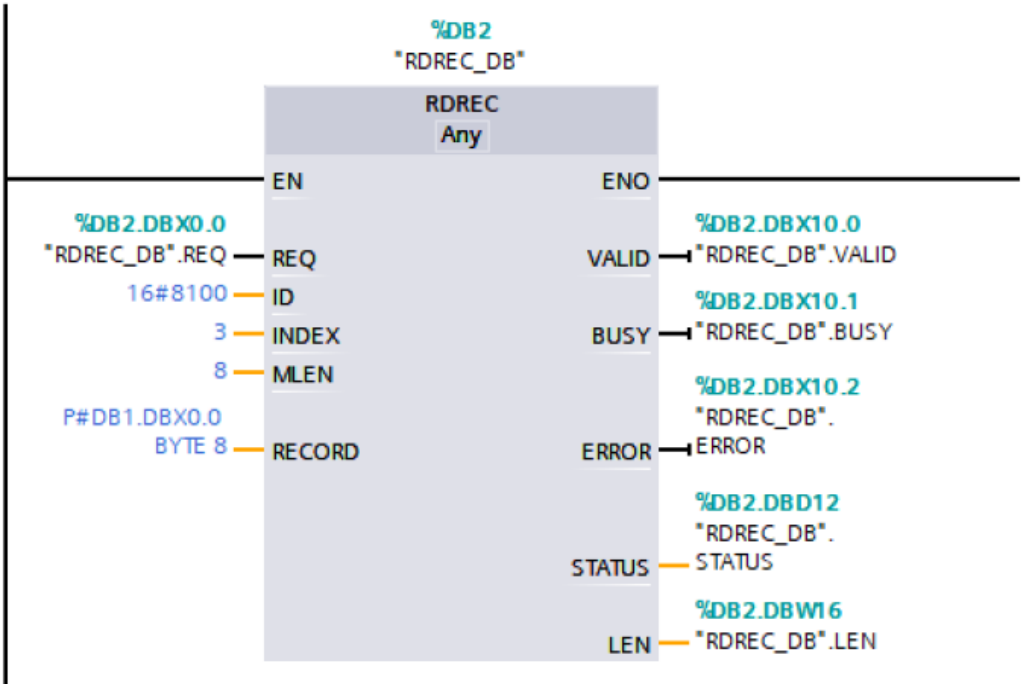
1. The index must be set to a valid parameter address.
2. Unused index keeps the initial value 0.
3. The address in the index indicates the starting address. The non-cyclic read/write operation starts from the set parameter address and continues based on the number of calls.
4. The index configuration does not need to comply with the rule starting from the first point, that is, you can keep Index3 to 0 and configure only Index4.

2. After configuration is done, click "Save project", compile, and download it to the master.

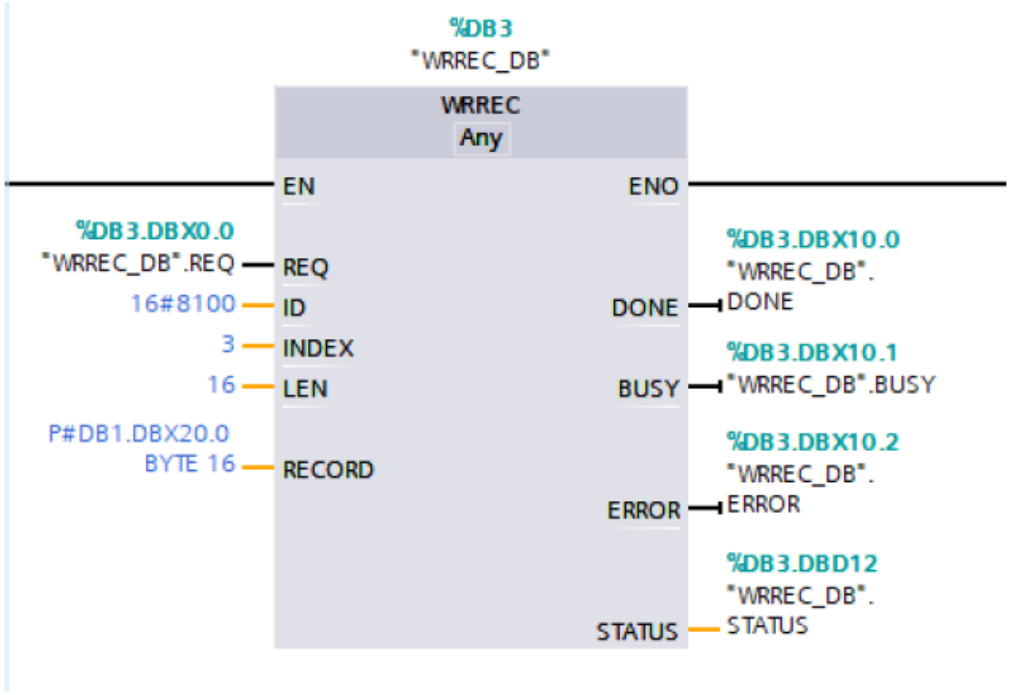
   Then create a new data block DB1 in the "Program block", as shown in the figure below.



3. Create OB1 in the "Program block", open it, and call the acyclic function block (acyclic read of input RDREC or SFB52; acyclic write of input WRREC or SFB53).



4. Read 8 bytes of parameters values starting from the address corresponding to Index3 (namely the four consecutive parameters starting from P1-09) and save them to DB1.DBW0 to DB1.DBW6 (or alternatively use DB1.DATA[0] to DB1.DATA[3]).



5. Write 16 bytes of data to the consecutive parameters starting from the address corresponding to Index3 (namely the eight consecutive parameters starting from P1-09), with the data coming from DB1.DBW20 to DB1.DBW34 (or DB1.DATA[10] to DB1.DATA[17]).

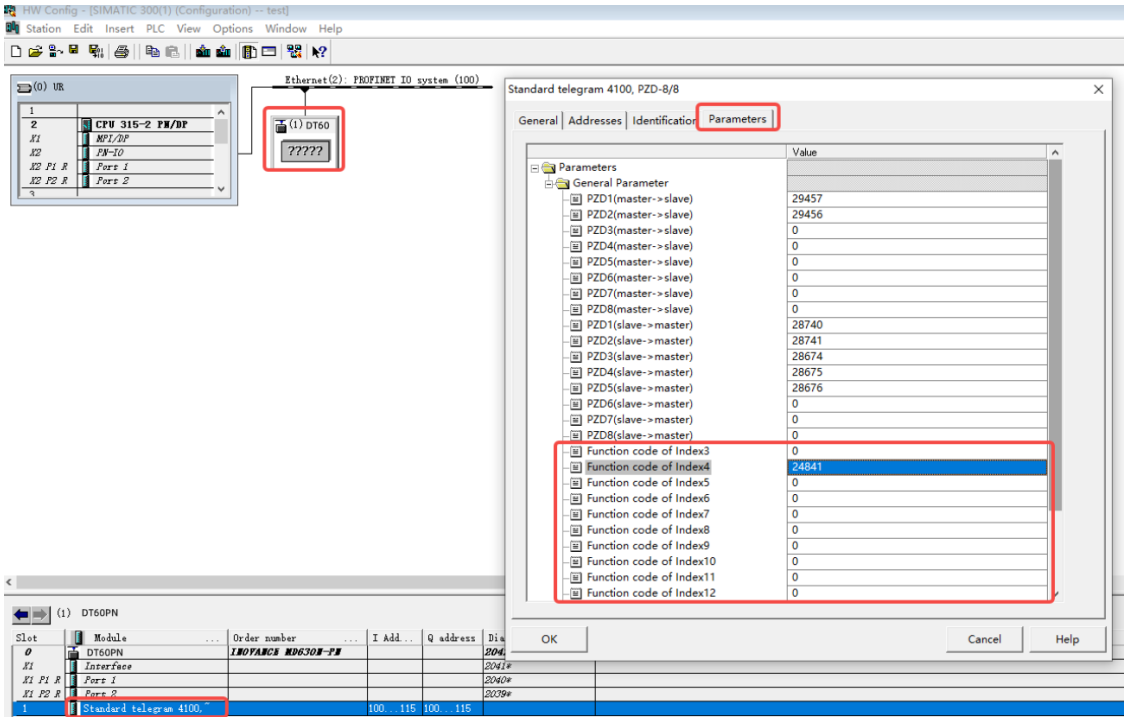
Param.	Description
REQ	Acyclic enable control (1: Start acyclic read/write)
ID	PROFINET Logic address of the I/O component, hexadecimal starting address of Q address, and bit15 must be set in format of "16#xxxx".
INDEX	Data log number, the number of the acyclic operation to be executed, which must match the Index number configured in the "Parameters" during configuration (accessing an invalid address can result in an error)
MLEN	Maximum number of bytes for acyclic operation, which ranges from 2 to 24; one parameter corresponds to two bytes; an error is returned for bytes outside the range or odd numbers.
VALID	When the bit is set, it indicates validated reception of acyclic read data.
DONE	When the bit is set, it indicates acyclic write data has been transmitted.
BUSY	When the bit is set, it indicates acyclic operation is not done.
ERROR	When the bit is set, it indicates an error occurs during acyclic operation.
STATUS	Block status or error message; when the value is negative, it indicates current error code (namely the most significant bit set to 1).
LEN	Indicates the length of data obtained by acyclic read operation.
RECORD	Data log position. For acyclic read operations, it indicates the storage location of the acyclic data to be read. For acyclic write operations, it indicates the storage area of the acyclic data to be written to the node.

8.6.11.2 Acyclic Read/Write in STEP7

1. Configure the corresponding Index parameter address before performing acyclic write/read operations.

In the HW Config interface, select the slave, then double-click Module1PAP (namely slot 11) of the message module Module1. In the pop-up window, select "Parameters." In "Function code of Index," enter the address required for acyclic access (for example, 24841 in the figure below corresponds to 0x6109, namely P1-09).

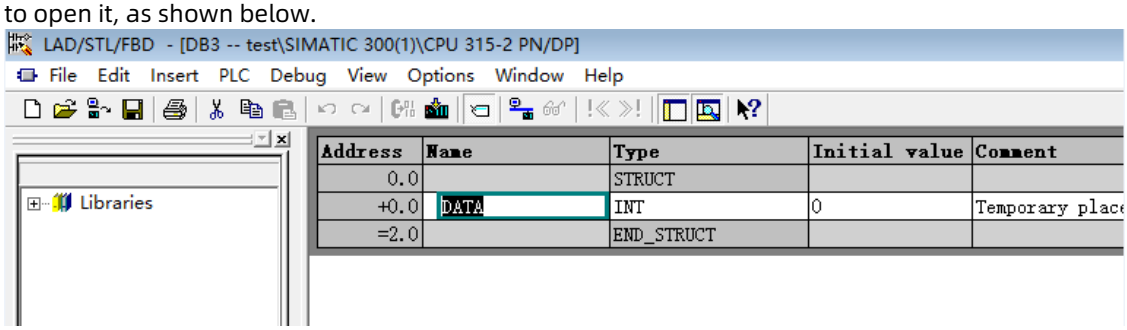
After configuration, click "OK," save, compile, and download to the master.



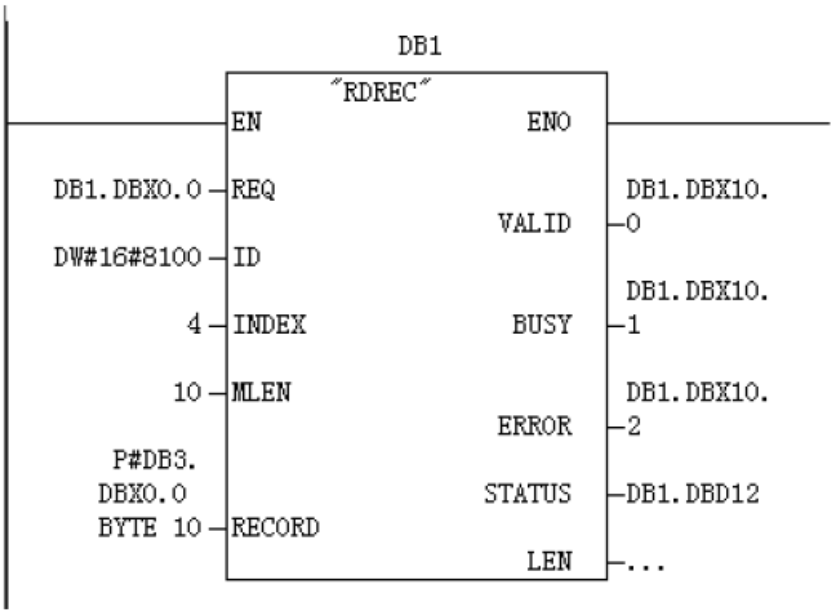
Note

1. The index must be set to a valid parameter address.
2. Unused index keeps the initial value 0.
3. The address in the index indicates the starting address. The non-cyclic read/write operation starts from the set parameter address and continues based on the number of calls.
4. The index configuration does not need to comply with the rule starting from the first point, that is, you can keep Index3 to 0 and configure only Index4.

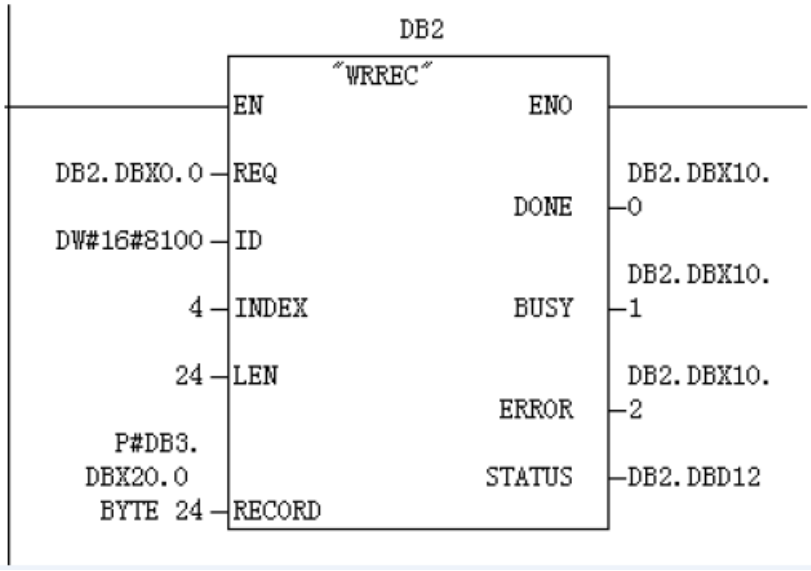
2. After configuration, you can perform acyclic read/write operations through programming. Configure a data block first. The following takes DB3 as an example. Create DB3 and double click to open it, as shown below.



Example of acyclic read:



3. Read 10 bytes of parameter values starting from the address corresponding to Index4 (namely the five consecutive parameters starting from P1-09) and save them to DB3.DBW0 to DB3.DBW8 (or DB3.DATA[0] to DB3.DATA[4]).
   Example of acyclic write:



4. Write 24 bytes of data to consecutive parameters starting from the address corresponding to Index4 (namely the 12 consecutive parameters starting from P1-09). These data come from DB3. DBW20 to DB3.DBW42 (or DB3.DATA[10] to DB3.DATA[21]).

Param.	Description
REQ	Acyclic enable control (1: Start acyclic read/write)
ID	PROFINET Logic address of the I/O component, hexadecimal starting address of Q address, and bit15 must be set in format of "DW#16#xxxx".

Param.	Description
INDEX	Data log number, the number of the acyclic operation to be executed, which must match the Index number configured in the "Parameters" during configuration (accessing an invalid address can result in an error)
MLEN	Maximum number of bytes for acyclic operation, which ranges from 2 to 24; one parameter corresponds to two bytes; an error is returned for bytes outside the range or odd numbers.
VALID	When the bit is set, it indicates validated reception of acyclic read data.
DONE	When the bit is set, it indicates acyclic write data has been transmitted.
BUSY	When the bit is set, it indicates acyclic operation is not done.
ERROR	When the bit is set, it indicates an error occurs during acyclic operation.
STATUS	Block status or error message; when the value is negative, it indicates current error code (namely the most significant bit set to 1).
LEN	Indicates the length of data obtained by acyclic read operation.
RECORD	Data log position. For acyclic read operations (SFB52), it indicates the storage location of the acyclic data to be read. For acyclic write operations (SFB53), it indicates the storage area of the acyclic data to be written to the node.

8.6.12 Replacing Faulty Devices

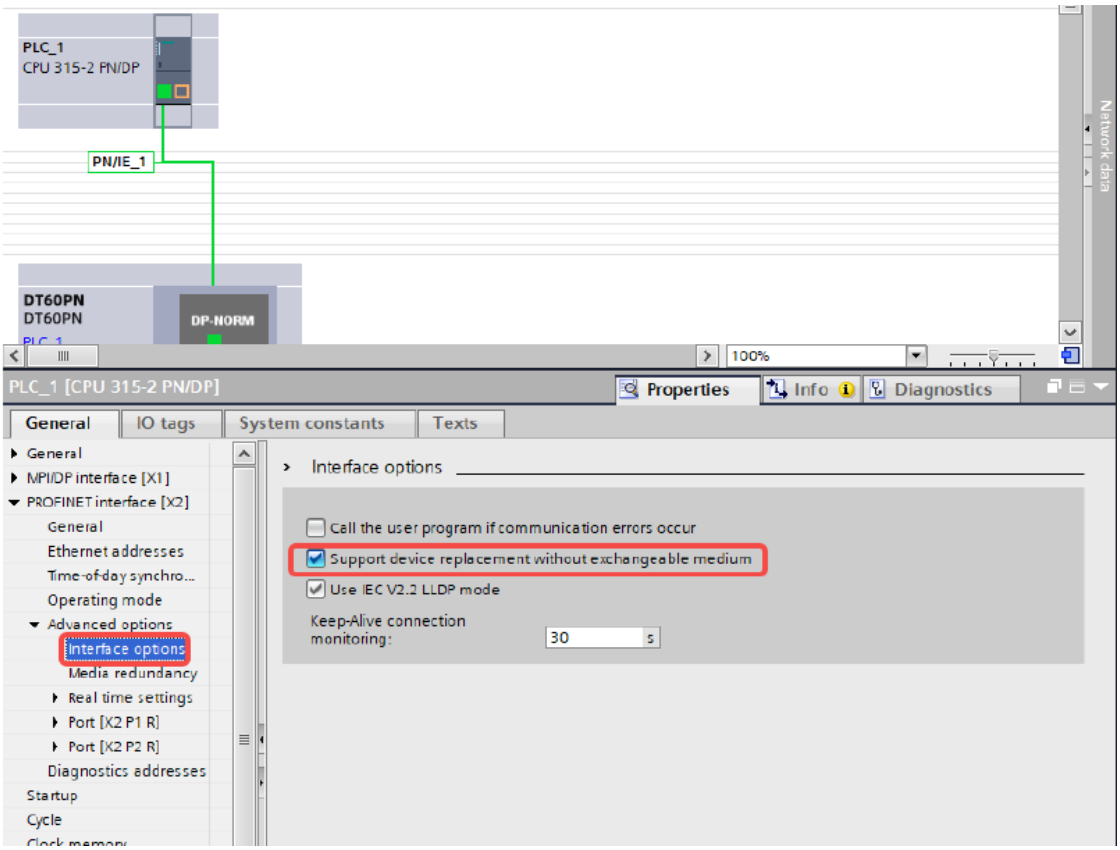
When using the PROFINET function, this series of drives support direct replacement of faulty devices without the need for reconfiguration or device assignment.

The following conditions must be met when replacing a faulty device.

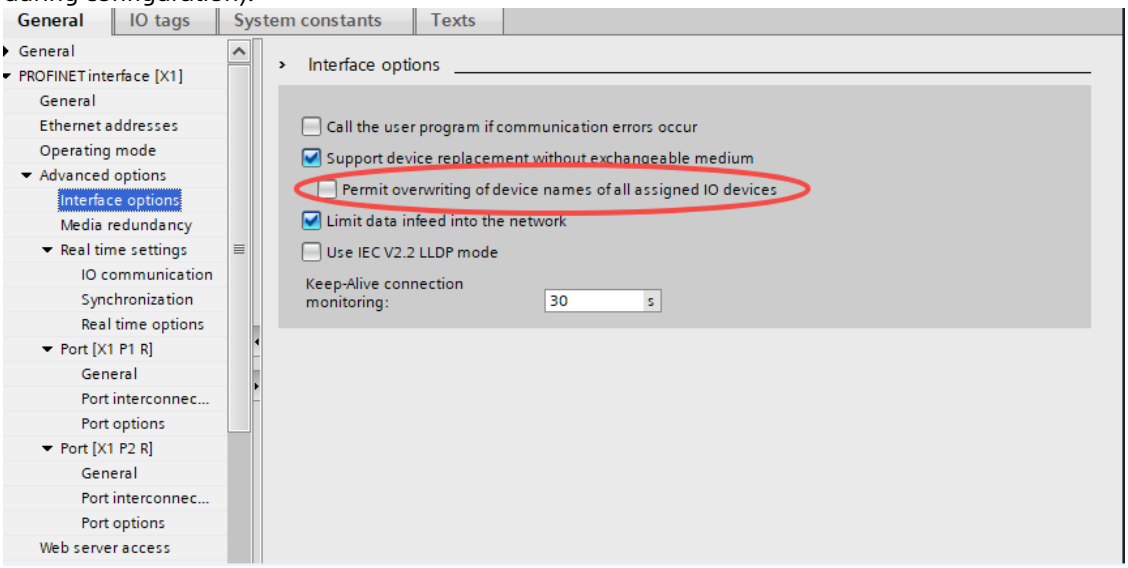
1. The new device and the device to be replaced are both DT60.
2. The new device has not been assigned with a device name (if assigned, reset with a PC).
3. The topology has been correctly set during configuration (namely the actual ports to which each network cable is connected have been defined).
4. During configuration, "Support device replacement without exchangeable medium" is enabled in the master.

8.6.12.1 Setting "Support Device Replacement Without Exchangeable Medium" and Topology in TIA Portal

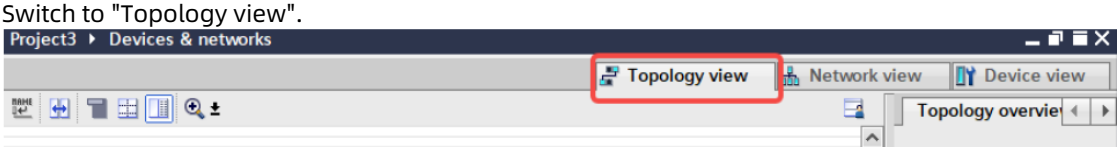
1. During configuration, select the slave in the "Network view", go to "Advanced options" under "General", choose "Interface options", and check "Support device replacement without exchangeable medium" (checked default during configuration).



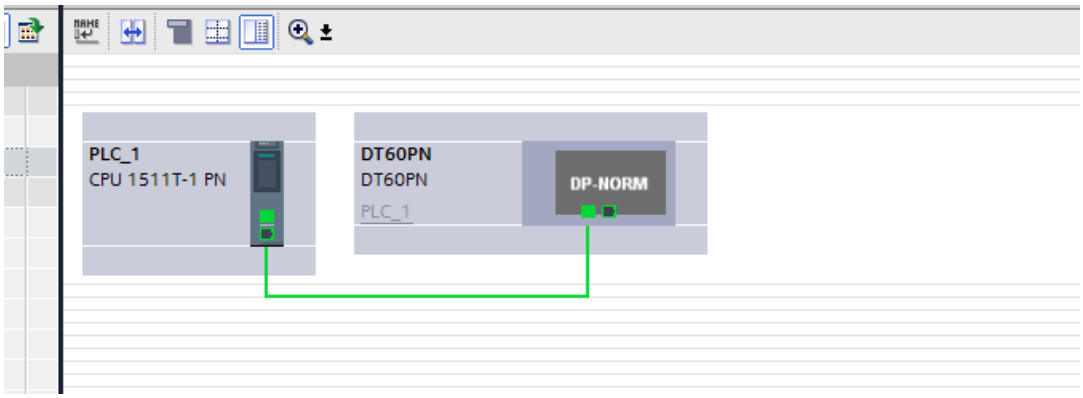
2. If the PLC is S7-1200 or S7-1500, an additional option titled "Allow overriding all assigned IO device names" will appear in this interface. If both options are checked, the replacement function will ignore the condition in *" Replacing the Faulty Device" on page 282*(unchecked by default during configuration).



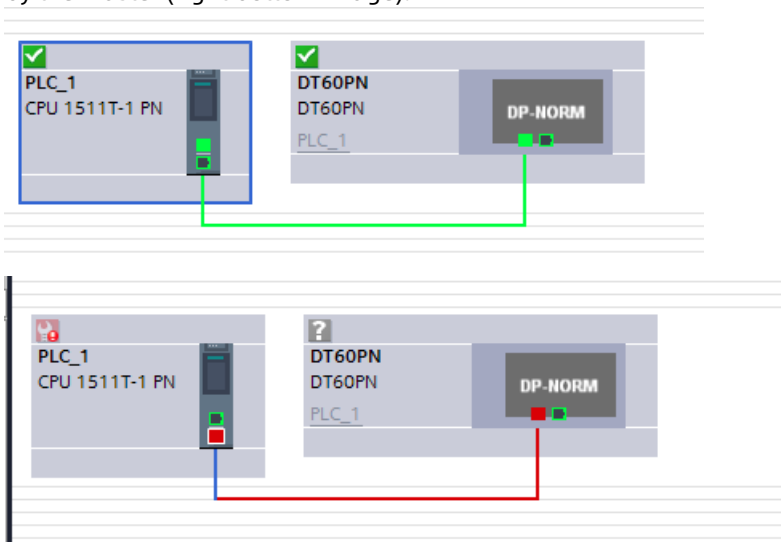
3. Switch to "Topology view".



4. Wire up the topology diagram based on actual connection.

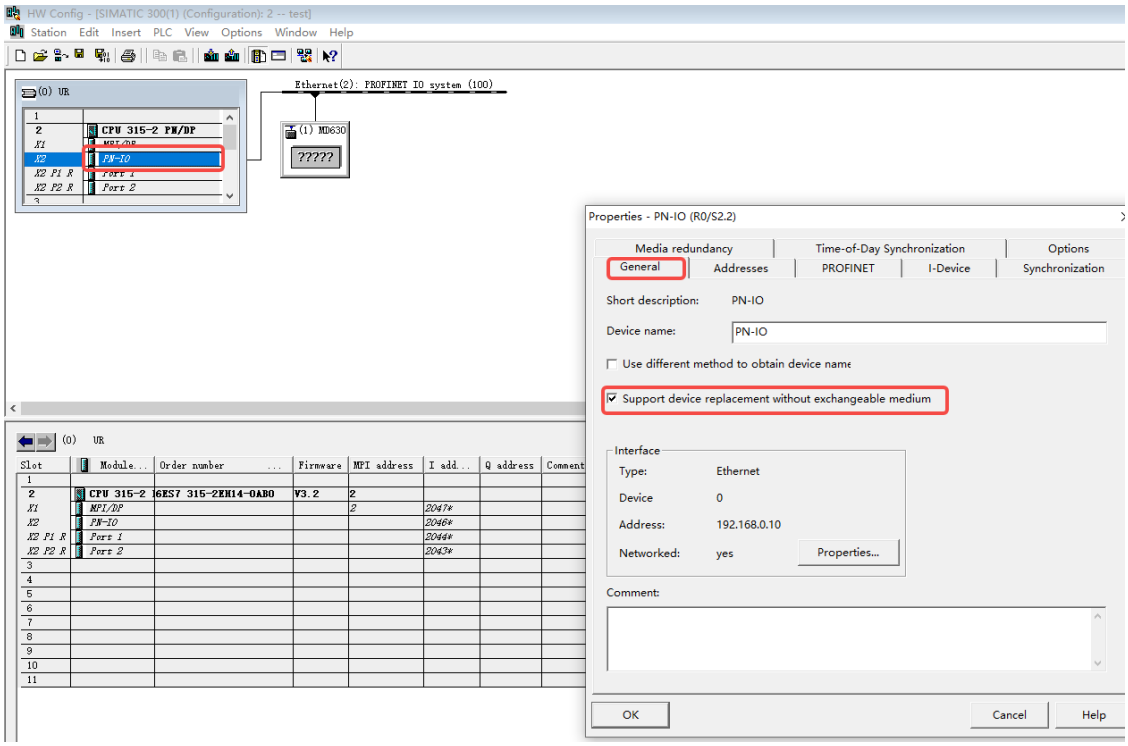


5. Compile and download to the master. If the topology is correct, the connection state is displayed in green in online mode (left bottom image); otherwise, it is displayed in red, with a fault reported by the master (right bottom image).

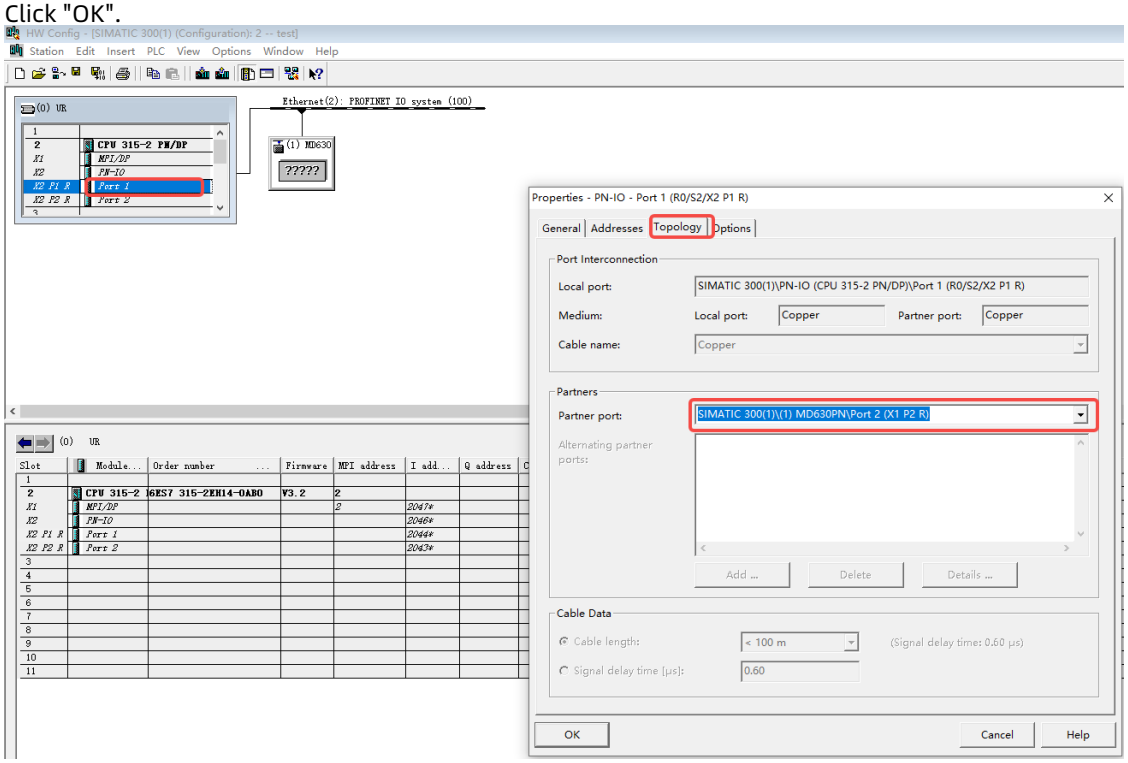


8.6.12.2 Setting "Support Device Replacement Without Exchangeable Medium" and Topology in STEP7

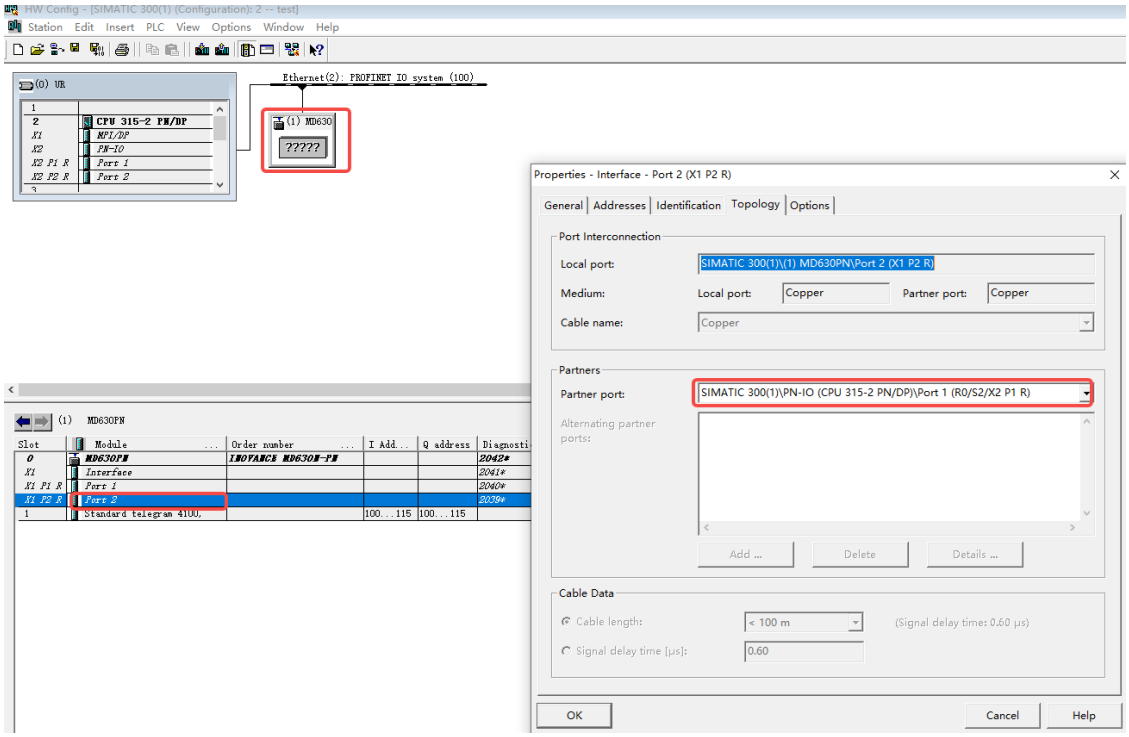
1. In the HW Config interface, double-click the PN-IO interface of the master, click "General" in the pop-up window, and select "Support device replacement without exchangeable medium" (this is selected by default in the configuration).



2. Double-click the port of the master, select "Topology" in the pop-up window, and from the "Partner port" drop-down list, select the port of the actual connected device (the default value is "Any partner"), as shown in the figure below, which is to connect PLC port1 to port2 of the drive. Click "OK".



3. After completing the configuration on the PLC side, the corresponding port of the corresponding device will be automatically updated to the PC's port, as shown in the figure below.



4. Continue configuring the other cascaded ports until all ports are configured, then compile and download the configuration to the PLC.

Caution

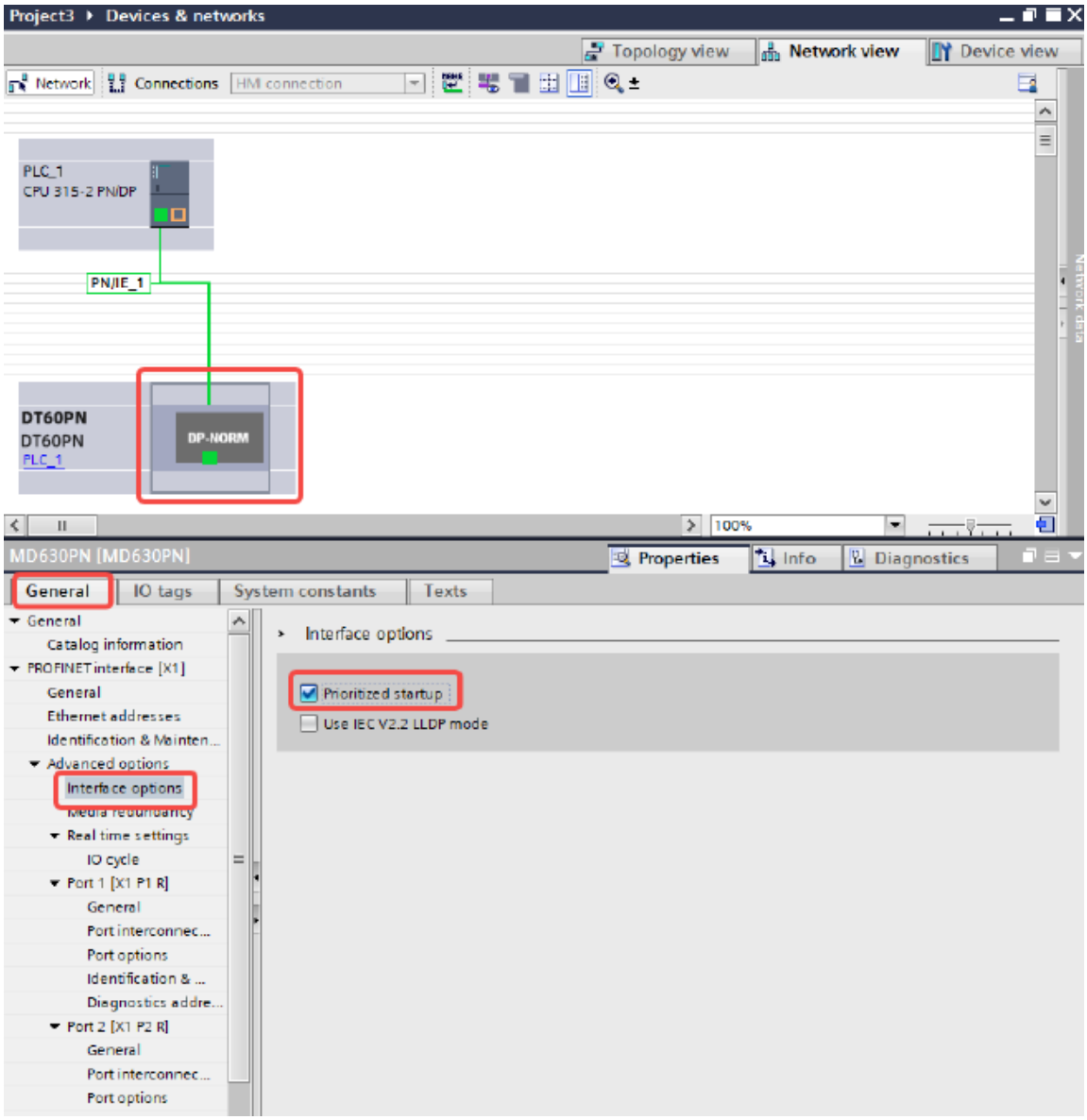
Communication is normal when the topology is incorrect. Normal switches do not support the topology. If you need to draw a topology, select a managed PN switch. Otherwise, the topology will be wrong.

8.6.13 Prioritized Startup Configuration

The drive supports PROFINET prioritized startup configurations. The device configured with prioritized startup will be connected to the master first. That is, devices configured with prioritized startup establishes communication with the master before devices not configured with prioritized startup.

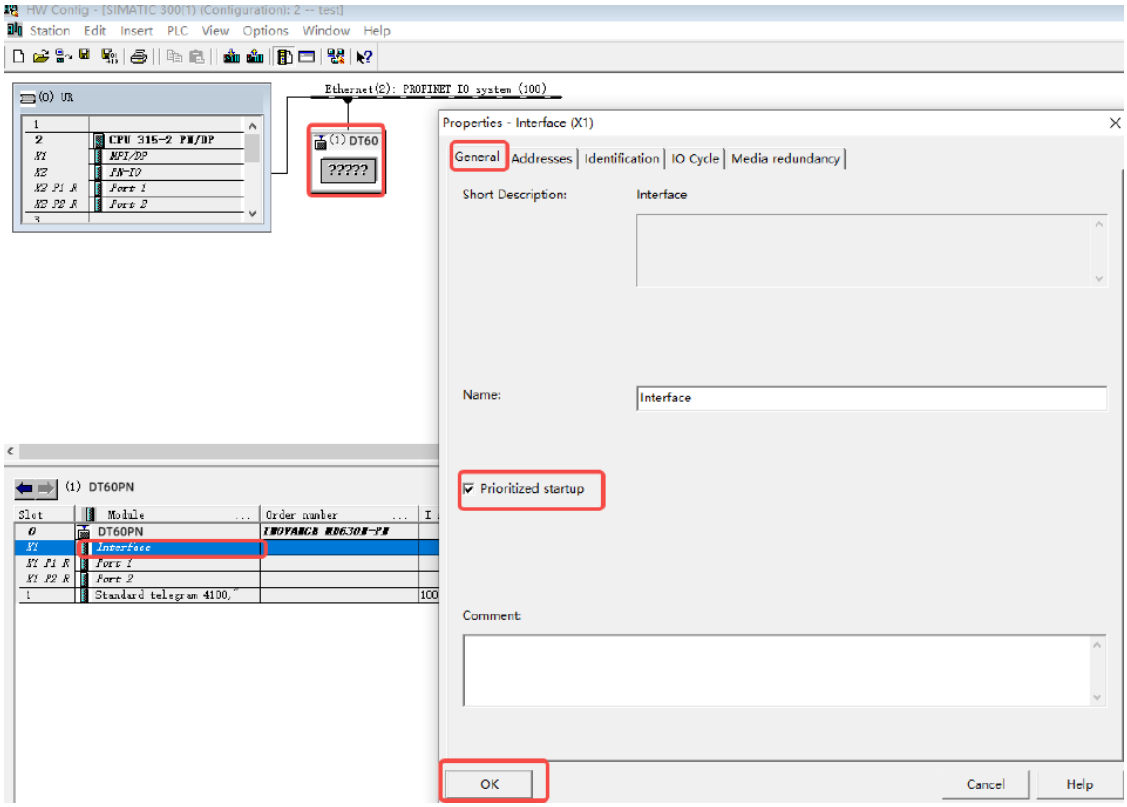
8.6.13.1 Configuring Prioritized Startup in TIA Portal

Select the slave, under "General" in "Advanced options", check "Interface options" for "Prioritized startup", save and compile, then download to the master.



8.6.13.2 Configuring Prioritized Startup in STEP7

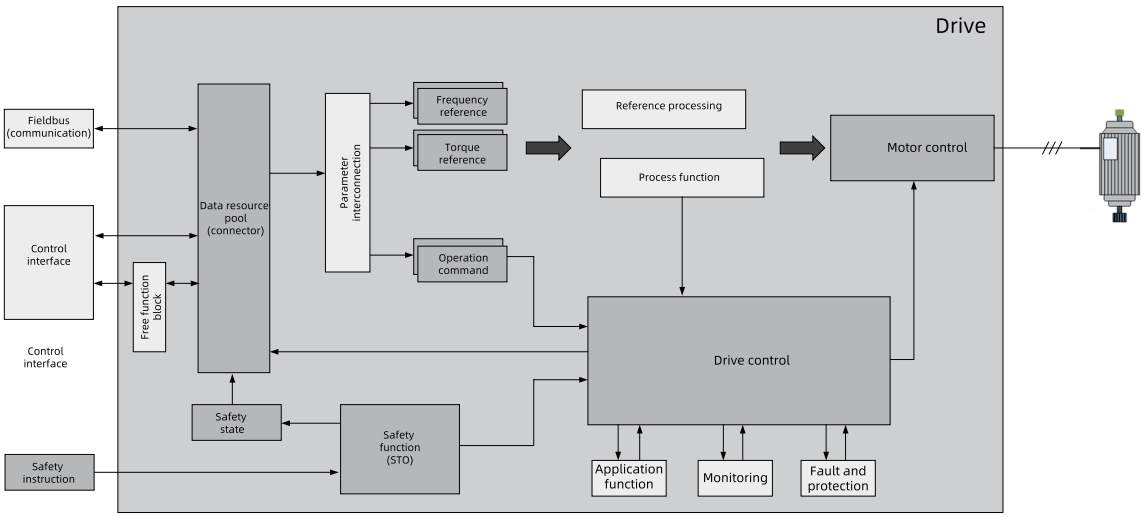
1. Select the slave, double-click "Interface", in the pop-up "Properties" window, select "General", check "Prioritized Startup", then click "OK".



2. After completing the configuration, save, compile, and download to the master.

9 Common Functions

9.1 Overview of Functions



9.2 Operation Commands

9.2.1 Selecting Control Channel and Operation Command

Function description

The command source is the source or input mode of commands to control the start, stop, forward run, reverse run, jog, and fault reset of the drive.

The following two control channels are provided.

- Groups b1 [Main command word of control channel 1] and b2 [Auxiliary command word of control channel 1] are used to set control channel 1.
- Groups b3 [Main command word of control channel 2] and b4 [Auxiliary command word of control channel 2] are used to set control channel 2.

You can switch the active control channel through b0-02 [Control channel selection]. In the default mode, the active control channel is control channel 1. Control channel 1 is used as an example in this section if no notes are provided.

Table 9–1 Control channel parameters

Param.	Name	Default value	Value range	Description
b0-02	Control channel selection	0	0: Setting channel 1 1: Setting channel 2 3 to 12: DI1 to DI10 Other: B connector	Defines the active control channel. The setpoint 0 indicates the control channel 1. The setpoint 1 indicates the control channel 2. Value description: 0: Inactive - Channel 1 is selected. 1: Active - Channel 2 is selected. 3 to 12: DI1 to DI10 - Which channel is selected depends on the final DI terminal status. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates the value is valid. Other: B connector - Which channel is selected depends on the B connector. You can select B connector through the pop-up window. The setpoint 0 indicates the value is invalid. The setpoint 1 indicates the value is valid. Note: After the DI terminal is assigned with function 70 [Control channel selection], the value of b0-02 is automatically switched to the corresponding DI terminal connector parameter (L0484 to L0490).

Operating principles

As shown in the following figure, in each control channel, operation commands are used to control start, stop, forward run, reverse run, jog, and fault reset of the drive. Commands can be set through the operating panel, terminal, communication, or user-defined method.

You can select the operation command source through b1-00 [Main command source of control channel 1] or b3-00 [Main command source of control channel 1].

- Operating panel: You can start/stop the drive through the built-in LED operating panel.
- Terminal: You can start/stop the drive through the terminal start/stop module function in group b9.
- Communication: You can start/stop the drive through writing values to specified communication address in the specified data format.
- User-defined: You can start/stop the drive through setting control command signal source directly to achieve complex and flexible configuration.

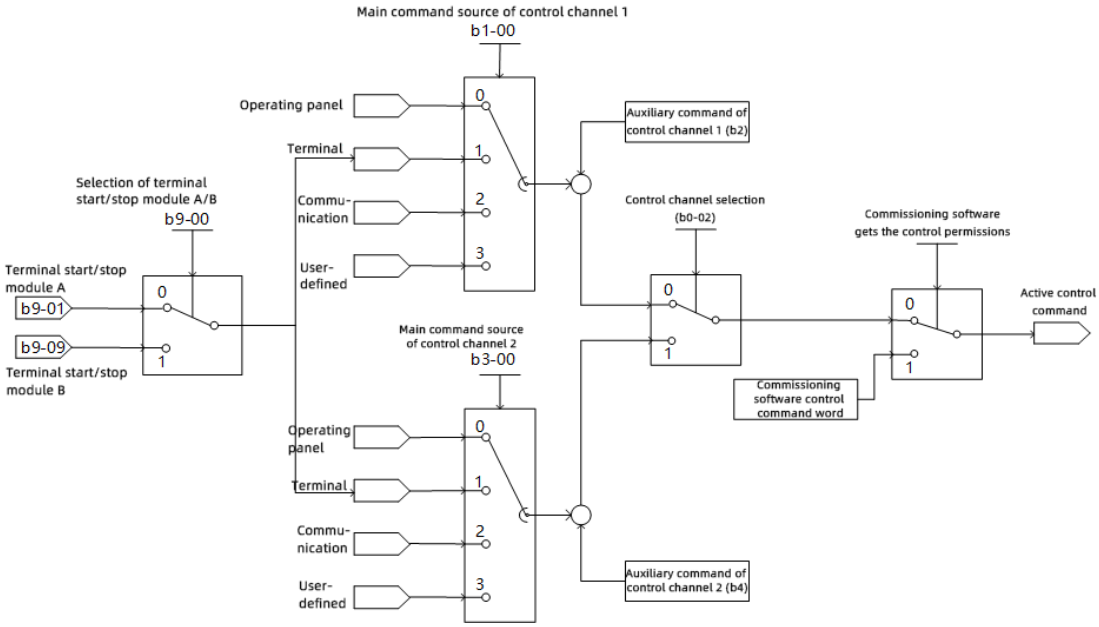


Figure 9-1 Control channel diagram

Note

- The commissioning software can control the start/stop of the AC drive through control in any main command source mode. The commissioning software has the first priority. In this case, the start/stop control mode configured in groups b1/b3 is not effective.
- In any main command source mode (including commissioning software), the auxiliary command word group b2/group b4 corresponding to the effective control channel remains active.

Related parameters

Param.	Name	Default value	Value range	Description
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Defines the main command source of control channel 1. Value description: 0: Operating panel - The LED operating panel is used as the main command source of control channel 1. You can control the drive by pressing RUN/STOP keys on the operating panel. 1: Terminal - The terminal is used as the main command source of control channel 1. The DI can be assigned with different functions such as start/stop, forward/ reverse run, jog, and multi-reference as needed. 2: Communication - EtherNet/IP or PROFINET communication is used as the main command source of control channel 1. If the drive needs to communicate with the host controller, you can input control commands through remote communication. This mode is suitable for remote control or centralized control on multiple devices. 3: User-defined - User-defined control is used as the main command source of control channel 1. In this case, the control commands can be set through b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

Param.	Name	Default value	Value range	Description
b3-00	Main command source of control channel 2	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Defines the main command source of control channel 2. Value description: 0: Operating panel - The LED operating panel is used as the main command source of control channel 2. You can control the drive by pressing RUN/STOP keys on the operating panel. 1: Terminal - The terminal is used as the main command source of control channel 2. The DI can be assigned with different functions such as start/stop, forward/ reverse run, jog, and multi-reference as needed. 2: Communication - EtherNet/IP or PROFINET communication is used as the main command source of control channel 2. If the drive needs to communicate with the host controller, you can input control commands through remote communication. This mode is suitable for remote control or centralized control on multiple devices. 3: User-defined - User-defined control is used as the main command source of control channel 2. In this case, the control commands can be set through b3-01 to b3-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

Note: Group F contains commonly used parameters. b1-00 is mapped to F0-03. These two parameters are equivalent.

9.2.2 Operation Control Through the Operating Panel

Function description

See the "Operating Panel" section for the standard operating panel of the drive. When b1-00 [Main command source of control channel 1] is set to 0 [Operating panel], you can start/stop the drive through the operating panel.

Procedure

The following shows how to set operation commands through the operating panel.

1. Set F0-03 [Main command source of control channel 1] to 0 [Operating panel] and press 

to set the operating panel as the main command source.
2. Set F0-30 to [Digital reference of main frequency] 10.00 Hz, and then press 

key again to display the frequency reference.

3. Press  to start the drive (with RUN indicator turned on). Then the drive runs at a frequency of 10 Hz.
4. When the drive is running, press  to stop the drive. In this case, the RUN indicator turns off.

Related parameters

Param.	Name	Default value	Value range	Description
b1-00 (F0-03)	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Defines the main command source of control channel 1. Value description: 0: Operating panel - The LED operating panel is used as the main command source of control channel 1. You can control the drive by pressing RUN/STOP keys on the operating panel. 1: Terminal - The terminal is used as the main command source of control channel 1. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference as needed. 2: Communication - Communication (such as Modbus) is used as the main command source of control channel 1. If the drive needs to communicate with the host controller, you can input control commands through remote communication. This mode is suitable for remote control or centralized control on multiple devices. 3: User-defined - User-defined control is used as the main command source of control channel 1. In this case, the control commands can be set through b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b5-01 (F0-30)	Digital reference of main frequency	50	0.00 Hz to A2-17	Defines the target frequency. It is activated when digital reference is used as the main frequency source.

Note: b1-00 and b5-01 are mapped to F0-03 and F0-30 in group F. These two sets of parameters are equivalent.

9.2.3 Operation Control Through Commissioning Software

For details, see *" iFA Commissioning Software" on page 120*.

9.2.4 DI-Based Operation

Function description

When b1-00 [Main command source of control channel 1] is set to 1 [Terminal], you can start/stop the drive through the DI terminal.

The drive supports two groups of terminal start/stop modules: Terminal start/stop module A (b9-01 to b9-08) and terminal start/stop module B (b9-09 to b9-16). The two groups of terminal start/stop

modules have identical functions and can be switched through b9-00 [Terminal start/stop module A/B selection]. Only one terminal start/stop module is active at a time.

Generally, these two groups of modules are configured with different control modes, which can be switched through b9-00.

Param.	Name	Default value	Value range	Description
b9-00 (F4-00)	Terminal start/ stop module A/ B selection	0	0: Module A 1: Module B Other: B connector	Select the terminal module based on the setpoint. The value 0 indicates terminal module A, and the value 1 indicates terminal module B. 0: Module A - The terminal start/stop module A is selected. 1: Module B - The terminal start/stop module B is selected. Other: B connector - The source of this parameter value is B connector. You can select B connector through the pop-up window. Note: After the DI is assigned with function 72 [Terminal module A/B selection], the value of b9-00 is automatically switched to the corresponding DI connector parameter (L0484 to L0490).

Note: b9-00 is mapped to F4-00 in group F. These two sets of parameters are equivalent.

In default state, the terminal start/stop module A is activated by default. Terminal module A is used as an example in this section if no notes are provided.

Operating principles

Set b9-01 [Mode of terminal start/stop module A] or b9-09 [Mode of terminal start/stop module B] to set the control mode of terminal commands. Six terminal command modes are available, including one-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, and three-wire mode 2.

Param.	Name	Default value	Value range	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	3	0: Disable 1: IN1 for start 2: IN1 for start and IN2 for direction 3: IN1 for forward start and IN2 for reverse start 4: IN1P (rising edge) for start, IN2 for stop 5: IN1P (rising edge) for start, IN2 for stop, and IN3 for direction 6: IN1P (rising edge) for start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop	Defines the mode of terminal start/stop module A. This parameter is valid for IN1/IN2/IN3 in the terminal function. Value description: 0: Disable, which means the mode is invalid, with IN1/IN2/IN3 invalid. 1: IN1 for start In this mode, one DI is connected for setting function IN1 for controlling start/stop of the drive in forward run. 2: IN1 for start and IN2 for direction In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction. 3: IN1 for forward start and IN2 for reverse start In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control start/stop in reverse run. The drive stops when both IN1 and IN2 are active. 4: IN1P (rising edge) for start and IN2 for stop In this mode, two DIs are connected for setting functions IN1 and IN2. The rising edge of IN1 is used to control start of forward run. IN2 is used for stop. 5: IN1P (rising edge) for start, IN2 for stop and IN3 for direction In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. IN2 is used to control stop, and IN3 is used to control the operating direction. 6: IN1P (rising edge) for start in forward direction, IN2P (rising edge) for start in reverse direction, and IN3 for stop In this mode, three DIs are connected for setting functions IN1/IN2/IN3. IN2 is used to control start of reverse run, and IN3 is used for stop.
b9-09 (F4-02)	Mode of terminal start/stop module B	3		

Note: b9-01 and b9-09 are mapped to F4-01 and F4-02 in group F. These two sets of parameters are equivalent.

1. One-wire mode

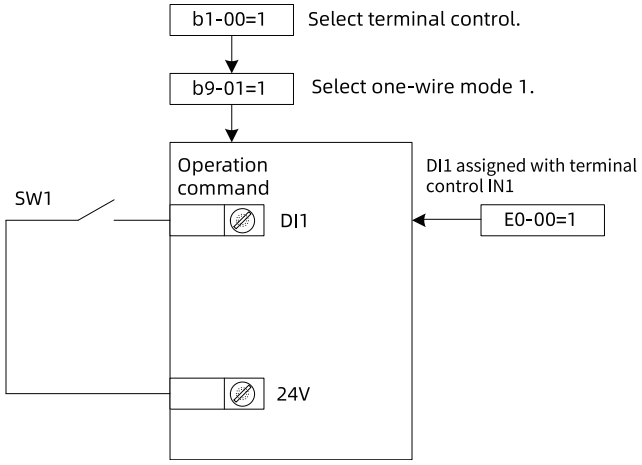
b9-01 [Mode of terminal start/stop module A] = 1 [IN1 for start], with one DI connected for setting function IN1 for operation command control. The following shows how to set parameters for assigning DI1 with operation commands.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	1 [IN1 for start]	In this mode, one DI is connected for setting function IN1 for controlling start/stop of the drive in forward run.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command

Note: b9-01 and E0-00 are mapped to F4-01 and F4-03 in group F. These two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] to allow DI1 to control operation commands.

Wiring and parameter setting for one-wire mode is shown in the following figure. When the control switch SW1 closes, the motor runs. When SW1 opens, the motor does not run.



SW1	Operation command
0	Stop
1	Operation

Figure 9-2 Wiring and parameter settings for one-wire mode

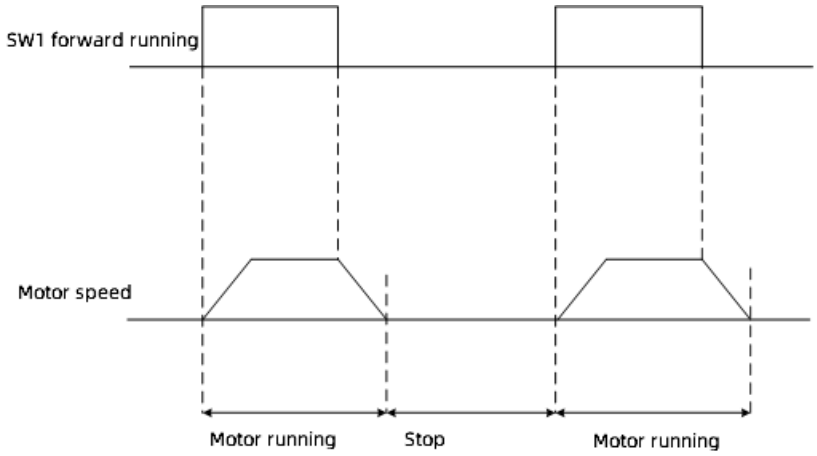


Figure 9-3 One-wire mode sequence

2. Two-wire mode 1

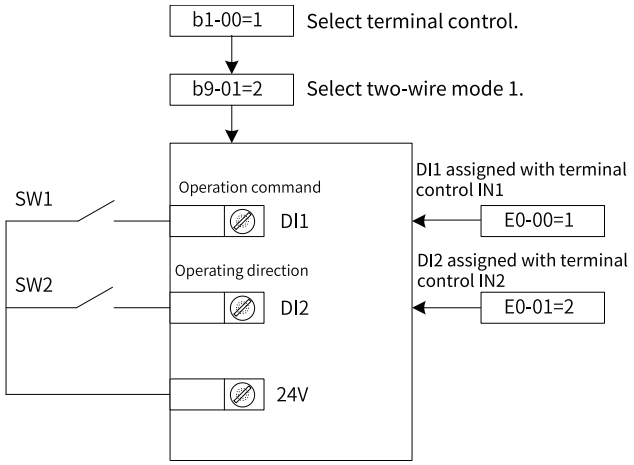
b9-01 [Terminal start/stop module A mode] = 2 [IN1 for start, IN2 for direction], with two DIs connected for setting functions IN1 and IN2. IN1 is used to control the operation command, and IN2 is used to control the operating direction. The following shows how to set parameters for assigning DI1 with operation commands and DI2 with operating direction.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	2 [IN1 for start, IN2 for direction]	In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function selection	2 [Terminal start/stop module A_IN2]	Operating direction

Note: b9-01 and E0-00/E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to make DI1 control operation commands and DI2 control operating direction.

The following figure shows wiring and parameter setting for two-wire mode 1. When the control switch SW1 closes, the operation is enabled. When SW2 opens, the motor runs forwardly. When SW2 closes, the motor runs reversely. When SW1 opens, the motor does not run regardless of the SW2 state.



SW1	SW2	Operation command
1	0	Forward
1	1	Reverse
0	0	Stop
0	1	Stop

Figure 9-4 Wiring and parameter setting for two-wire mode 1

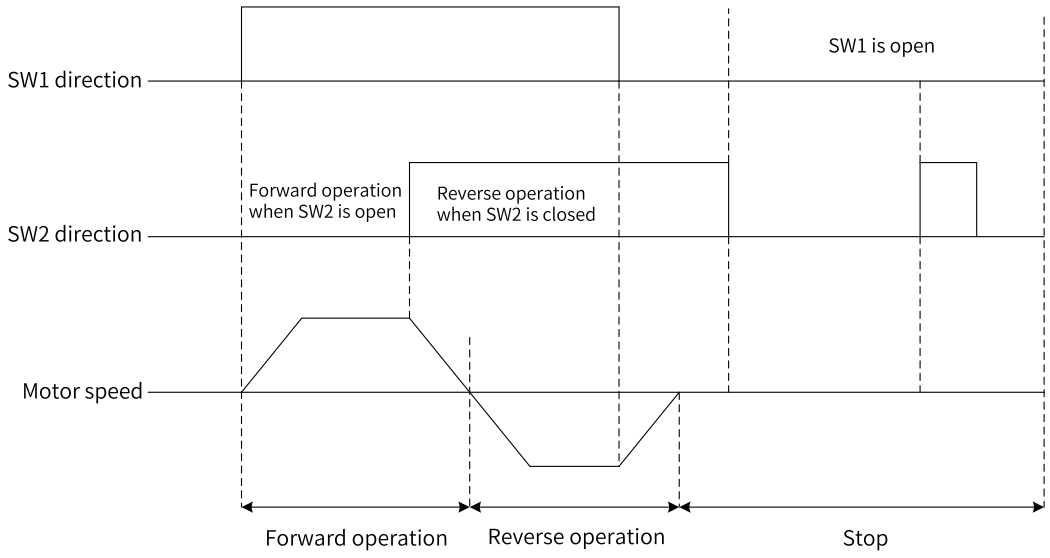


Figure 9-5 Two-wire mode 1 sequence

3. Two-wire mode 2

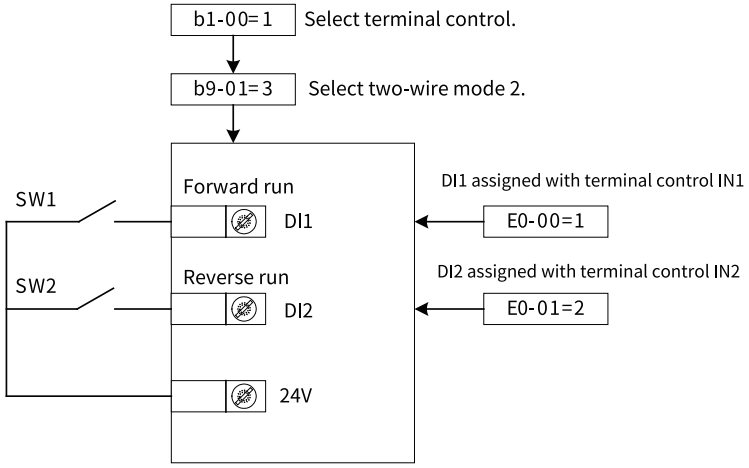
Set b9-01 [Terminal start/stop module A mode] to 3 [IN1 for forward start, IN2 for reverse start] and connect two DIs for setting functions IN1 and IN2. IN1 is used to control the start/stop in forward run. IN2 is used to control start/stop in reverse run. When both IN1 and IN2 are active, the motor stops. The following shows how to set parameters for assigning DI1 with forward run and DI2 with reverse run.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/ stop module A	3 [IN1 for forward start, IN2 for reverse start]	In this mode, two DIs are connected for setting functions IN1 and IN2. IN1 is used to control start/stop in forward run. IN2 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Forward run
E0-01 (F4-04)	DI2 function selection	2 [Terminal start/stop module A_IN2]	Reverse run

Note: b9-01 and E0-00\E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to make DI1 control forward run and DI2 control reverse run.

The wiring and parameter setting for two-wire mode 2 are shown in the following figure. In this mode, When SW1 closes, the motor runs forwardly. When SW1 opens, the motor stops. When SW2 closes, the motor rotates reversely. When SW2 opens, the motor stops. When SW1 and SW2 both open or close, the motor stops.



SW1	SW2	Operation command
1	0	Forward
0	1	Reverse
1	1	Stop
0	0	Stop

Figure 9-6 Wiring and parameter setting for two-wire 2

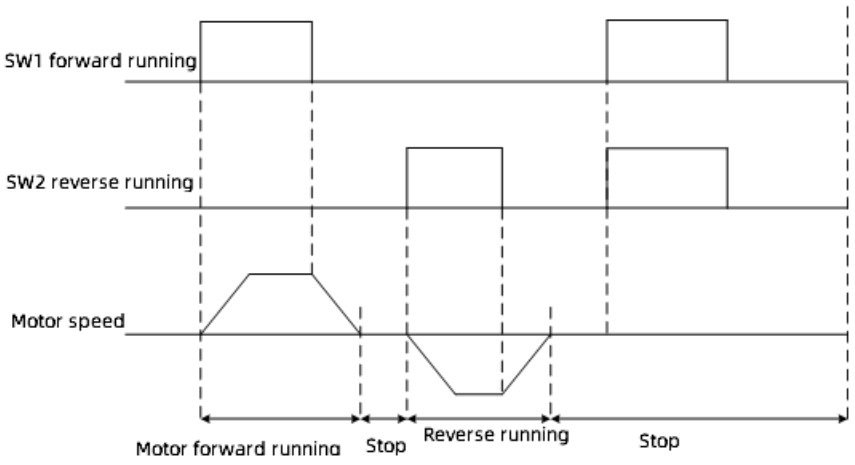


Figure 9-7 Sequence for two-wire mode 2 (in normal conditions)

When the terminal functions are not set correctly, the motor does not run when SW1 closes. When SW1 opens and SW2 closes, the motor does not run. When SW1 and SW2 both open or close, the motor does not run, as shown in the following figure.

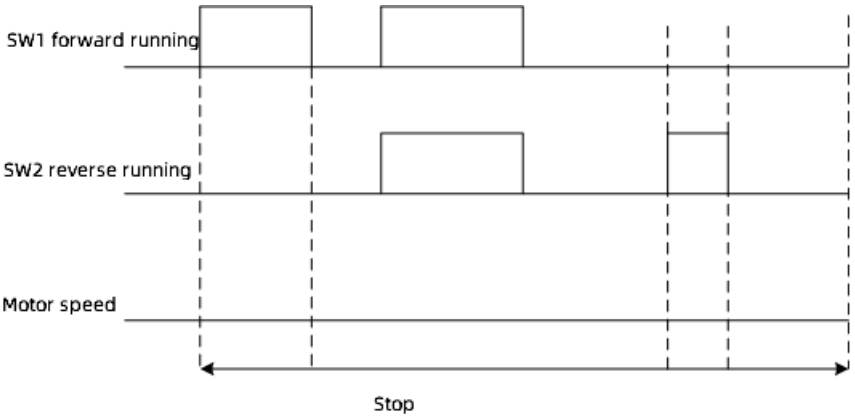


Figure 9-8 Sequence for two-wire mode 2 (in abnormal conditions)

4. Two-wire mode 3

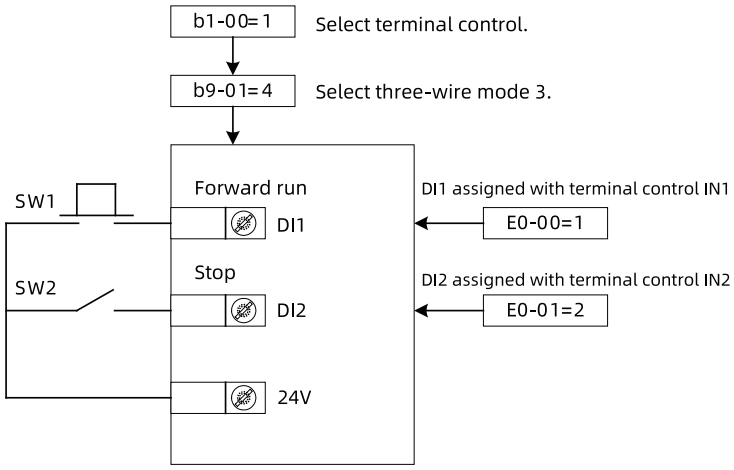
Set b9-01 [Terminal start/stop module A mode] to 4 [IN1P (rising edge) for start, IN2 for stop]. In this mode, two DIs are connected for setting functions IN1 and IN2. The rising edge of IN1 is used for, and IN2 is used for stop. The following shows how to set parameters for assigning DI1 with start and DI2 with stop functions.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	4 [IN1P (rising edge) for start, IN2 for stop]	In this mode, two DIs are connected for setting functions IN1 and IN2, The rising edge of IN1 is used to control forward start, and IN2 is used for stop.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function selection	2 [Terminal start/stop module A_IN2]	Stop

Note: b9-01 and E0-00\E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 function selection] to 2 [Terminal start/stop module A_IN2] to start through DI1 and stop through DI2.

The wiring and parameter setting for two-wire mode 3 are shown in the following figure, in which SW2 is normally closed and SW1 is normally open. When SW1 and SW2 close, the motor runs. When SW2 opens, the motor stops.



SW1	SW2	Operation command
X	0	Stop
0->1	1	Operation

Figure 9-9 Wiring and parameter setting for two-wire mode 3

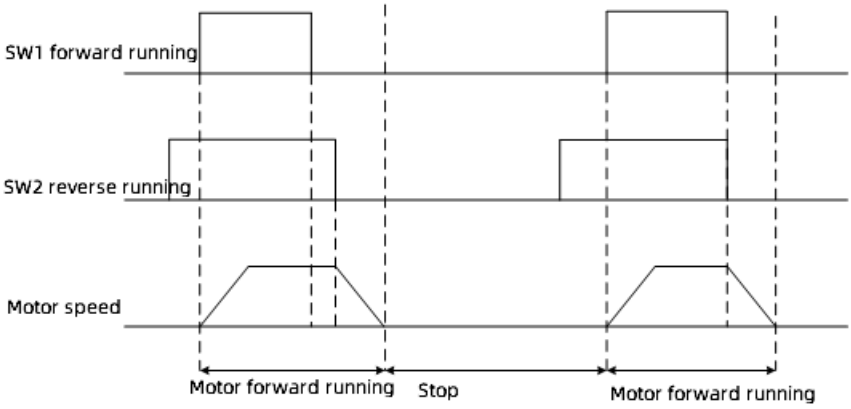


Figure 9-10 Sequence for two-wire mode 3 (in normal conditions)

When the terminal functions are not correctly set, and control switches SW2 and SW1 close, the motor does not execute the start command, as shown below.

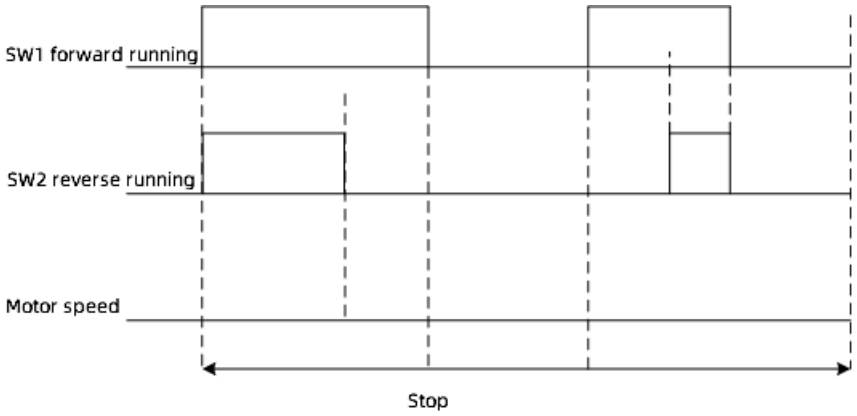


Figure 9-11 Sequence for two-wire mode 3 (in abnormal conditions)

5. Three-wire mode 1

Set b9-01 [Terminal start/stop module A mode] to 5 [IN1P (rising edge) for start, IN2 for stop, and IN3 for direction]. In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. IN2 is used to control stop. IN3 is used to control the operating direction.

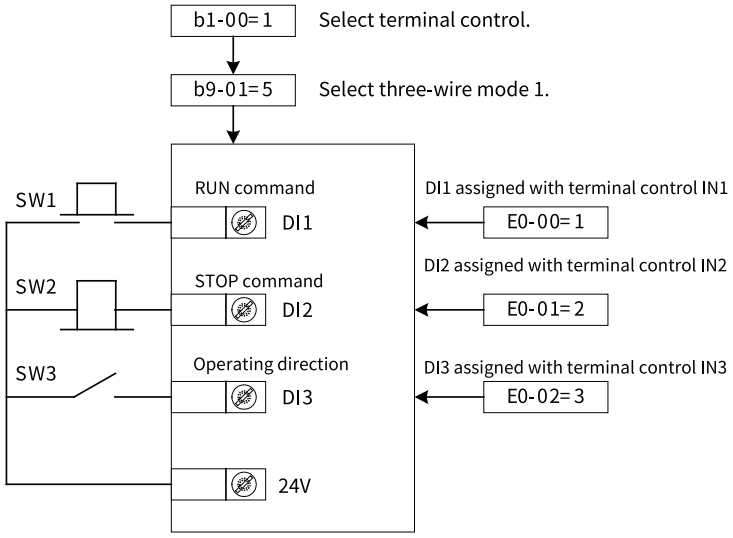
For example, DI1 controls start of forward run, DI2 control the stop function, and DI3 controls the operating direction. The parameters are set as follows.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	5 [IN1P (rising edge) FOR start, IN2 for stop, and IN3 for direction]	In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control forward start. IN2 is used to control the stop function, and IN3 is used to control the operating direction.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01 (F4-04)	DI2 function selection	2 [Terminal start/stop module A_IN2]	Stop
E0-02	D13 function selection	3 [Terminal start/stop module A_IN3]	Operating direction

Note: b9-01 and E0-00/E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 terminal function selection] to 1 [Terminal A control_IN1], E0-01 [DI2 terminal function selection] to 2 [Terminal A control_IN2], and E0-02 [DI3 terminal function selection] to 3 [Terminal A_IN3] to control forward run through DI1, stop through DI2, and operating direction through DI3.

The wiring and parameter setting for three-wire mode 1 are shown in the following figure, in which SW2 is normally closed and SW1/SW3 are normally open. When SW2 and SW1 close, the drive starts to run. If SW3 opens, the motor rotates in the forward direction. If SW3 closes, the motor rotates in reverse direction. The drive stops immediately at the moment when SW2 opens. SW2 must remain closed during normal startup and operation. Commands from SW1 takes effect immediately as soon as SW1 is closes.



SW1	SW2	SW3	Operation command
X	0	X	Stop
0->1	1	0	Forward
0->1	1	1	Reverse

Figure 9-12 Wiring and parameter setting for three-wire mode 1

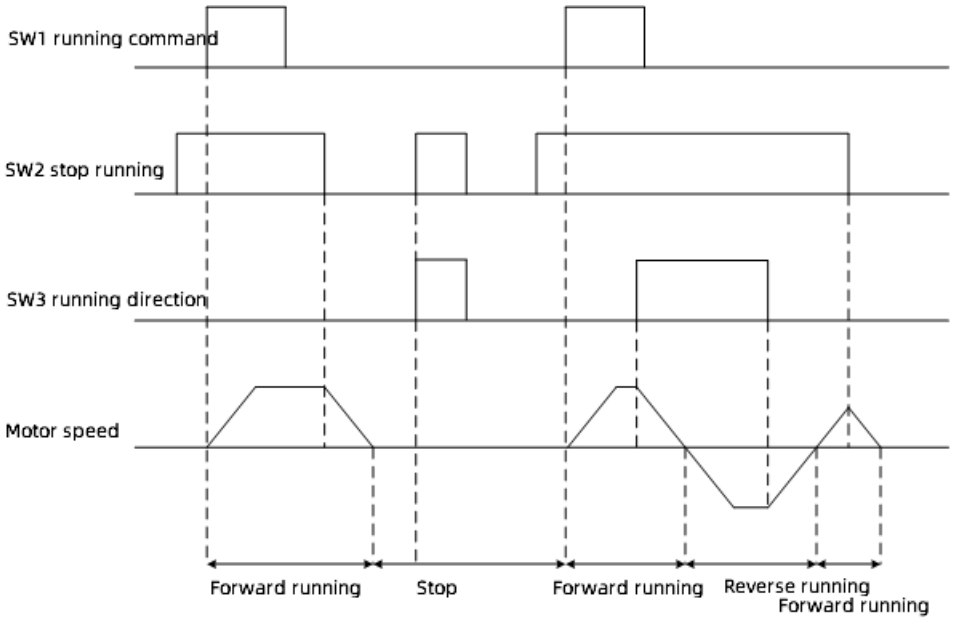


Figure 9-13 Three-wire mode 1 sequence

6. Three-wire mode 2

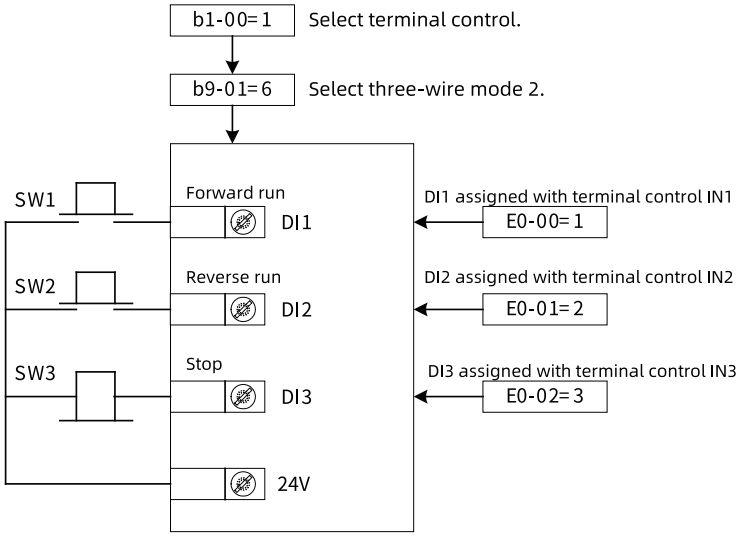
Set b9-01 [Terminal start/stop module A mode] to 6 [IN1P (rising edge) for forward start, IN2P (rising edge) for reverse start, and IN3 for stop]. In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run. The rising edge of IN2 is used to start of reverse run, and IN3 is used for stop. The following shows how to set parameters for controlling forward run through DI1, reverse run through DI2, and stop through DI3.

Param.	Name	Setpoint	Description
b9-01 (F4-01)	Mode of terminal start/stop module A	6 [IN1P (rising edge) for start, IN2P (rising edge) for reverse start, and IN3 for stop]	In this mode, three DIs are connected for setting functions IN1/IN2/IN3. The rising edge of IN1 is used to control start of forward run, IN2 is used to control start of reverse run, and IN3 is used for stop.
E0-00 (F4-03)	DI1 function selection	1 [Terminal start/stop module A_IN1]	Forward start
E0-01 (F4-04)	DI2 function selection	2 [Terminal start/stop module A_IN2]	Reverse start
E0-02	D13 function selection	3 [Terminal start/stop module A_IN3]	Stop

Note: b9-01 and E0-00\E0-01 are mapped to F4-01, F4-03, and F4-04 in group F. The two sets of parameters are equivalent.

Set E0-00 [DI1 terminal function selection] to 1 [Terminal A control_IN1], E0-01 [DI2 terminal function selection] to 2 [Terminal A control_IN2], and E0-02 [DI3 terminal function selection] to 3 [Terminal A control_IN3] to control forward run through DI1, reverse run through DI2, and stop through DI3.

The wiring and parameter setting for two-wire mode 2 are shown in the following figure, in which SW3 is normally closed and SW1/SW2 are normally open. If you press SW1 when SW3 closes, the drive runs forwardly. If you press SW2 when SW3 closes, the drive runs reversely. When SW3 opens, the drive stops immediately. During normal start-up and operation, SW3 must remain in the closed state. Commands from SW1 and SW2 take effect immediately as soon as SW1 and SW2 close.



SW1	SW2	SW3	Operation command
X	X	0	Stop
0->1	X	1	Forward
X	0->1	1	Reverse

Figure 9-14 Wiring and parameter setting for three-wire mode 2

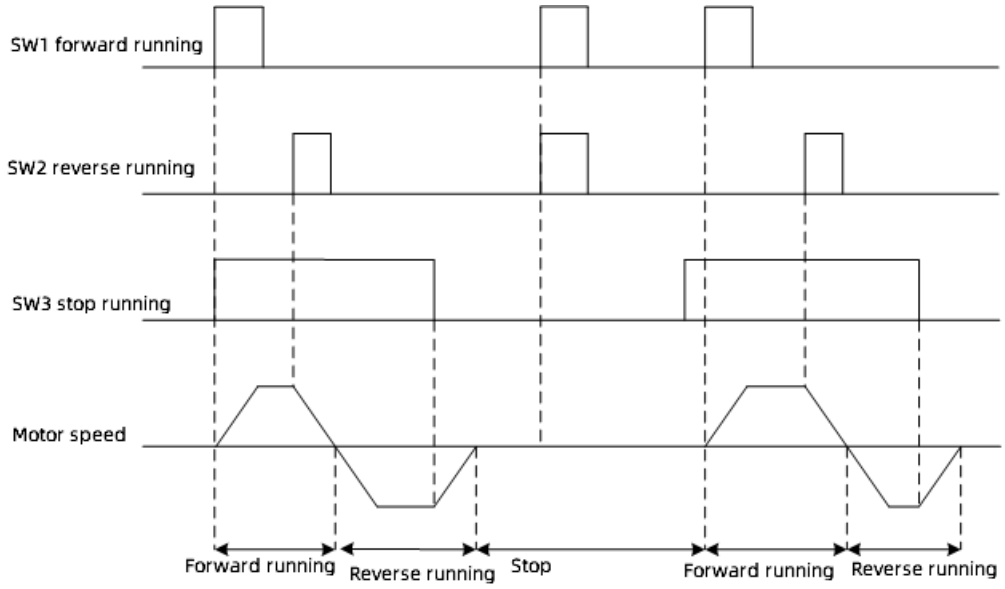


Figure 9-15 Sequence for three-wire mode 2

Application instance

The following shows how to set operation commands through terminals.

- Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
- Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
- Set b9-01 [Mode of terminal start/stop module A] to 4 [IN1P (rising edge) for start, IN2 for stop].
- Set E0-00 [DI1 function selection] to 1 [Terminal A control_IN1] and E0-01 to 2 [Terminal A control_IN2].

After preceding steps are done, enable DI1 when DI2 is valid. In this case, the drive runs at the set frequency. When DI2 opens, the drive stops immediately.

9.2.5 Operation Control Through Communication

Application scenarios

When implementing remote control of the drive, set b1-00 [Main command source of control channel 1] to 2 [Communication]. In this case, the operation command of the drive can be set through communication to achieve start/stop of the drive.

See the table below for communication protocols supported.

Model	Protocol	Hardware
DT60	EtherNet/IP and PROFINET	M12 communication terminal (CN6 and CN7)

Function description

The drive supports EtherNet/IP and PROFINET communication, which can be selected through n0-10 [Communication type selection].

Set EtherNet/IP communication parameters in group n5 and PROFINET parameters in group n6.

Param.	Name	Default value	Value range	Description
n0-10 (Fd-01)	Communication type selection	1	2: EtherNet/IP 3: PROFINET	Defines the communication type. Value description: 2: EtherNET/IP - EtherNET/IP communication applied 3: PROFINET- PROFINET communication applied
n0-60 (Fd-47)	MAC1 (EtherNet/IP, PROFINET)	0x0070	-	Displays the first byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.
n0-61 (Fd-48)	MAC2 (EtherNet/IP, PROFINET)	0x00CA	-	Displays the second byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.
n0-62 (Fd-49)	MAC3 (EtherNet/IP, PROFINET)	0x004D	-	Displays the third byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.
n0-63 (Fd-50)	MAC4 (EtherNet/IP, PROFINET)	0x00AA	-	Displays the fourth byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.
n3-64 (Fd-51)	MAC5 (EtherNet/IP, PROFINET)	0x00AA	-	Displays the fifth byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.
n3-65 (Fd-52)	MAC6 (EtherNet/IP, PROFINET)	0x00AA	-	Displays the least significant byte of the MAC address. Note: The first three bytes of the MAC address represent the supplier code and the last three bytes represent the manufacturer serial number.

1. When setting n0-10 [Communication type selection] to 2 [EtherNet/IP], select EtherNet/IP as the communication protocol and configure related communication parameters in group n5.

Param.	Name	Default value	Value range	Description
n5-00 (Fd-58)	DHCP enable	0	0: Disable 1: Enable	Enables/disables DHCP of the drive. Value description: 0: Disabled - DHCP function disabled 1: Enabled - DHCP function enabled Note: After enabling DHCP, the IP address-related parameters n5-01 to n5-12 are invalid, and IP addresses are assigned by the IP assignment tool of DHCP.
n5-01 (Fd-59)	Most significant byte of the IP address	0	0 to 255	Defines the most significant byte of the IP address. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-02 (Fd-60)	Second most significant byte of the IP address	0	0 to 255	Defines the second most significant byte of the IP address. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-03 (Fd-61)	Third byte of the IP address	0	0 to 255	Defines the third byte of the IP address. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-04 (Fd-62)	Least significant byte of the IP address	0	0 to 255	Defines the least significant byte of the IP address. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-05 (Fd-63)	Most significant byte of the subnet mask	0	0 to 255	Defines the most significant byte of subnet mask. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-06 (Fd-64)	Second most significant byte of the subnet mask	0	0 to 255	Defines the second most significant byte of subnet mask. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-07 (Fd-65)	Third byte of subnet mask	0	0 to 255	Defines the third byte of the subnet mask. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.

Param.	Name	Default value	Value range	Description
n5-08 (Fd-66)	Least significant byte of the subnet mask	0	0 to 255	Defines the least significant byte of subnet mask. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-09 (Fd-67)	Most significant byte of the gateway	0	0 to 255	Defines the most significant byte of the gateway. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-10 (Fd-68)	Second most significant byte of the gateway	0	0 to 255	Defines the second most significant byte of gateway. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-11 (Fd-69)	Third byte of gateway	0	0 to 255	Defines the third byte of the gateway. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.
n5-12 (Fd-70)	Least significant byte of the gateway	0	0 to 255	Defines the least significant byte of gateway. Note: The setting range is 0 to 255. Set this parameter based on actual scenarios.

2. When setting n0-10 [Communication type selection] to 3 [PROFINET], select the PROFINET communication protocol and configure the relevant communication parameters in group n6.

Param.	Name	Default value	Value range	Description
n6-01 (Fd-76)	Most significant byte of the IP address	0	0 to 255	Defines the most significant byte of the IP address. Note: It is displayed only after the PN slave and master are connected properly. The setting range is 0 to 255. It is automatically set after the PN master configures and assigns the device name.
n6-02 (Fd-77)	Second most significant byte of the IP address	0	0 to 255	Defines the second most significant byte of the IP address. Note: Same as "Highest byte of IP address"
n6-03 (Fd-78)	Third byte of the IP address	0	0 to 255	Defines the third byte of the IP address. Note: Same as "Highest byte of IP address"
n6-04 (Fd-79)	Least significant byte of the IP address	0	0 to 255	Defines the least significant byte of the IP address. Note: Same as "Highest byte of IP address"

Param.	Name	Default value	Value range	Description
n6-05 (Fd-80)	Most significant byte of the subnet mask	0	0 to 255	Defines the most significant byte of subnet mask. Note: Same as "Highest byte of IP address"
n6-06 (Fd-81)	Second most significant byte of the subnet mask	0	0 to 255	Defines the second most significant byte of subnet mask. Note: Same as "Highest byte of IP address"
n6-07 (Fd-82)	Third byte of subnet mask	0	0 to 255	Defines the third byte of the subnet mask. Note: Same as "Highest byte of IP address"
n6-08 (Fd-83)	Least significant byte of the subnet mask	0	0 to 255	Defines the least significant byte of subnet mask. Note: Same as "Highest byte of IP address"
n6-09 (Fd-84)	Most significant byte of the gateway	0	0 to 255	Defines the most significant byte of gateway address. Note: Same as "Highest byte of IP address"
n6-10 (Fd-85)	Second most significant byte of the gateway	0	0 to 255	Defines the second most significant byte of gateway address. Note: Same as "Highest byte of IP address"
n6-11 (Fd-86)	Third byte of gateway	0	0 to 255	Defines the third byte of the gateway address. Note: Same as "Highest byte of IP address"
n6-12 (Fd-87)	Least significant byte of the gateway	0	0 to 255	Defines the least significant byte of gateway address. Note: Same as "Highest byte of IP address"

Communication address

Set F0-03 [Main command source of control channel 1] to 2 [Communication] and configure the communication parameters correctly. After sending a command to the control command address of the drive according to the communication protocol, you can control the start, stop, forward rotation, reverse rotation, jog, and fault reset of the drive. The following communication addresses are supported by the drive for control commands.

Comm. address		Description
Control word 2 set through communication	7311H	The setpoint of 7311H is in decimal. References corresponding to different values are shown below. 0: Stop mode set by F2-17 (Stop mode) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop mode set by F2-17 (Stop mode) 7: Reset fault 8: Emergency stop For example, write 1 to 7311H to control forward run of the drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. bit0: ON_OFF1; 0: Stop, 0-1: Run bit01: OFF2; 0: stop bit02: OFF3; 0: stop bit03: Running allowed; 1: enabled bit04: Reset command; 1: reset Bit05: JOG1; 1: enable Bit06: JOG2; 1: enable bit07: opposite to the speed; 1: opposite For example, write 0x000F to 7321H to control the start of the AC drive.

Application instance

The following takes 7311H as an example to show how to set commands through communication.

1. Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect.
2. Set the corresponding communication parameters. Set Modbus communication parameters in group n2 or communication parameters in groups n4 to n6.
3. Set the command source to "Communication". Set b0-02 [Control channel selection] to 0 [Control channel 1]. Set b1-00 [Main command source of control channel 1] to 2 [Communication].
4. Send a write command from the host computer to the drive, and write 1 to 7311H to start the drive, or write 0 to stop the drive.

9.2.6 Operation Control Through User-Defined Channel

Application scenarios

The control channels 1 and 2 are configured with the user-defined command source. The following takes the control channel 1 as an example. By setting b1-00 [Main command source of control channel 1] to 3 [User-defined], you can configure control commands such as start and stop through parameter group b1.

Function description

The control commands that can be set in the user-defined mode are shown below.

- ON_OFF1 (Start/Stop): The value 0 indicates it is inactive and the value 1 indicates it is active. It is generally used together with OFF2 and OFF3 to control the drive. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered by the rising edge (0→1). When the stop command is triggered by the falling edge (1→0), the drive stops as defined by d0-04 [OFF1 stop mode].
- OFF2 (Coast to stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF3 to control the drive. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers emergency stop upon falling edge (1→0), and the drive stops as defined by d0-05 [OFF2 (coast to stop) mode].
- OFF3 (Quick stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF2 to control the drive. When ON_OFF1 is active and the OFF2 command is inactive, and no fault occurs, the OFF3 command triggers emergency stop upon falling edge (1→0), and the drive stops as defined by d0-06 [OFF3 (coast to stop) mode].
- Jog 1 (JOG1): The value 0 indicates it is inactive and the value 1 indicates it is active. When it is active, the drive runs at the frequency set by jog 1.
- Jog 2 (JOG2): The value 0 indicates it is inactive and the value 1 indicates it is active. When it is active, the drive runs at the frequency set by jog 2.
- Speed inversion: The value 0 indicates it is inactive and the value 1 indicates it is active. It controls whether the speed direction of the drive is opposite to the set direction.
- Operation permission: The value 0 indicates it is inactive and the value 1 indicates it is active. It controls whether IGBT of the drive is triggered. After ON_OFF1 is activated, the drive can operate normally only when the operation enable command is set to 1.
- Fault reset: The value 0 indicates it is inactive and the value 1 indicates it is active. When a fault occurs on the drive, the fault reset command is triggered upon the rising edge (0→1).

The default settings for the above user-defined control commands are as follows.

User-defined command	Setpoint
ON_OFF1 (start/stop)	0: The start command is triggered upon the rising edge (0→1).
OFF2 (Coast to stop)	1: The stop command of OFF2 is inactive.
OFF3 (Quick stop)	1: The stop command of OFF3 is inactive.
Jog 1	0: The jog 1 command is inactive.
Jog 2	0: The jog 2 command is inactive.
Speed inversion	0: Speed direction complies to the set direction.
Operation permission	1: The drive is allowed to run.
Fault reset	0: The fault reset command is inactive.

The user-defined start/stop commands include ON_OFF1, OFF2, and OFF3. You can set the values of ON_OFF1, OFF2 and OFF3 to enable start/stop control of the drive. The following table describes the user-defined start/stop commands.

Table 9–2 Description of user-defined start/stop commands

Operation mode	Command type	Setpoint	Result
Start	Normal start	ON_OFF1: 0→1	The drive starts normally.
		OFF2: 1	
		OFF3: 1	
Stop	OFF1 stop command	ON_OFF1: 1→0	The drive stops according to the OFF1 setting. The OFF1 stop mode includes decelerate to stop, coast to stop, and stop with maximum capacity.
		OFF2: 1	
		OFF3: 1	
	OFF2 stop command	ON_OFF1: 1	The drive stops according to the mode set by OFF2 (Coast to stop).
		OFF2: 1→0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The drive stops according to the OFF3 setting. The OFF3 stop mode includes quick stop and stop with maximum capacity.
		OFF2: 1	
		OFF3: 1→0	

Related parameters

Param.	Name	Default value	Value range	Description
b1-00	Main command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Defines the main command source of control channel 1. Value description: 0: Operating panel - The main command of control channel 1 is set through the LED operating panel. 1: Terminal - The main command of control channel 1 is set through the terminal. 2: Communication - The main command of control channel 1 is set through communication. 3: User-defined - The main command source of control channel 1 is user-defined control. The control commands can be set by b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b1-01	User-defined ON_OFF1 (start/stop) source	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined ON_OFF (start/stop) source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates OFF1 start/stop is active. Value description: 0: Inactive - This function is inactive. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-02	User-defined OFF2 (coast to stop) source 1	1	0: Active 1: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined OFF2 (coast to stop) source 1. Bit signal = 0 indicates OFF2 stop is active. Bit signal = 1 indicates this function is inactive. Value description: 0: Active - OFF2 (Coast to stop) is active. 1: Inactive - OFF2 (Coast to stop) is inactive. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window. Note:There are three sources for OFF2 (coast to stop) of control channel 1: b1-02, b2-00, and b2-01. If any one of the sources is active, OFF2 (coast to stop) command is active.
b1-03	User-defined OFF3 (quick stop) source 1	1	0: Active 1: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined OFF3 (quick stop) source 1. Bit signal = 0 indicates OFF3 stop is active. Bit signal = 1 indicates this function is inactive. Value description: 0: Active - OFF2 (Coast to stop) is active. 1: Inactive - OFF2 (Coast to stop) is inactive. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window. Note: There are three sources of OFF3 (quick stop) of control channel 1: b1-03, b2-02, and b2-03. If any one of the sources is active, OFF3 (quick stop) command is active.
b1-04	User-defined operation permission source	1	0: Operation inhibited 1: Operation allowed 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined operation permission source. Bit signal = 0 indicates operation is not allowed. Bit signal = 1 indicates operation is allowed. Value description: 0: Operation inhibited 1: Operation allowed 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on the B connector, which can be selected through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-05	User-defined fault reset source 1	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined fault reset source 1. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Value description: 0: Inactive - Indicates that the reset is inactive. 1: Active - Indicates that the fault reset command is active, and the fault can be reset. 3 to 12: DI1 to DI10 - Depends on the DI terminal status. Other: B connector - Depends on the B connector, which can be selected through the pop-up window. Note: There are three sources of user-defined fault reset for control channel 1: b1-05, b2-04, and b2-05. If any one of the sources is active, the user-defined fault reset command is active.
b1-06	User-defined jog 1 command source	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines user-defined jog (JOG1) source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Value description: 0: Inactive - Indicates that jog is inactive. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on other B connectors, which can be selected through the pop-up window.
b1-07	User-defined jog 2 source	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined jog 2 source. Bit signal = 0 indicates this function is inactive. Bit signal = 1 indicates this function is active. Value description: 0: Inactive - Indicates that jog is inactive. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on the B connector, which can be selected through the pop-up window.
b1-08	User-defined speed inversion source	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined speed inversion source. Bit signal = 0 indicates the speed is not inverted. Bit signal = 1 indicates the speed is inverted. Value description: 0: Inactive - Speed inversion is inactive. 1: Active - Speed inversion is active. 3 to 12: DI1 to DI10 - Depends on the state of the DI. Other: B connector - Depends on other B connectors, which can be selected through the pop-up window.

Application instance

1. Set F0-03 [Main command source of control channel 1] to 3 [User-defined] to set user-defined control as the command source.
2. Set b1-01 [User-defined ON_OFF1 (start/stop) source] to 3 [DI1].
3. Set E0-00 [DI1 terminal function selection] to 0 [No function].
4. Set b1-02 [User-defined OFF2 (Coast to stop) source 1] to 1 [Invalid] and b1-03 [User-defined OFF3 (Quick stop) source 1] to 1 [Invalid].

After preceding steps are done, the drive starts when DI1 closes. If b1-02 and b1-03 are set to 0 during operation, the drive stops.

9.3 Frequency References

9.3.1 Setting Channel and Frequency Reference

The drive provides two channels for setting the motor frequency reference, which can change the motor operation state. Parameter group b5 corresponds to the setting channel 1, and group b6 corresponds to the setting channel 2.

Select different setting channels to switch between two different frequency references and dynamically change the frequency reference source. For example, set b5-00 [Main frequency source] to 0 [Parameter setting] to allow speed references to be set through parameters in setting channel 1. When b6-00 [Main frequency source] is set to 9 [Communication], speed references can be set through communication in setting channel 2.

You can select the active setting channel through b0-03 [Setting channel selection]. When setting channel 1 is selected, parameter group b5 is activated, and the AI is used as the speed reference. When setting channel 2 is selected, parameter group b6 is activated, and the speed reference is set through communication. See details in the following table.

Table 9–3 Setting channel selection

b0-03	Group b5	Group b6
0 [Setting channel 1]	Active	-
1 [Setting channel 2]	-	Active

The frequency reference for each setting channel is defined by the main frequency and auxiliary frequency.

Main frequency reference x Main frequency setting gain coefficient = Effective main frequency reference.

Auxiliary frequency reference x Auxiliary frequency reference gain coefficient = Effective auxiliary frequency reference.

After the preceding operations are performed on the effective main and auxiliary frequency references, the operation result is used as the input for the ramp function generator. See *"9.3.2.1 Selecting the Main Frequency Reference Source" on page 318*, *"9.3.3 Selecting the Auxiliary*

Frequency Reference Source" on page 345, and *"9.3.4 Source of Main and Auxiliary Frequency Superposition Reference" on page 347* for details on how to set the main frequency.

In addition to the main frequency and auxiliary frequency, each setting channel has two jog frequencies. Jog frequency 1 is active only when jog command 1 is active, and jog frequency 2 is active only when jog command 2 is active. For details, see *"9.3.5 Setting Jog Frequency and Additional Frequency" on page 348*.

Additional frequencies are also available. Set the additional frequency of two setting channels through b5-04 and b6-04, which is used in applications where speed regulation needs to be activated directly without acceleration/deceleration time. The additional frequency is active only during normal operation. The effective additional frequency is superimposed directly to the output of the ramp function generator. For details, see *"9.3.5 Setting Jog Frequency and Additional Frequency" on page 348*.

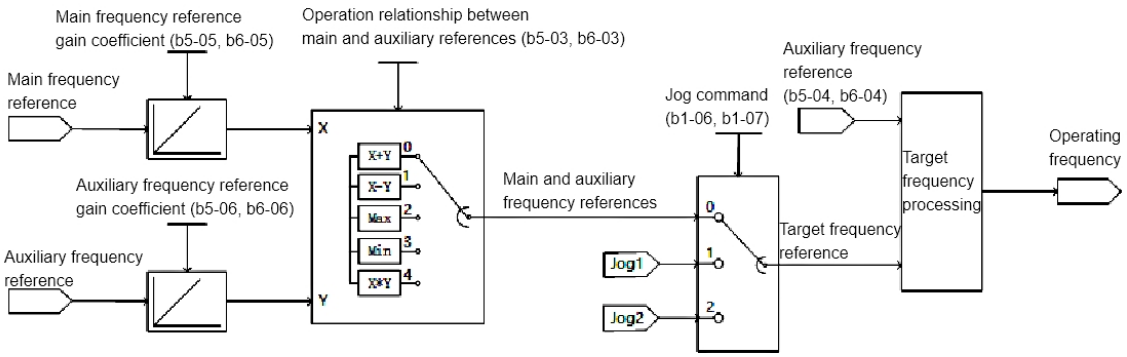


Figure 9-16 Setting channel flowchart

Related parameters

Param.	Name	Default value	Value range
b0-03	Setting channel selection	0	0: Setting channel 1 1: Setting channel 2 3 to 12: DI1 to DI10 Other: B connector
F0-29 (b5-00)	Main frequency source	0: F0-30	0: F0-30 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
b6-00	Main frequency source	0: b6-01	0: b6-01 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector

Caution

F0-29 is mapped from b5-00, and these two parameters are equivalent.

When the main frequency source is set to 0, the value of b6-01 in units of Hz is used as the main frequency. When the main frequency source is set to other options, the frequency is set in percentage, with the base value (100%) defined by A2-04 [Per-unit frequency base value].

9.3.2 Selecting the Setting Channel

9.3.2.1 Selecting the Main Frequency Reference Source

Function description

The main frequency reference can be set through digital reference, multi-reference, simple PLC, PID, communication, and F connector. You can select the source through b5-00 and b6-00.

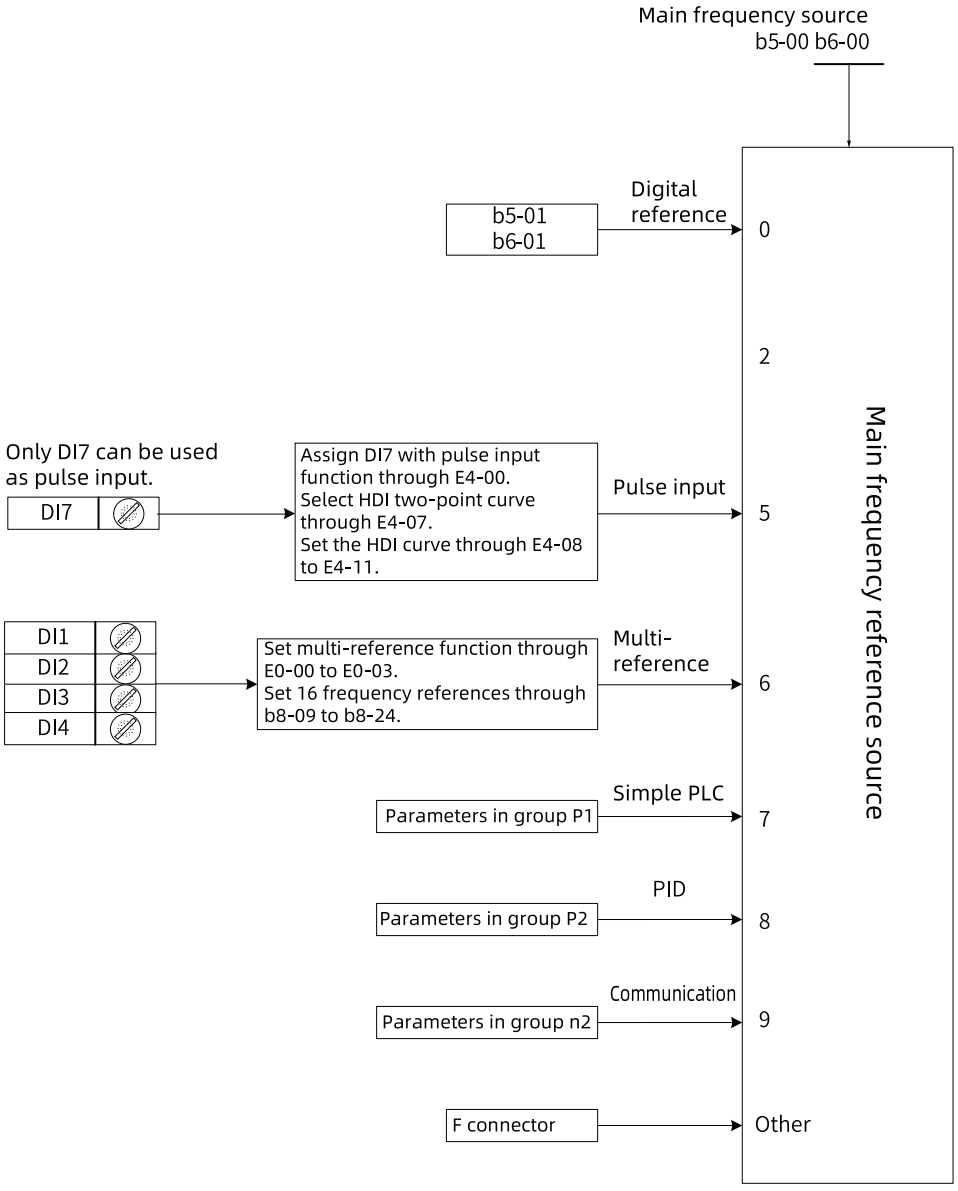


Figure 9-17 Diagram of main frequency source selection

Related parameters

Table 9–4 Parameters for setting main frequency source

Param.	Name	Default value	Value range	Description
b5-00 (F0-29)	Main frequency source	0: b5-01	0: b5-01 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the main frequency source of the setting channel 1. Value description: 0: b5-01 - The initial value of frequency reference is the value of "Digital reference of main frequency". The ▲ and ▼ keys (or the multi-function input terminal) on the operating panel can be used to change the frequency reference of the drive. When the drive is powered on again after power failure, whether the frequency adjusted by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key is saved depends on the value of P0-89 [UP/DOWN retention upon power failure]. The UP/DOWN adjustment can be cleared by the DI terminal assigned with the "UP/DOWN adjustment clear" function. 6: Multi-reference - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The main frequency is set through PID. 9: Communication - The main frequency is set through communication. The frequency can be set through remote communication. Other: F connector After the parameter No. of a floating connector is set, the connector value is read as the frequency. It is used for extension of common sources. Note: The addresses for the frequency set through communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setpoint is defined by n0-13. When the frequency is written through communication by using address 0x7310, the setpoint is defined by n0-14.

When the main frequency source is set to "0: Digital reference," the value of b5-01 or b6-01 in units of Hz is used as the main frequency reference.

When the main frequency source is set to any other option, the frequency is set in percentages, with the base value (100%) defined by A2-04 [Per-unit frequency base value].

9.3.2.2 Setting Main Frequency Through Parameter

Function description

When setting b5-00 [Main frequency source] to 0 [b5-01], the main frequency reference of the drive can be input through b5-01 [Digital reference of main frequency] in units of Hz.

Related parameters

Param.	Name	Default value	Value range	Description
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 Hz to A2-17	Defines the target frequency. This parameter is active when the main frequency source is set to a parameter. b5-01 and F0-30 have the same function. b5-01 changes automatically along with F0-30.

Application instance

When F0-30 or b5-01 [Digital reference of main frequency] is set to 30 Hz, the frequency reference of the drive is 30 Hz.

9.3.2.3 Setting the Main Frequency Through Operating Panel

Function description

The drive supports the built-in operating panel of the drive. You can set the main frequency of the drive by pressing the key on the operating panel.

Related parameters

Param.	Name	Default value	Value range	Description
F0-30 (b5-01)	Digital reference of main frequency	50.00 Hz	0.00 Hz to A2-17	Defines the target frequency. This parameter is active when the main frequency source is set to a parameter. b5-01 and F0-30 have the same function. After F0-30 is modified, b5-01 is automatically synchronized.
P0-87	UP/DOWN base during operation	0	0: Operating frequency 1: Frequency reference	Defines the frequency base adjusted by UP/DOWN key during operation. Value description: 0: Operating frequency - The target frequency increases or decreases based on the operating frequency during UP/DOWN adjustment. 1: Frequency reference - The target frequency increases or decreases based on the frequency reference during UP/DOWN adjustment.

Param.	Name	Default value	Value range	Description
P0-88	UP/DOWN retention upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UP/DOWN is retentive when the drive stops. Value description: 0: Non-retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. After the drive stops, the adjusted frequency is cleared. 1: Retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. After the drive stops, the adjusted frequency is reserved.
P0-89	UP/DOWN retention upon power failure	0	0: Disable 1: Enable	Defines whether the frequency corrected by UP/DOWN is retentive upon power failure. Value description: 0: Not enabled - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. The adjusted frequency is cleared upon power-off. 1: Enabled - Set b5-01 and b6-01 [Digital reference of main frequency] through the operating panel, then adjust the frequency using the ▲ and ▼ keys on the operating panel or the UP and DOWN terminals. The adjusted frequency is saved upon power-off.

Application instance

You can set the frequency by modifying the parameters or modifying the frequency by pressing the UP/DOWN key on the operating panel.

- Modifying frequency reference through operating panel

  1. After switch-on, press  to enter the parameter setting interface, and then press  ,  , and  to locate b0-03 [Setting channel selection] and set it to 0. Finally, press  to confirm the settings.
  2. Locate b5-00 [Main frequency source] and set it to 0 (b5-01).
  3. Locate b5-01 [Digital reference of main frequency] and set it to 20.00. That is, the output frequency of setting channel 1 is set to 20.00 Hz. In this case, the operating panel LED flashes, displaying 20.00.

- Press UP/DOWN key to modify the frequency value.
  Set the main frequency source to a parameter through the operating panel, and set the frequency to 20.00 Hz.

  Quickly set the frequency references when the drive is at a standstill through  and  or UP and DOWN terminals. The following shows how to correct the frequency of 20.00 Hz to 19.99 Hz or 20.01 Hz through the operating panel.

  1. For intuitive display, make the operating panel LED flash, displaying  .
  2. Click  once, and the operating panel flashes, displaying  .
  3. On the basis of 19.99 Hz, click  twice to make the LED flash, displaying  .

     To make the frequency reference corrected by the UP/DOWN key to be restored at next power-on, set P0-89 [UP/DOWN retention upon power failure] to "1: Enable".

     The frequency reference can also be corrected through  ,  , or UP/DOWN terminals quickly during trial run of the drive.

  The following shows how to change the current target frequency through  and  when the drive is accelerating to 10 Hz during acceleration from 0.00 Hz to 20.00 Hz.

  1. Set P0-87 [UP/DOWN base during operation] to "0: Operating frequency" through the operating panel.
  2. For intuitive display, make the operating panel display the current operating frequency.
  3. Run the drive. When the operating frequency reaches 10.00Hz, press the key once. When the frequency displayed by the operating panel is kept at 10.01 Hz and acceleration is deactivated, click the key once to make the operating panel keep displaying 10.02 Hz.

You can set whether the frequency reference corrected by UP/DOWN during operation is retained at stop through P0-88[UP/DOWN retention at stop]. To retain the frequency, set P0-88 [UP/DOWN retention at stop] to 1 [Retentive] and P0-89 [UP/DOWN retention power failure] to 1 [Retentive].

9.3.2.4 Setting the Main Frequency through Multi-references

Application scenarios

This mode is suitable for applications where the operating frequency of the drive does not require continuous adjustment, and only several frequency values need to be used.

Function description

Set b5-00 [Main frequency source] to 6 [Multi-reference]. Up to 16 multi-references can be set, which can be selected through b8-03 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit3] or combination of input signals from the four DI terminals. You can also set multi-references through fewer than four DIs. In this case, missing digits are populated with 0.

The relationship between the number of multi-references and the number of DI terminals is shown below.

- Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0.
- Three to four multi-references: Two DIs (K1 and K2); b8-05 and b8-06 are set to 0.

- Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0.
- Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)

Related parameters

The multi-references are set through parameters in group b8, as listed in the following table.

Table 9–5 Parameters for multi-references

Param.	Name	Default value	Value range	Description
b8-03	Multi-reference selection bit0	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit0. Multi-reference bit1 to bit3 are used together to support 16 multi-references in total. Value description: 0: 0 - The value of multi-reference bit0 is 0. 1: 1 - The value of multi-reference bit0 is 1. 3 to 12: DI1 to DI10 - Depends on the final state of the DI. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Other: B connector - Depends on the B connector, which can be selected through the pop-up window. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Note: A total of 16 multi-reference can be supported through binary combination of b8-03 [Multi-reference selection bit0], b8-04 [Multi-reference selection bit1], b8-05 [Multi-reference selection bit2], and b8-06 [Multi-reference selection bit3]. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.
b8-04	Multi-reference selection bit1	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit1. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-05	Multi-reference selection bit2	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit2. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-06	Multi-reference selection bit3	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit3. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.

Param.	Name	Default value	Value range	Description
(b8-08) (F0-38)	Source of multi-reference 0	0	0: F0-39 5: PID 6: b5-01/b6-01 Other: F connector	Defines the source of multi-reference 0. b5-08 [Source of multi-reference 0] is mapped to F0-38 in group F. The two parameters have the same function. Value description: 0: F0-39 - Multi-reference 0 is set by F0-39. 5: PID - Multi-reference 0 is set by PID. 6: b5-01/b6-01 - Multi-reference 0 is set by b5-01/b6-01. The corresponding frequency per-unit value is calculated based on the frequency reference. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the main frequency reference. It is used for extension of common sources. Note: When the value of b8-02 [Multi-reference unit selection] is not 0, the source of multi-reference 0 can only be set to 0 [b8-09], and other setpoints are invalid.
b8-09 (F0-39)	Multi-reference 0	0.00 %	b8-42 and b8-43	The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Note: 1. The unit of the multi-reference value is percentage (%). The drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states that correspond to 16 frequency setpoints. 2. This parameter defines the frequency reference of each speed when the frequency reference source is set to multi-reference. b8-09 to b8-24 correspond to a total of 16 frequency setpoints for 16 multi-references numbered from 0 to 15. The frequency setpoint is calculated as a percentage to the rated frequency. The value 100% corresponds to the rated motor frequency.
b8-10 (F0-40)	Multi-reference 1	0.00 %	b8-42 and b8-43	
b8-11 (F0-41)	Multi-reference 2	0.00 %	b8-42 and b8-43	
b8-12 (F0-42)	Multi-reference 3	0.00 %	b8-42 and b8-43	
b8-13	Multi-reference 4	0.00 %	b8-42 and b8-43	
b8-14	Multi-reference 5	0.00 %	b8-42 and b8-43	
b8-15	Multi-reference 6	0.00 %	b8-42 and b8-43	
b8-16	Multi-reference 7	0.00 %	b8-42 and b8-43	
b8-17	Multi-reference 8	0.00 %	b8-42 and b8-43	
b8-18	Multi-reference 9	0.00 %	b8-42 and b8-43	
b8-19	Multi-reference 10	0.00 %	b8-42 and b8-43	
b8-20	Multi-reference 11	0.00 %	b8-42 and b8-43	
b8-21	Multi-reference 12	0.00 %	b8-42 and b8-43	
b8-22	Multi-reference 13	0.00 %	b8-42 and b8-43	
b8-23	Multi-reference 14	0.00 %	b8-42 and b8-43	
b8-24	Multi-reference 15	0.00 %	b8-42 and b8-43	

b8-08 to b8-12 are mapped to F0-38 to F0-42 in group F. The two parameter sets are equivalent.

To use multi-reference as the main frequency reference source, assign functions 12...15 to the DIs or set b8-03 [Multi-reference selection bit0]...b8-06 [Multi-reference selection bit3].

The functions assigned to DI terminals must be different. By default, DI4 is assigned with multi-reference terminal 1.

Table 9–6 Multi-reference input terminal

Param.	Name	Setpoint	Description
E0-00 (F4-03)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F4-04)	DI2 function selection	13	Multi-reference terminal 2
E0-02 (F4-05)	DI3 function selection	14	Multi-reference terminal 3
E0-03 (F4-06)	DI4 function selection	15	Multi-reference terminal 4

Application instance

In the following figure, DI1, DI2, DI3, and DI4 are used as the multi-reference input terminals, which form a four-bit binary number. The state combinations of these terminals represent different multi-reference values. When (DI4, DI3, DI2, DI1) = (0, 0, 1, 0), the state combination value is 2, corresponding to the frequency set by b8-11 [Multi-reference value 2]. The target operating frequency is calculated automatically based on b8-11 (Multi-reference 2) x A2-04 (Per-unit base value of frequency). The following figure shows the frequency setting.

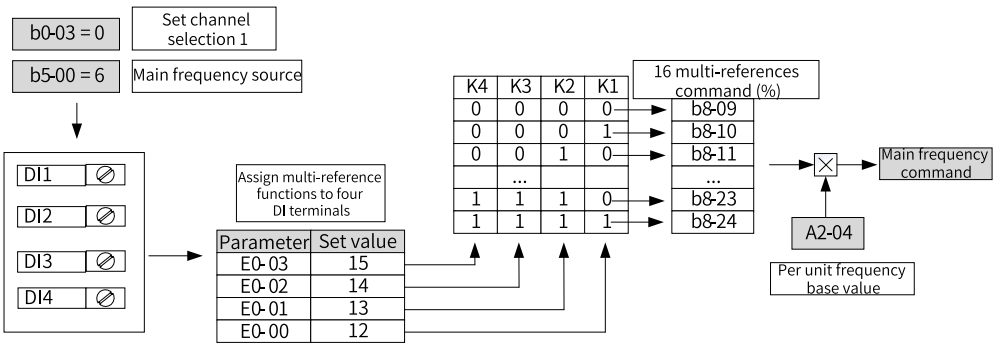


Figure 9-18 Multi-speed mode setting

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values, For details, see the following table.

Table 9–7 Description of multi-reference function

K4	K3	K2	K1	Reference	Parameter
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08 = 0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11

K4	K3	K2	K1	Reference	Parameter
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

In the preceding section, the multi-reference values are determined by assigning functions to terminals through parameters in group E0. You can also set the multi-reference values through parameters in group b8.

9.3.2.5 Setting Main Frequency Through Simple PLC

Application scenarios

In industrial applications where the AC motor only needs to execute start/stop, timed segment-based speed regulation, and automatic forward/reverse run, you can use the simple PLC to achieve control functions without a PLC.

The simple PLC can directly set the operating speed, direction, and operating time of each phase. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor operates cyclically within timed period at different speed and direction.

Function description

Set b5-00 [Main frequency source] to 7 [Simple PLC] to select the PLC as the main frequency source.

Related parameters

Table 9–8 Related parameters

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module	0	0: Disable 1: Enable	Used to enable/disable the simple PLC module. Value description: 0: Disable - The simple PLC module is disabled. The current STEP, current STEP operating time (hours and seconds), and STEP per-unit value of the simple PLC module are cleared. 1: Enable - The simple PLC module is enabled, but whether the calculation and output of the PLC module are normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines the source for enabling simple PLC calculation. Value description: 0: Inactive - The simple PLC calculation function is inactive. 1: Active - The simple PLC calculation function is active. 3 to 12: DI1 to DI10 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI10. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Other: B connector - Whether the simple PLC calculation function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the operating time. It also outputs the current STEP and current STEP operating time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the current step. 2. If the simple PLC calculation is disabled, the output current STEP, current STEP operating time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default value	Value range	Description
P1-02	Simple PLC operation mode	0	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running one cycle 3: Output 0 after running for one cycle	Defines the operation mode of the simple PLC. Value description: 0: Keep multi-reference 0 output after running for one cycle - The output of multi-speed reference 0 is maintained after the end of a single cycle of the simple PLC module. 1: Keep final values after running for one cycle - The final value is output after the simple PLC module runs for one cycle. 2: Repeat after running one cycle - The simple PLC module starts running again from the first STEP after completing a cycle. 3: Output 0 after running for one cycle - The PLC STEP per-unit value is output as 0 after the simple PLC module runs for one cycle. Note: 1. If this parameter is set to 0, 1, or 3, the single-cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2. If this parameter is set to 2, the simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed.
P1-03	Simple PLC function selection	0	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, and recalculated when enabled 1: Current STEP retained when calculation deactivated, and continue when enabled	Defines the simple PLC function. Value description: Ones: Retention upon power failure 0: Non-retentive - The current STEP or the current STEP operating time of the simple PLC is not saved upon power failure. 1: Retentive - The current STEP and current STEP operating time of the simple PLC is saved upon power failure. Tens: Calculation enable configuration 0: If P1-01 is disabled, the current STEP is kept. If P1-01 is enabled, operation starts from STEP0 and the operating time is calculated again. 1: When calculation (P1-01) is disabled, the current STEP is kept. When calculation (P1-01) is enabled, the drive runs from the current STEP and the current operating time continues.

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Used to reset the simple PLC status. Value description: 0: Inactive - When the simple PLC state reset is inactive, the simple PLC operates according to the setting. 1: Active - When simple PLC status reset is active, the simple PLC module returns to initial state. The simple PLC outputs the value of multi-speed reference 0 (P1-09) only when the STEP 0 is under execution by simple PLC. 3 to 12: DI1 to DI10 - Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI10. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Others: B connector - Whether the simple PLC state reset function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active.
P1-08	Simple PLC operating time unit	0	0: s (second) 1: h (hour)	Defines the simple PLC operating time unit. Value description: 0: s (second) - The simple PLC operating time is in seconds. 1: h (hour) - The simple PLC operating time is in hours.
P1-09	Multi-reference 0 set by simple PLC	0	-800.0 to +800.0	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Operating time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency. Note: It is recommended to set the operating time of multi-reference i in simple PLC to a value higher than the ramp-up/down time.

Param.	Name	Default value	Value range	Description
P1-11	Ramp-up/down time of multi-reference 0 set by simple PLC	0	0: Ramp-up/down time of ramp 1 (b7-04 [Ramp 1 ramp-up time]/b7-05 [Ramp 1 ramp-down time]) 1: Ramp-up/down time of ramp 2 (b7-10 [Ramp 2 ramp-up time]/b7-11 [Ramp 2 ramp-down time]) 2: Ramp-up/down time of ramp 3 (b7-16 [Ramp 3 ramp-up time]/b7-17 [Ramp 3 ramp-down time]) 3: Ramp-up/down time of ramp 4 (b7-22 [Ramp 4 ramp-up time]/b7-23 [Ramp 4 ramp-down time])	Defines the ramp-up/down time of multi-reference 0 set by simple PLC. Value description: 0: Ramp-up/down time of ramp 1 - The ramp-up/down time of ramp 1 (b7-04/b7-05) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 1: Ramp-up/down time of ramp 2 - The ramp-up/down time of ramp 2 (b7-10/b7-11) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 2: Ramp-up/down time of ramp 3 - The ramp-up/down time of ramp 3 (b7-16/b7-17) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 3: Ramp-up/down time of ramp 4 - The ramp-up/down time of ramp 4 (b7-22/b7-23) is used as the ramp-up/down time of multi-reference 0 set by simple PLC.
P1-12	Multi-reference 1 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-13	Operating time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Ramp-up/down time of multi-reference 1 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-15	Multi-reference 2 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-16	Operating time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Ramp-up/down time of multi-reference 2 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-18	Multi-reference 3 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-19	Operating time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-20	Ramp-up/down time of multi-reference 3 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-21	Multi-reference 4 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-22	Operating time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Ramp-up/down time of multi-reference 4 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-24	Multi-reference 5 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-25	Operating time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Ramp-up/down time of multi-reference 5 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-27	Multi-reference 6 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-28	Operating time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Ramp-up/down time of multi-reference 6 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-30	Multi-reference 7 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-31	Operating time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Ramp-up/down time of multi-reference 7 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-33	Multi-reference 8 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-34	Operating time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-35	Ramp-up/down time of multi-reference 8 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-36	Multi-reference 9 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-37	Operating time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Ramp-up/down time of multi-reference 9 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-39	Multi-reference 10 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-40	Operating time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Ramp-up/down time of multi-reference 10 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-42	Multi-reference 11 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-43	Operating time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Ramp-up/down time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Operating time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Ramp-up/down time of multi-reference 12 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-48	Multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-49	Operating time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-50	Ramp-up/down time of multi-reference 13 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-51	Multi-reference 14 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-52	Operating time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-53	Ramp-up/down time of multi-reference 14 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-54	Multi-reference 15 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-55	Operating time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Ramp-up/down time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

Application instance

The follow shows basic steps to set simple PLC as the main frequency source.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-00 [Main frequency source] to 7 [Simple PLC] to select simple PLC as the main frequency reference.
2. Set P1-09 [Multi-reference 0 set by simple PLC], P1-12 [Multi-reference 1 set by simple PLC], P1-15 [Multi-reference 2 set by simple PLC], P1-18 [Multi-reference 3 set by simple PLC], P1-21 [Multi-reference 4 set by simple PLC], P1-24 [Multi-reference 5 set by simple PLC], P1-27 [Multi-reference 6 set by simple PLC], P1-30 [Multi-reference 7 set by simple PLC], P1-33 [Multi-reference 8 set by simple PLC], P1-36 [Multi-reference 9 set by simple PLC], P1-39 [Multi-reference 10 set by simple PLC], P1-42 [Multi-reference 11 set by simple PLC], P1-45 [Multi-reference 12 set by simple PLC], P1-48 [Multi-reference 13 set by simple PLC], P1-51 [Multi-reference 14 set by simple PLC], and P1-54 [Multi-reference 15 set by simple PLC]. These 16 multi-reference values correspond to the frequency references of 16 STEPS of simple PLC. Set P1-10 [Operating time of multi-reference 0 set by simple PLC] and P1-11 [Ramp-up/down time of multi-reference 0 set by simple PLC] (and so on for other STEPS) to define the operating time and ramp-up/down time of STEP 0.
3. Set P1-02 to select the simple PLC operation mode.
4. Set the ones of P1-03 to configure whether the current STEP and the current STEP operating time of the simple PLC are retentive upon power-off. Set the tens of P1-03 to set the simple PLC module status when the calculation is disabled and enabled again.
5. Set P1-01 [Simple PLC calculation enable source].

- If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the operating time. It also outputs the current STEP and current STEP operating time (hours and seconds) of the simple PLC, as well as the per-unit value obtained in the current STEP.
- If the simple PLC calculation is disabled, the current STEP and current STEP operating time (hours and seconds) of the simple PLC are the values when the calculation stops. The per-unit value obtained in the simple PLC step is the value of STEP i when the calculation stops.

6. Set P1-00 to 1 to enable the simple PLC module.
   In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP0. The main frequency is set to the frequency set by STEP0, that is, multi-reference 0 (defined by P1-09). After the current STEP is performed by the simple PLC, switch to the next STEP, and the main frequency setpoint is also switched to the frequency set by the PLC.

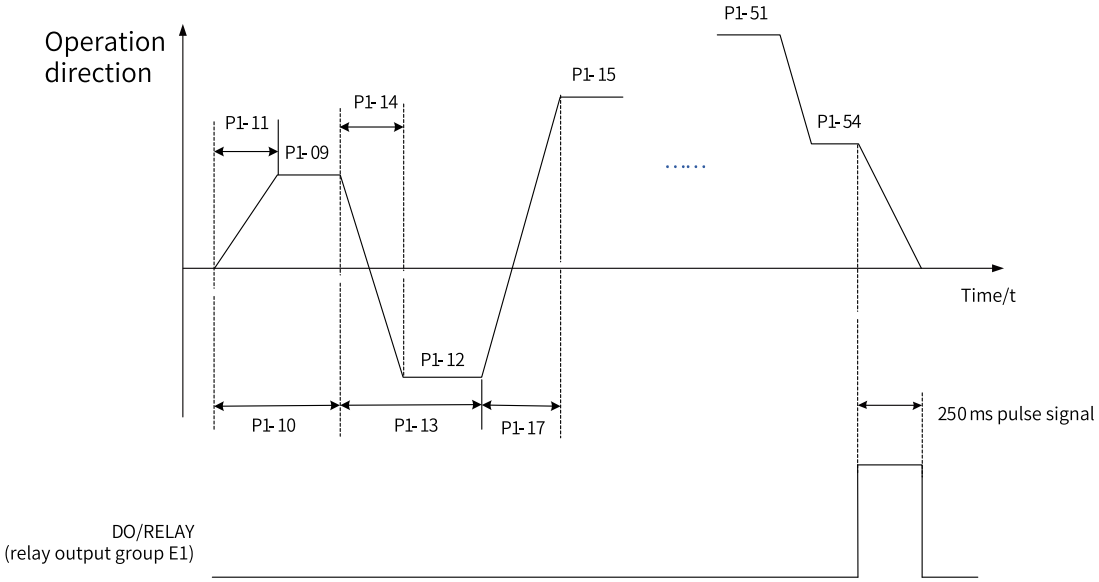


Figure 9-19 Use of simple PLC as the main frequency source

9.3.2.6 Setting Main Frequency Through PID

Application scenarios

Select the PID control output as the operating frequency, which is generally used for process closed-loop control such as constant pressure closed-loop control and constant tension closed-loop control.

Function description

Set b5-00 [Main frequency source] to 8 [PID] to select the PID output as the main frequency.

PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value

When the PID output is selected as the operating frequency, the PID output 100% corresponds to A2-04 (Per-unit base value of frequency).

PID control adjusts the PID output by modifying the proportional, integral, and derivative parameters. The PID control parameters are defined as follows.

- Proportional gain Kp: Once the deviation between the PID output and the input is generated, the PID adjusts the control output so that the controlled value changes to reduce deviation. The speed of the deviation reduction depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
- Integral time Ti: Determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
- Derivative time Td: Determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.

See detailed PID function description in *"11.6.1 Process PID Control" on page 608*.

Related parameters

Table 9–9 Related parameters

Param.	Name	Default value	Value range	Description
P2-00	Process PID	0	0: Inhibited 1: Enable Other: B connector	Defines whether PID is enabled. 0: Inhibited - The process PID is not used for calculation and the output is cleared. 1: Enabled - PID operation is performed based on parameters. Other: B connector - Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Direct acting 1: Reverse acting Other: B connector	Defines the PID action direction. 0: Direct acting - When the feedback value is lower than the PID reference, the output frequency of the drive increases. 1: Reverse acting - When the feedback value is lower than the PID reference, the output frequency of the drive decreases. Other: B connector - The PID direction is controlled by a parameter in the bit connector. The value 0 represents direct acting and the value 1 represents reverse acting.

Param.	Name	Default value	Value range	Description
P2-02	PID reference source	0	0: PID value reference 5: Multi-reference 6: Simple PLC 8: Communication Other: F connector	Defines the PID reference source. Value description: 0: PID value reference - The PID target is the value of P2-03 [PID value reference]. 5: Multi-reference - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-02 is set to 5 [Multi-reference], b8-08 [Source of multi-reference 0] cannot be set to 5 [PID reference]. 6: Simple PLC - The PID target reference is set by simple PLC. 8: Communication - The PID reference is set through remote communication. Other: F connector - The PID target reference is set by a parameter in the floating-point connector. Note: When this parameter is set to 5 [Multi-reference], b8-08 [Multi-reference 0 setting mode] cannot be set to 5 [PID reference].
P2-03	PID value reference	50.0%	0.0% to 800.0%	Used to set the PID reference value when P2-02 [PID reference source] is set to 0.
P2-04	PID feedback source	0	5: Communication Other: F connector	Defines the PID feedback channel. Value description: 5: Communication - The PID feedback is set through remote communication.
P2-14	Proportional gain Kp1 of PID parameter 1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. Note: The deviation reduction speed depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	Integral time Ti1 of PID parameter 1	2.00	0.01s to 10.00s	Defines the integral time Ti of the first parameter set in PID control. Note: It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.

Param.	Name	Default value	Value range	Description
P2-16	Derivative time Td1 of PID parameter 1	0.000	0.000s to10.000s	Defines the derivative time Td of the first group of parameters in PID control. Note: The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.
P2-17	Proportional gain Kp2 of PID parameter 2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. Note: See P2-14 for details.
P2-18	Integral time Ti2 of PID parameter 2	2.00	0.01s to 10.00s	Defines the integral time Ti of the second group of parameters in PID control. Note: See P2-15 for details.
P2-19	Derivative time Td2 of PID parameter 2	0.000	0.000s to10.000s	Defines the derivative time Td of the second group of parameters in PID control. Note: See P2-16 for details.

Param.	Name	Default value	Value range	Description
P2-26	Source of maximum PID output	0	0: 100% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the maximum PID output value, which is the per-unit value in percentage. Value description: 0: 100% - The maximum PID output value is 100%. 6: Multi-reference - When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - The maximum value of PID output is defined by simple PLC output reference. 8: PID - The maximum value of PID output is the current PID output. 9: Communication - The maximum value of PID output is set through communication. The maximum value of PID output can be inputted through remote communication. Other: F connector - The maximum PID output value is the value in the selected floating-point connector.
P2-27	Source of minimum PID output	0	0: -100% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the minimum PID output value, which is the per-unit value in percentage. Value description: 0: -100% - The minimum PID output value is -100%. 6: Multi-reference - When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - The minimum value of PID output is defined by simple PLC output reference. 8: PID - The minimum value of PID output is the current PID output. 9: Communication - The minimum value of PID output is set through communication. The minimum PID output value can be inputted through remote communication. Other: F connector - The minimum PID output value is the value in the selected floating-point connector.

Application instance

The steps for setting PID as the main frequency source are as follows.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-00 [Frequency source] to 8 [PID] to select PID as the main frequency reference source of setting channel 1.
2. Set P2-00 [General PID enable] to 1 [Enable] to enable PID.
3. Set P2-02 [PID reference source] to select the target PID reference source. When P2-02 [PID reference source] is set to 0 [PID value reference], set P2-03 [PID value reference]. The setpoint 100% of P2-03 corresponds to the value set in P2-05 [PID reference feedback range].

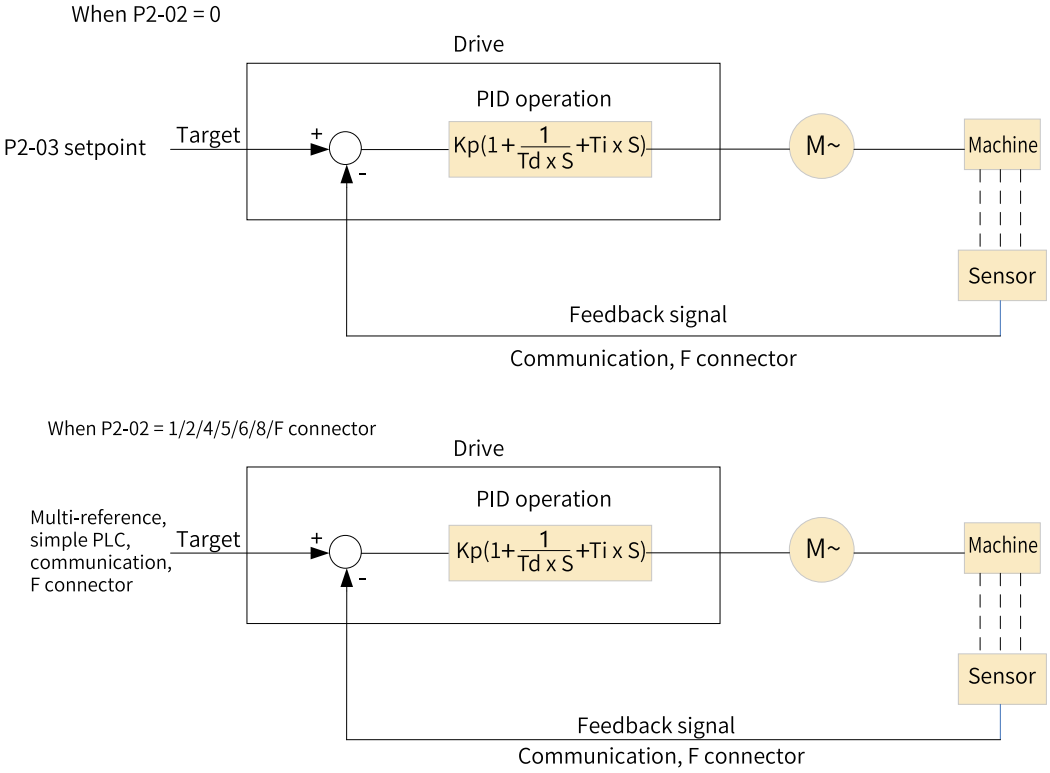


Figure 9-20 Schematic of process PID control

4. Set P2-04 [PID feedback source] to select the PID feedback source.
5. Set P2-01 [PID action direction] to select the PID action direction.
6. Set P2-26 [Maximum output value source] and P2-27 [Minimum output value source] to define the maximum output value and minimum output value of PID respectively. The PID output is between the maximum and minimum values.
   Then the main frequency of the drive is defined by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback. The main frequency of the drive also changes with the PID output.

   The following figure shows the logic of process PID control parameter configuration.

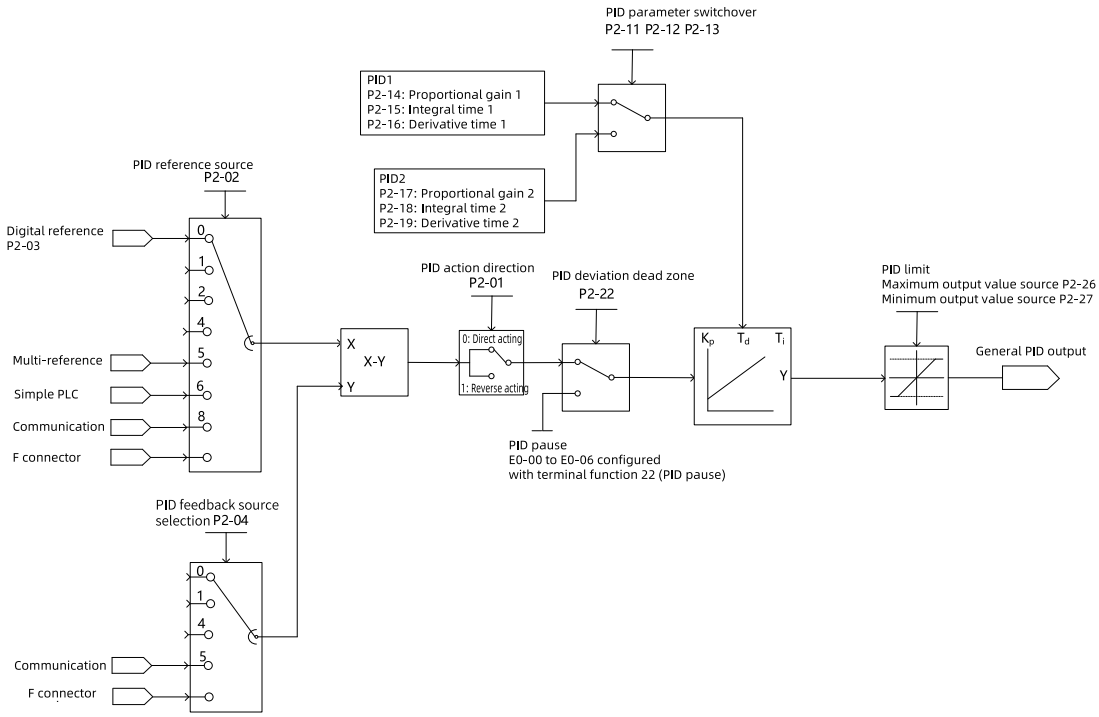


Figure 9-21 Parameter setting for process PID control

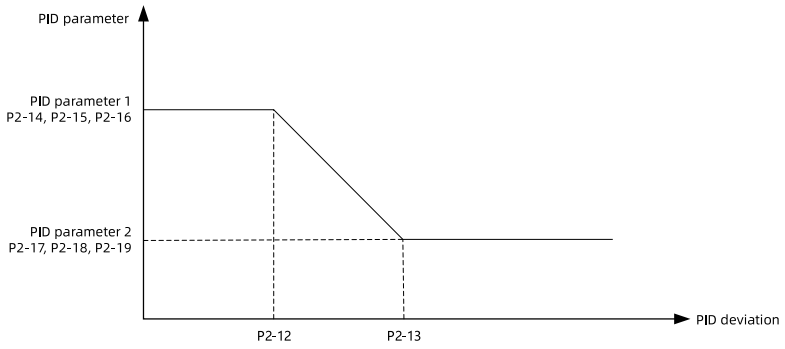


Figure 9-22 PID parameter switchover

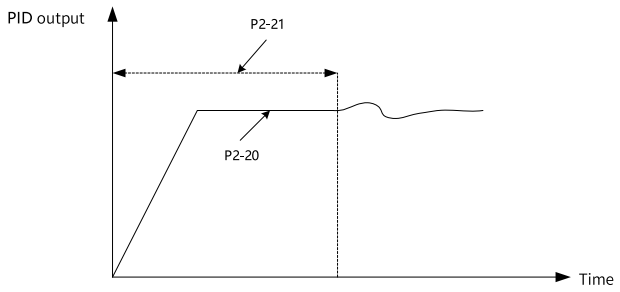


Figure 9-23 PID initial value function

You can set the maximum and minimum values of PID through P2-26 and P2-27.

For example, when the main frequency source is PID and A2-04 [Per-unit frequency base value] is 50 Hz, you can set P2-09 [PID inversion cutoff frequency] to 2 Hz, P2-27 [Minimum output value] to L2480 [PID inversion cutoff output], and P2-26 to 0 to allow a PID output range of 100.0% to -4.0%. Accordingly, the frequency reference range of the selected channel is 100% to -4%.

9.3.2.7 Setting the Main Frequency Through Communication

Application scenarios

This function applies to applications requiring torque setting through communication, such as applications where wiring conditions cannot be met, where drives are far from the host controller, or where the host controller controls multiple drives simultaneously.

Function description

Set b5-00 [Main reference source] to 9 [Communication] to set communication as the main reference source.

See the table below for communication protocols supported.

Model	Protocol	Hardware
DT60	EtherNet/IP and PROFINET	M12 port of the drive (LAN1 and LAN2 ports)

Related parameters

The drive supports EtherNet/IP and PROFINET communication, which can be selected through n0-10 [Communication type selection].

Set EtherNet/IP communication parameters in group n5, and PROFINET parameters in group n6.

See communication-related parameters in *" Communication" on page 188*.

Communication address

Set the input source parameters such as b5-00 [Main frequency source] to 9 [Communication], and configure the communication-related parameters correctly. After sending a command to the communication address specified by the drive according to the communication protocol, you can set the main frequency of the drive.

The following table lists the communication addresses supported by the drive.

Comm. address		Description
Communication setpoint 2	7310H	The target frequency can be set through the communication address. The property of values written by this address is defined by n0-14 [7310H Speed reference selection]. The converted floating point value can also be set as the communication reference of the commonly-used floating-point connector. When n0-14 is set to 0, the number of decimal points is the same as A0-70 and unsigned 16-bit value in units of frequency is used. For example, when a decimal value 1000 is written and A0-70 [Number of frequency decimal places] is set to 2 [Two decimal places], the frequency reference is 10.00 Hz. When a decimal value 40000 is written and A0-70 [Number of frequency decimal places] is set to 1 [One decimal place], the frequency reference is 4000.0 Hz. When n0-14 is set to 1, the number of decimal points is the same as A0-70 and signed 16-bit value in units of frequency is used. For example, when a decimal value -1000 is written and A0-70 [Number of frequency decimal places] is set to 2 [Two decimal places], the frequency reference is -10.00 Hz. When a decimal value 20000 is written and A0-70 [Number of frequency decimal places] is set to 1 [One decimal place], the frequency reference is 2000.0 Hz. When n0-14 is set to 2, the signed 16-bit integer in units of speed is used. For example, when a decimal value -1500 is written and the number of pole pairs is 2, the frequency reference is 50.00 Hz. When a decimal value -3000 is written and the number of pole pairs is 2, the frequency reference is -100.00 Hz. When n0-14 is set to 3, the signed 16-bit value with two decimal places in units of percentage is used. The value written is a percentage to the rated frequency. For example, when the decimal value -10000 is written and the rated frequency is 50.00 Hz, the frequency reference is -50.00 Hz. When n0-14 is set to 4, the signed 16-bit value with two decimal places in units of percentage is used. The value written is a percentage to the maximum frequency. For example, when a decimal value -10000 is written and the maximum frequency is 150.00 Hz, the frequency reference is -150.00 Hz.

The data format of the special address 7310H is defined by n0-14 [7310H Speed reference selection], as shown in the following table.

- When the value of n0-14 [7310H Speed reference selection] is set to 0, 1, or 2, the setpoint of 7310H can be used as the frequency source.
- When the value of n0-14 [7310H Speed reference selection] is 3 or 4, the setpoint of 7310H can be used as input sources for torque references, V/f decoupled voltage, and PID references.

Param.	Name	Default value	Value range
n0-14	7310H Speed reference selection	1	0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (Signed 16-bit) 3: Percentage (corresponds to rated frequency/ signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/ signed 16-bit/2 decimal places)

For example, when n0-14 [7310H Speed reference selection] is set to 1 [Frequency (signed 16-bit)] and A0-70 [Frequency decimal places] is set to 2 [Two decimal places], writing 2500 to 7310H sets the main frequency to 25.00 Hz. Writing -2500 to 7310H sets the main frequency to -25.00 Hz.

Application instance

The following shows how to set "Communication" as the main frequency source of channel 1.

1. Set b0-03 to 0 and b5-00 to 9 to set communication as the main frequency reference source of setting channel 1.
2. Set n0-14 to define 7310H speed reference configuration.
3. Send a write command to the drive through the host controller.

The following shows how to set the main frequency through Modbus communication. For example, when setting the frequency to 100.00% (actual transmitted value is 10000) through communication, the transmitted write command is 01 06 10 00 27 10 97 36.

The following table describes the definition of each byte.

Byte	Definition
01H (editable)	AC drive address
06H	Write command
7310H	Frequency reference address
2710H (10000 in decimal)	Target frequency
9736H	CRC

Similarly, to set the frequency reference to -100% (-10000) through communication, send the write command 01 06 10 00 D8 F0D7 4E. In the command, D8F0 is the lower four bits of the hexadecimal number converted from -10000.

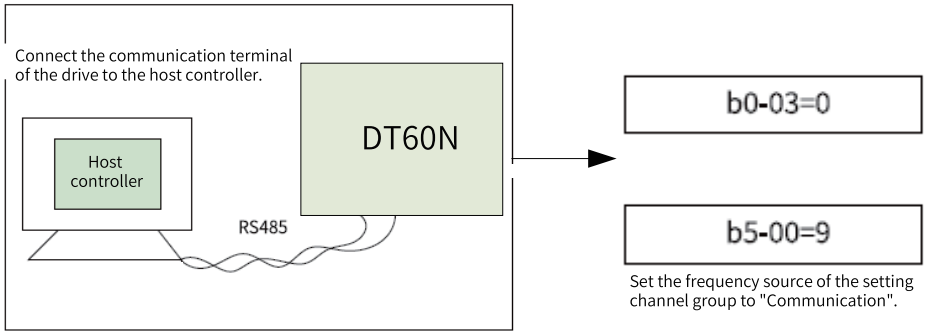


Figure 9-24 Setting main frequency through communication

When n0-14 is set to 1 (7310H Speed reference selection), the range of frequency set through communication is -A2-17 to +A2-17 (Maximum motor frequency). Assume that 0xF448 (-3000) is input to address 0x7310, and the current frequency has 2 decimal places, then the frequency written is -30.00 Hz.

Table 9–10 Relationship between master commands and slave responses

Command from the master		Response from the slave	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
High bits of parameter address	73H	High bits of parameter address	73H
Low bits of parameter address	10H	Low bits of parameter address	10H
High bits of data content	F4H	High bits of data content	F4H
Low bits of data content	48H	Low bits of data content	48H

Command from the master		Response from the slave	
High bits of CRC	97H	High bits of CRC	97H
Low bits of CRC	36H	Low bits of CRC	36H

9.3.2.8 Setting the Main Frequency Through F Connector

Application scenarios

This function is applicable to parameter interconnection, expanding the sources for parameter setting. You can select different parameters as the main frequency source as needed.

Function description

Set b5-00 [Main frequency source] to "Other: [F Connector]". You can select any parameter from L22 [Floating-point connector 1] to L33 [Floating-point connector 12] as the frequency source. That is, by setting the parameter number of a floating-point connector, the value of that connector can be read as the main frequency reference. It is used for extension of common sources.

Application instance

The following example uses F connector parameter L2244 [AI1 input value] to illustrate the usage method when the main frequency source is F connector.

1. Set b5-00 to [Other].
2. In the pop-up options, locate L22 [Floating-point connector 1] and select L2244 [AI1 input value].

After setting is done, AI1 input value is used as the main frequency source. After AI1 curve is set, the frequency reference can be calculated based on the AI1 input voltage.

9.3.3 Selecting the Auxiliary Frequency Reference Source

Function description

The auxiliary frequency reference can be set through multi-references, simple PLC, PID, communication, and F connector, as defined by b5-02 and b6-02.

When the auxiliary frequency source is set to "0: 0", the auxiliary frequency is set to 0. When the auxiliary frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by A2-04 [Frequency per-unit base value].

When the auxiliary frequency is used as a reference source, it is set in the same way as the main frequency reference. The setting of the auxiliary frequency is similar to that of main frequency. The main and auxiliary frequency references are outputted after main and auxiliary operations.

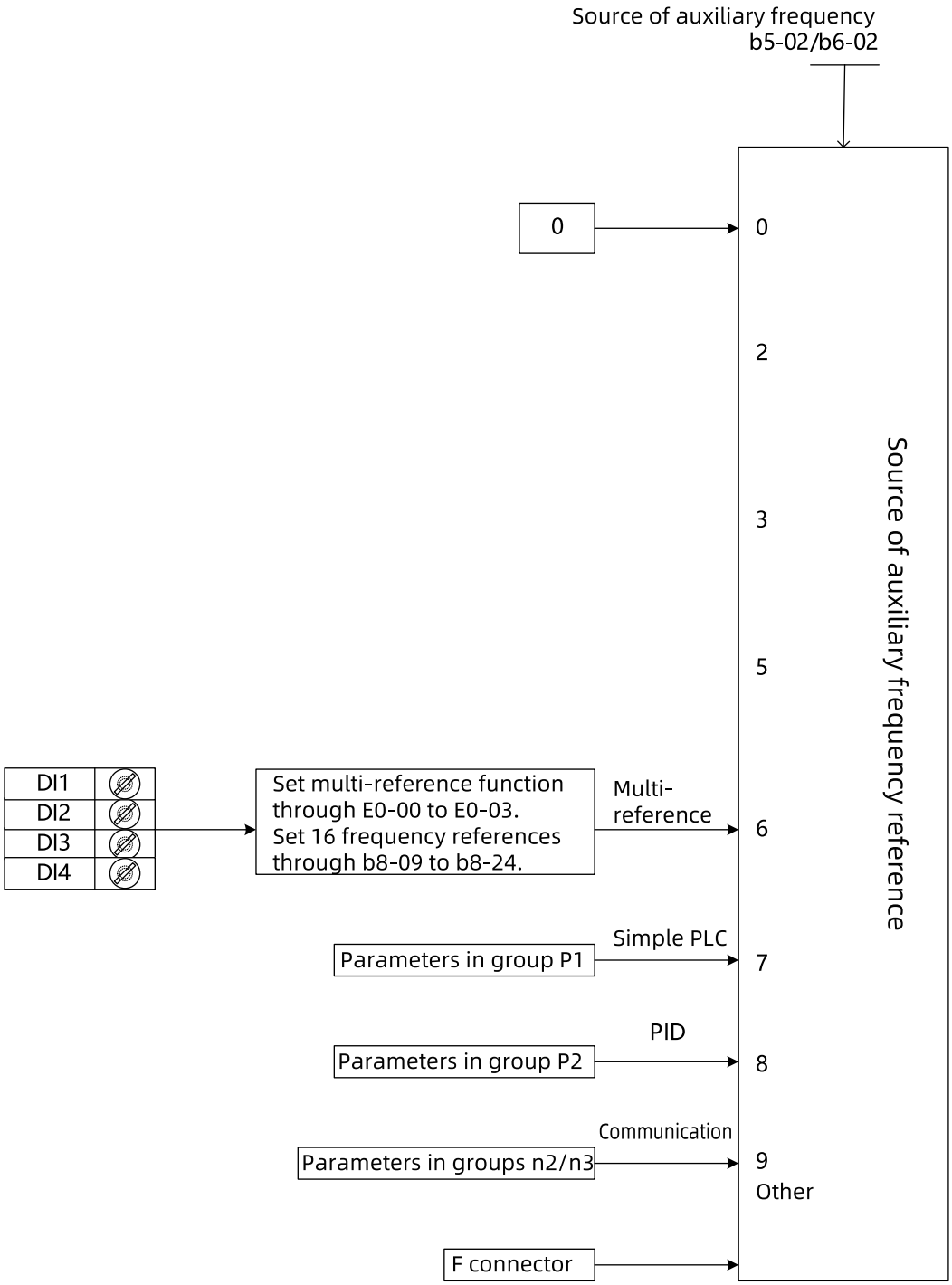


Figure 9-25 Auxiliary frequency reference source selection

Related parameters

Param.	Name	Value range	Default value	Description
b5-02 (b6-02) (F0-31)	Auxiliary frequency source	0: 0 (Invalid) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	0	Defines the auxiliary frequency source. Value description: 0: 0 - The auxiliary frequency is set to 0. 6: Multi-reference - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals have 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The auxiliary frequency is set through PID. 9: Communication - The auxiliary frequency is set through communication. The frequency can be set through remote communication. Other: F connector A parameter number is set for a floating-point connector, and the value of the connector is read as the reference value. It is used for extension of common sources. Note: The addresses for the auxiliary frequency set through communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When writing frequency through communication using address 0x1000, the setting option is determined by n0-13. When writing frequency through communication using address 0x7310, the setting option is determined by n0-14.

9.3.4 Source of Main and Auxiliary Frequency Superposition Reference

Application scenarios

This function applies to cases where the final frequency reference is not determined solely by the main frequency, but rather by a combined calculation of main and auxiliary frequencies.

Function description

Main and auxiliary frequency operation is used to set the frequency reference by performing operations on the main frequency and auxiliary frequency. Set F0-32 (b5-03) [Main and auxiliary frequency operation] to define the relationship between the target frequency and the main/auxiliary frequency operation. The default value is "0: Main frequency + Auxiliary frequency". The main frequency and auxiliary frequency are calculated in percentage (%). The frequency reference is the product of the calculation result and A2-04 [Per-unit frequency base value].

The following five main and auxiliary calculation relationships are available.

- 0 [Main frequency + Auxiliary frequency]: The main frequency is superimposed by the auxiliary frequency as the target frequency.
- 1 [Main frequency - Auxiliary frequency]: The target frequency is set by subtracting the auxiliary frequency from the main frequency
- 2 [Max (|Main|, |Auxiliary|)]: The target frequency is the higher of the original absolute values of the main and auxiliary frequencies (without the absolute value symbol).
- 3 [Min(|Main|, |Auxiliary|)]: The target frequency is the smaller of the original absolute values of the main and auxiliary frequencies (without the absolute value symbol).
- 4 [Main frequency x Auxiliary frequency]: The target frequency is the product of main frequency and auxiliary frequency.

For example, when the main frequency is 100%, the auxiliary frequency is 30%, and A2-04 [Per-unit base value of frequency] is 50.00 Hz. When b5-03 [Main and auxiliary frequency calculation relationship] is set to 1 [Main frequency - Auxiliary frequency], the frequency reference value is (100% - 30%) x 50.00 = 35.00 Hz.

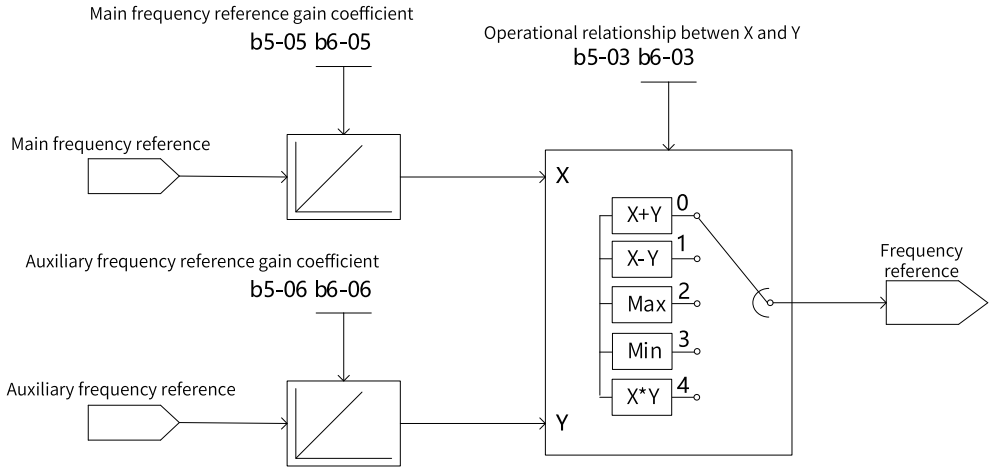


Figure 9-26 Diagram of main and auxiliary frequency reference input

9.3.5 Setting Jog Frequency and Additional Frequency

Application scenarios

In addition to the main frequency and auxiliary frequency, each setting channel has two jog frequencies. Jog frequency 1 is active only when jog command 1 is active, and jog frequency 2 is active only when jog command 2 is active.

Set b5-04 and b6-04 to define the additional frequency of two setting channels, which is used for speed adjustment without ramp-up/down time. The additional frequency is active only during normal operation. The effective additional frequency is superimposed directly to the output of the ramp function generator.

Function description

The following figure shows the relationship between the main frequency, auxiliary frequency, jog frequency, and additional frequency.

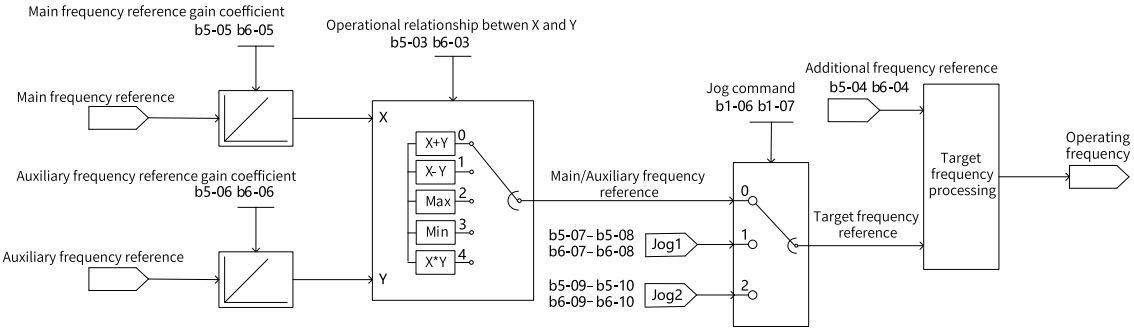


Figure 9-27 Frequency reference channel

Related parameters

Table 9–11 Related parameters

Param.	Name	Default value	Value range	Description
b5-04	Additional frequency source	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the additional frequency source of the setting channel 1. Value description: 0: Inactive - The additional frequency is set to 0. 6: Multi-reference - In the multi-reference mode, combinations of different DI terminal states correspond to different frequency reference. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/ deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The additional frequency is set through PID. 9: Communication - The additional frequency is set through communication. In this mode, the additional frequency is set through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional frequency. It is used for extension of common sources. Note: The address for setting additional frequency through communication is 0x1000 (Modbus-specific) and 0x7310 (CAN and Modbus). When writing frequency through communication using address 0x1000, the setting option is determined by n0-13. When writing frequency through communication using address 0x7310, the setting option is determined by n0-14. The additional frequency is superimposed directly to the frequency reference.

Param.	Name	Default value	Value range	Description
b5-07 (F0-56)	Source of jog frequency 1	0	0: b5-08 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 1. Value description: 0: b5-08 - The jog frequency 1 is set through b5-08. 6: Multi-reference - When multi-reference is used as the source of jog frequency 1, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog frequency 1 is set through PID. 9: Communication - The jog frequency 1 is set through communication. In this mode, the jog frequency 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources. b5-07 and F0-56 have the same function. b5-07 changes automatically along with F0-56.
b5-08 (F0-57)	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. When b5-07 is set to 0, this parameter is active. b5-08 and F0-57 have the same function. b5-08 changes automatically along with F0-57.

Param.	Name	Default value	Value range	Description
b5-09 (F0-58)	Source of jog frequency 2	0	0: b5-10 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 2. 0: b5-10 - The jog frequency 2 is set through b5-10. 6: Multi-reference - When multi-reference is used as the jog frequency 2 source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog frequency 2 is set through PID. 9: Communication - The jog frequency 2 is set through communication. When selecting the source, you can set the jog frequency 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. It is used for extension of common sources. b5-09 and F0-58 have the same function. b5-09 changes automatically along with F0-58.
b5-10 (F0-59)	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. When b5-09 is set to 0, b5-10 is active. b5-10 and F0-59 have the same function. b5-10 changes automatically along with F0-59.

Param.	Name	Default value	Value range	Description
b6-04	Additional frequency source	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the additional frequency source. Value description: 0: 0 - The additional frequency is set to 0. 6: Multi-reference - When the parameter is set to 6, combinations of different DI states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 reference values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The additional frequency is set through PID. 9: Communication - The additional frequency is set through communication. In this mode, the additional frequency is set through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter is set for a floating-point connector, and the value of the connector is read as the additional frequency. It is used for extension of common sources. Note: The addresses for setting the additional frequency through communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When writing frequency through communication using address 0x1000, the setting option is determined by n0-13. When writing frequency through communication using address 0x7310, the setting option is determined by n0-14. The additional frequency is superimposed directly to the frequency reference.

Param.	Name	Default value	Value range	Description
b6-07	Source of jog frequency 1	0	0: b6-08 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 1. Value description: 0: b6-08 - The jog frequency 1 is set through b6-08. 6: Multi-reference - When multi-reference is used as the source of jog frequency 1, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog frequency 1 is set through PID. 9: Communication - The jog frequency 1 is set through communication. In this mode, the jog frequency 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b6-08	Digital reference of jog frequency 1	2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. It is valid when b6-07 is set to 0.

Param.	Name	Default value	Value range	Description
b6-09	Source of jog frequency 2	0	0: b6-10 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 2. Value description: 0: b6-10 - The jog frequency 2 is set through b6-10. 6: Multi-reference - When multi-reference is used as the source of jog frequency 2, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The jog frequency 2 is set through PID. 9: Communication - The jog frequency 2 is set through communication. When selecting the source, you can set the jog frequency 2 through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b6-10	Digital reference of jog frequency 2	-2.00 Hz	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. This parameter is active when b6-09 is set to 0.

9.3.6 Setting Frequency Reference Limits

Application scenarios

This function is used to limit the motor from operating above or below a certain frequency, which can be achieved by setting frequency limits.

Operating principles

Frequency upper limit: Defines the maximum running frequency of the motor. Frequency lower limit: Defines the minimum running frequency of the motor. The maximum frequency limits the maximum output frequency. The minimum frequency limits the minimum output frequency.

When C4-06 [Rated motor frequency] is set to a value higher than C4-10 [Maximum motor frequency], the maximum motor frequency is equal to the rated motor frequency.

The frequency reference limits include the positive frequency upper limit, positive frequency lower limit, negative frequency upper limit, and negative frequency lower limit.

The active positive frequency upper limit is limited by the combination of three parameters: C4-10 [Maximum motor frequency], d1-05 [Source of positive frequency upper limit 2], and d1-03 [Digital reference of positive frequency upper limit 1]. The minimum value of the three parameters is used as the positive frequency upper limit of the frequency reference.

For the positive frequency lower limit, the two limit parameters are C4-11 [Minimum motor frequency] and d1-07 [Digital reference of positive frequency lower limit]. The maximum values of the two parameters are the final effective limit of the positive frequency lower limit of the frequency reference. The negative frequency limits are similar.

The frequency reference is also limited by the positive/negative speed limits of the RFG (ramp function generator) after being input into the RFG. The positive speed upper limit of RFG is limited only by the smaller of C4-10 [Maximum motor frequency] and d1-05 [Selection of positive frequency upper limit 2]. The negative speed upper limit of RFG is limited by the higher of C4-10 [Maximum motor frequency] and d1-06 [Selection of negative frequency upper limit 2].

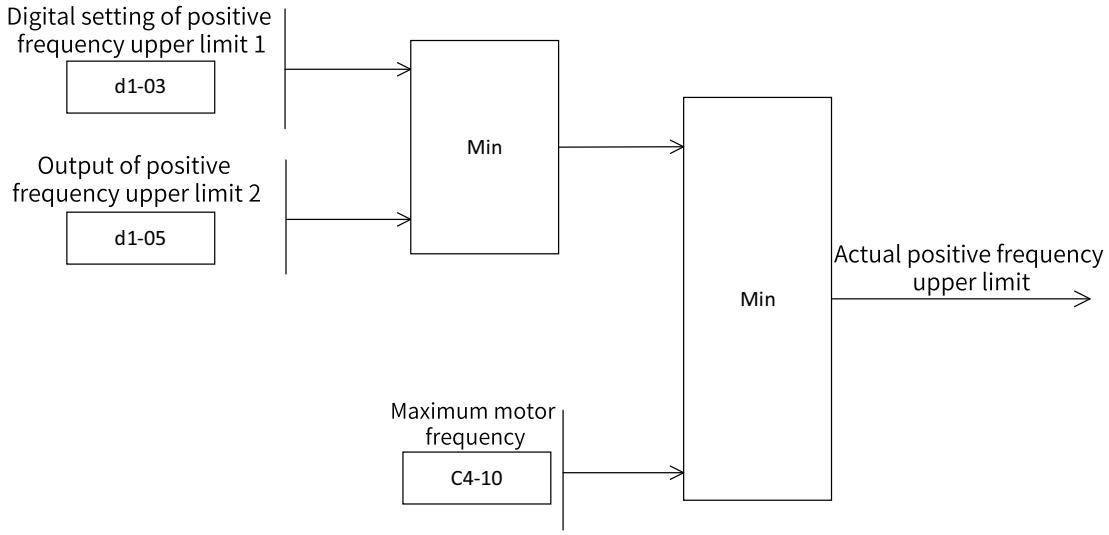


Figure 9-28 Active positive upper limit

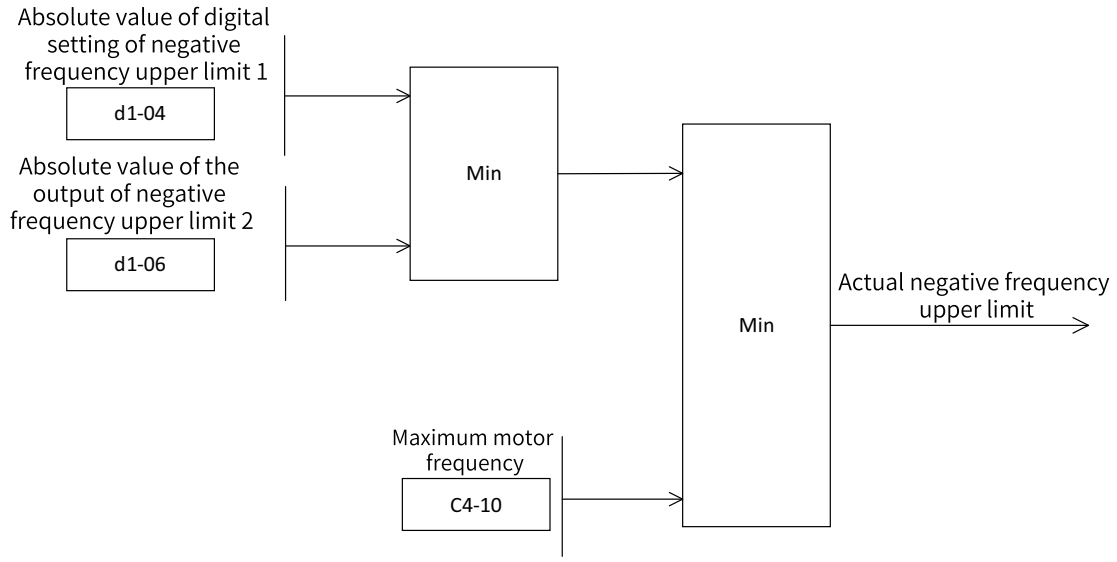


Figure 9-29 Active negative upper limit

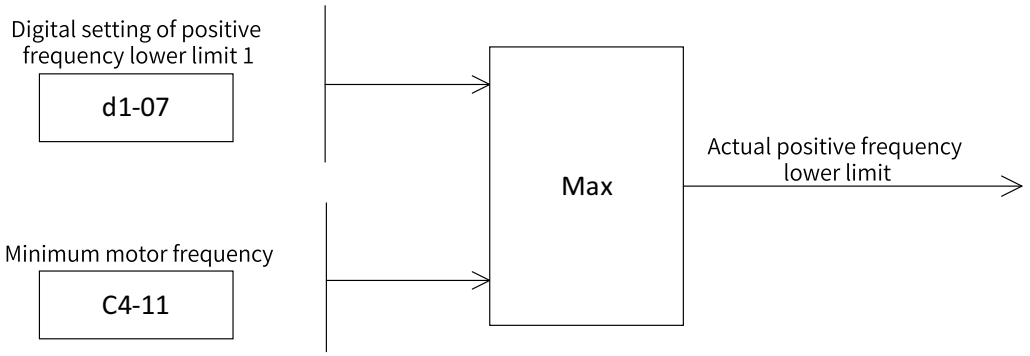


Figure 9-30 Active negative upper limit

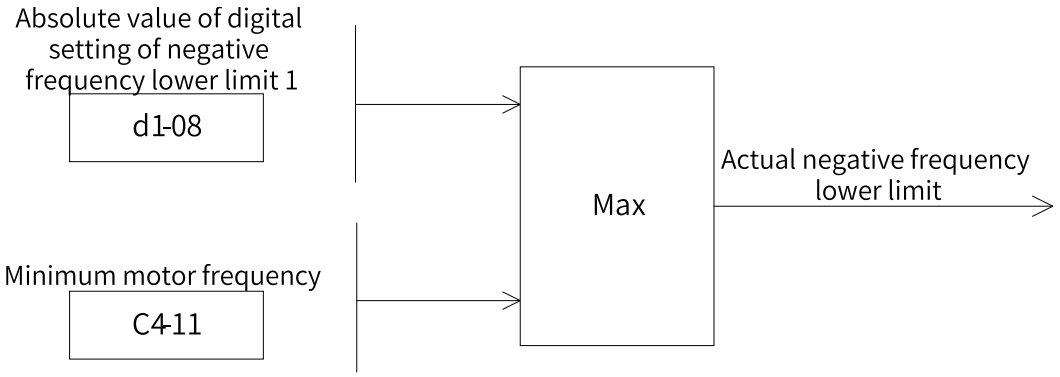


Figure 9-31 Active negative lower limit

Related parameters

Table 9–12 Parameters related to the frequency reference limit

Param.	Name	Default value	Value range	Description
F1-06 (C4-06)	Rated frequency of the motor	50.00 Hz	0.01 Hz to 599.00 Hz	Set this parameter based on the rated frequency on the motor nameplate. C4-06 [Rated motor frequency] is mapped to F1-06 in group F. These two parameters have the same function.
F1-10 (C4-10)	Maximum frequency of the motor	50.00 Hz	C4-06 to 599.00 Hz	Defines the allowable maximum frequency of the motor in Hz. C4-10 [Maximum motor frequency] is mapped to F1-10 in group F. These two parameters have the same function.
F1-11 (C4-11)	Minimum frequency of the motor	0	0.00Hz to C4-10	This parameter indicates the allowed minimum frequency of the motor. C4-11 [Minimum motor frequency] is mapped to F1-11 in group F. These two parameters have the same function.

Param.	Name	Default value	Value range	Description
d1-03 (F2-22)	Positive frequency upper limit 1	800.0%	d1-07 to 800.0%	Limits the maximum positive operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. d1-03 and F2-22 have the same function. d1-03 changes automatically along with F2-22. Note: The positive frequency upper limit is the smaller of F2-22 and F2-24.
d1-04 (F2-23)	Negative frequency upper limit 1	-800.0%	800.0% to d1-08	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. d1-04 and F2-23 have the same function. d1-04 changes automatically along with F2-23. Note: The negative frequency upper limit is the smaller of F2-23 and F2-25.

Param.	Name	Default value	Value range	Description
d1-05 (F2-24)	Positive frequency upper limit 2	0.0	0: 800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the maximum positive operating frequency. It is a per-unit value based on the rated motor frequency, that is, the value 100% indicates the rated motor frequency. Value description: 0: 800% - The positive frequency upper limit is set to 800%. 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 upper limit values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. 9: Communication - The positive frequency upper limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive frequency upper limit depends on the value of the selected F connector. Note: The positive frequency upper limit is the smaller between F2-22 and F2-24.

Param.	Name	Default value	Value range	Description
d1-06 (F2-25)	Negative frequency upper limit selection	1	0: -800% 1: Inverted value of positive frequency upper limit 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Value description: 0: -800% - The upper limit is set to -800%. 1: Inverted value of positive frequency upper limit - The inverted value of d1-03 is used as the upper limit. 6: Multi-reference - When multi-reference is used as the negative frequency upper limit source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 upper limit values. 7: Simple PLC Simple PLC is a multi-reference used to control the running time and acceleration/deceleration time. Multi-reference parameters are used to set the reverse frequency upper limit. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The negative frequency upper limit is set through PID. 9: Communication - The negative frequency upper limit is set through communication. The negative frequency upper limit can be input through remote communication. Other: F connector - The negative frequency upper limit is set through the F connector. Note: The active negative frequency upper limit is the smaller of d1-06 and d1-07.
d1-07 (F2-26)	Digital reference of positive frequency lower limit	0.0	0.0% to d1-03	Limits the minimum positive operating frequency, which is a per-unit value based on the rated frequency of the motor, that is, the value 100% corresponds to the rated frequency of the motor. d1-07 and F2-26 have the same function. d1-07 changes automatically along with F2-26.
d1-08 (F2-27)	Digital reference of negative frequency lower limit	00.	d1-04 to 0.0%	Limits the minimum negative operating frequency, which is a per-unit value based on the rated motor frequency, that is, the value 100% corresponds to the rated frequency of the motor. d1-08 and F2-27 have the same function. d1-08 changes automatically along with F2-27.

9.3.7 Actions for Setpoints Lower Than Minimum Frequency

Application scenarios

This function is used to set the AC drive state when the frequency reference of the drive is lower than the minimum value.

Function description

The minimum frequency of the motor defines the minimum output frequency.

If the frequency reference of the drive is lower than C4-11 [Minimum frequency of the motor], set P0-11 [Operation mode for frequency references lower than the lower limit] to define the corresponding action of the drive. Four actions are supported: run at the minimum frequency of the motor, stop, run at zero speed, and coast to stop.

- 0: Run at frequency lower limit
  If the frequency reference is lower than the lower limit (U6-08 Positive minimum frequency), the drive runs at the frequency defined by "U6-08 Positive minimum frequency". In reverse run, if the frequency reference is lower than the absolute value of the active lower limit (U6-10 Absolute value of negative minimum frequency), the drive runs at "U6-10 negative minimum frequency".
- 1: Stop
  If the frequency reference is lower than the frequency lower limit, the drive stops.
- 2: Run at zero speed
  If the frequency reference is lower than the frequency lower limit, the drive runs at zero speed.
- 3: Coast to stop
  If the frequency reference is lower than the frequency lower limit, the drive coasts to stop.

Related parameters

Table 9–13 Parameters related to setting the action at frequencies lower than the minimum value

Param.	Name	Default value	Value range	Description
P0-11	Operation mode for frequency references lower than the minimum motor frequency	0	0: Run at frequency lower limit 1: Stop 2: Run at zero speed 3: Coast to stop	Defines the operation mode when the frequency reference is lower than the frequency lower limit. Value description: 0: Run at frequency lower limit - During forward run, if the frequency reference is lower than the frequency lower limit (U6-08 Minimum positive frequency), the drive operates at the frequency defined by U6-08. During reverse run, if the frequency reference is lower than the absolute value of the frequency lower limit (U6-10 Absolute value of minimum negative frequency), the drive operates at the frequency defined by U6-10. 1: Stop - If the operating frequency is lower than the frequency lower limit, the drive stops. 2: Run at zero speed- If the frequency reference is lower than the frequency lower limit, the drive runs at zero speed. 3: Coast to stop - If the frequency reference is lower than the frequency lower limit, the drive coasts to stop.

9.3.8 Adjusting Frequency Through Terminals

Application scenarios

During remote control of the drive, you can adjust the operating frequency through the DI terminal instead of communication or analog signal input.

Operating principles

As shown in the figure below, set E0-00 [DI1 terminal function selection] to 6 [Frequency UP adjustment] and E0-01 [DI2 terminal function selection] to 7 [Frequency DOWN adjustment]. Select the base frequency for terminal adjustment during operation through P0-87 [UP/DOWN base during operation]. When P0-87 is set to the default value 0 [Operating frequency], the target frequency after terminal adjustment is the current operating frequency (adjusted value), which means the operating frequency follows the terminal adjustment signal in real time. When DI1 is active high, the current frequency increases. When DI2 is active high, the current frequency decreases.

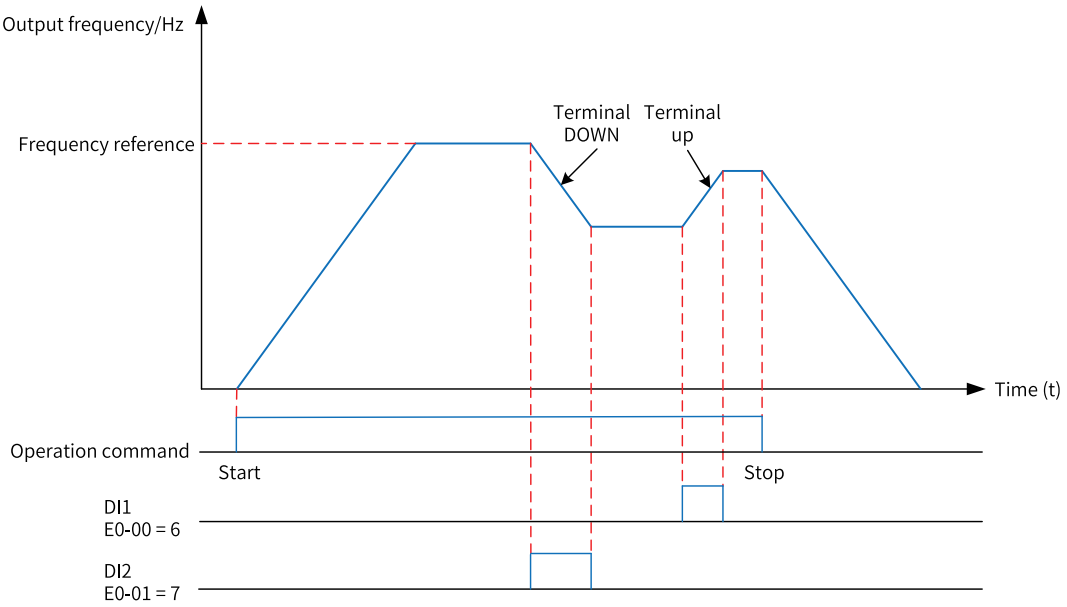


Figure 9-32 Adjusting frequency through terminals

Additionally, the frequency reference adjusted by UP/DOWN terminals can be retained after stop by setting P0-88 [Retention of UP/DOWN adjustment at stop]. To retain the frequency reference at power failure, set P0-88 [UP/DOWN retention selection at stop] to 1 [Retentive] and P0-89 [UP/DOWN retention selection upon power failure] to 1 [Retentive].

Related parameters

Param.	Name	Default value	Value range	Description
P0-87	UP/DOWN base during operation	0	0: Operating frequency 1: Frequency reference	Defines the frequency base adjusted by UP/DOWN key during operation. Value description: 0: Operating frequency - The target frequency increases or decreases based on the operating frequency during UP/DOWN adjustment. 1: Frequency reference - The target frequency increases or decreases based on the frequency reference during UP/DOWN adjustment.
P0-88	UP/DOWN retention upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UP/DOWN is retentive when the drive stops. Value description: 0: Non-retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the panel, then adjust frequency using the ▲ and ▼ keys on the operating panel or the terminal assigned with UP/DOWN function. After the drive stops, the adjusted frequency value is cleared. 1: Retentive - Set b5-01 and b6-01 [Digital reference of main frequency] through the panel, then adjust frequency using the ▲ and ▼ keys on the operating panel or the terminal assigned with UP/DOWN function. After the drive stops, the adjusted frequency value is retained.
P0-89	UP/DOWN retention upon power failure	0	0: Disable 1: Enable	Defines whether the frequency adjusted by UP/DOWN is retentive upon power failure. Value description: 0: Disable - Set b5-01 and b6-01 through the operating panel and then adjust the frequency by the ▲ or ▼ keys on the operating panel or terminals functioning as UP/DOWN keys. The frequency adjustment is cleared upon power failure. 1: Enable - Set b5-01 and b6-01 through the operating panel and then adjust the frequency by the ▲ or ▼ keys on the operating panel or terminals functioning as UP/DOWN keys. The frequency adjustment is retentive upon power failure.

Application instance

To control operation and frequency of the drive through terminals, do as follows.

1. Set b1-00 [Main command source of control channel 1] to 1 [Terminal control].
2. Set b9-00 [Terminal start/stop module A/B selection] to 0 [Module A].
3. Set b9-01 [Terminal start/stop module A mode] to 1 [IN1 for start].
4. Assign DI1 with the function of terminal control IN1, and assign DI2 and DI3 with frequency adjustment function. Terminal function setpoint and wiring diagram are as follows:

Param.	Name	Setpoint	Description
E0-00	DI1 function selection	1 [Terminal start/stop module A_IN1]	Operation command
E0-01	DI2 function selection	6 [Frequency UP adjustment]	Used to increase the frequency.
E0-02	DI3 function selection	7 [Frequency DOWN adjustment]	Used to reduce the frequency.

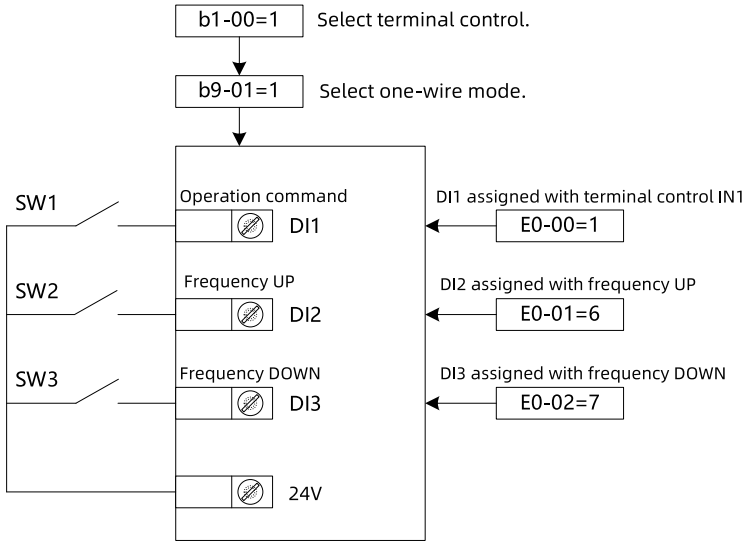


Figure 9-33 Adjusting frequency through terminals

5. Set P0-87 [UP/DOWN base during operation] to 0 [Operating frequency].

After preceding steps are done, the drive starts running when DI1 closes. The operating frequency decreases gradually when DI3 closes. The operating frequency increases gradually when DI2 closes. The command is inactive and the frequency remains unchanged when both DI2 and DI3 close. The frequency will no longer change once it reaches the upper limit or decreases to the lower limit.

9.3.9 Frequency Reference Source Selection

The frequency reference for each setting channel is defined by the main frequency and auxiliary frequency.

Main frequency reference x Main frequency reference gain coefficient = Effective main frequency reference.

Auxiliary frequency reference x Auxiliary frequency reference gain coefficient = Effective auxiliary frequency reference.

After the preceding operations are performed on the effective main and auxiliary frequency references, the operation result is used as the input for the ramp function generator.

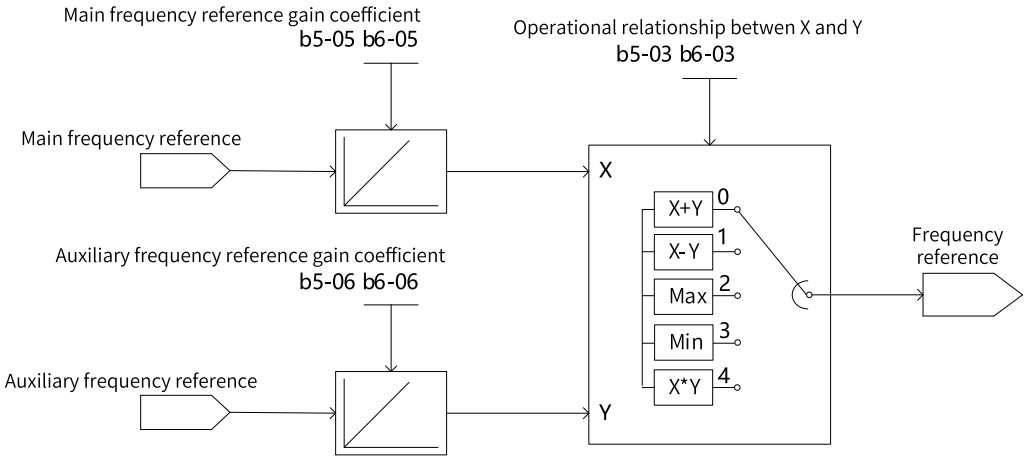


Figure 9-34 Diagram of main and auxiliary frequency reference input

In some cases, frequency regulation needs to be activated directly without being processed with the acceleration/deceleration time. In this case, an additional frequency reference that activated only during operation can be provided, which can be superimposed to the output frequency of the ramp function generator directly.

9.4 Torque Reference

9.4.1 Selecting Torque Reference

Similar to frequency reference setting, the drive provides two channels for setting the torque reference to change the motor operation state. Parameter group b5 corresponds to the setting channel 1, and group b6 corresponds to the setting channel 2.

You can select the active setting channel through b0-03 [Setting channel selection], as shown below. When the setting channel 1 is selected, parameters in group b5 are activated. In this case, the torque reference is set by parameters in group b5. When the setting channel 2 is selected, parameters in group b6 are activated. In this case, the torque reference is defined by parameters in group b6.

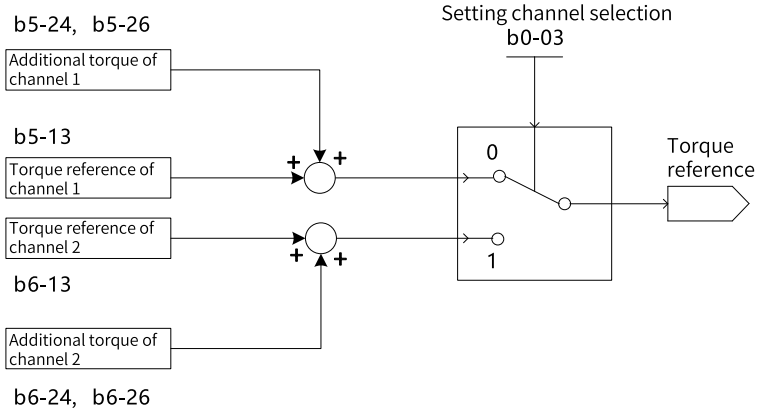


Figure 9-35 Torque reference source

You can also set the additional torque, which is active only during normal operation. The effective additional torque is superimposed directly to the output torque. For details, see *"9.4.8 Setting Additional Torque Reference" on page 385*.

9.4.2 Selecting Torque Reference Source

Function description

The setting channel 1 is activated by default. The motor control mode needs to be set to torque control (d0-01 = 1). You can set the torque reference through b5-13 [Torque reference source], which is set in the similar way as the frequency.

The torque reference is set in percentages, whose base value (100%) is defined by A2-06 [Per-unit torque base value].

Related parameters

Table 9–14 Related parameters

Param.	Description	Default value	Value range	Description
b5-13 (b6-13)	Torque reference source	0: b5-14 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	0	0: Digital reference - The digital reference is used as the source. 6: Multi-reference - When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - The torque reference is set through PID. 9: Communication - The torque reference is set through communication. Torque reference is set through remote communication. The drive must be installed with a communication card to for communication with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the torque reference. It is used for extension of common sources.
b5-19 (b6-19)	Speed limit source in torque control mode	0: b5-20 1: Speed channel	0	Defines the speed limit source. Value description: 0: b5-20 - The speed limit is set through b5-20. 1: Speed channel - The speed limit is set through the speed channel in torque control mode.
b5-20 (b6-20)	Digital reference of speed limit in torque mode	-800.0 % to +800.0%	100.0%	Defines the digital reference value of the speed limit, which is active when the "Speed limit source" is set to "0: b5-20".

Param.	Description	Default value	Value range	Description
b5-21 (b6-21)	Speed limit bias mode in torque mode	0: Bidirectional bias 1: Uni-directional bias 2: Overspeed control mode	0	Defines the speed limit bias mode in the torque control mode. Value description: 0: Bidirectional bias - The bias is effective for both directions (forward and reverse). 1: Unidirectional bias - The bias is effective only for one direction (opposite to the limit direction). 2: Overspeed control mode - The bias is active in both directions (forward and reverse), and the absolute values of positive and negative speed limits are equal to the speed limit plus the bias.
b5-22 (b6-22)	Speed limit bias source in torque control mode	0: b5-23 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	0	Defines the speed limit bias source. Value description: 0: b5-23 - The speed limit bias is set through b5-23. 6: Multi-reference - When multi-reference is used as the source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - PID output is used as the speed limit bias source. 9: Communication - The speed limit offset is set through communication. When selecting the source, you can set the speed limit bias through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the speed limit bias source. It is used for extension of common sources.
b5-23 (b6-23)	Digital reference of speed limit bias in torque mode	0.0% to 800.0%	5.0%	Defines the speed limit bias as a percentage to the rated speed. This parameter is activated when b5-22 [Speed limit bias source] is set to 0 [b5-23].

9.4.3 Setting Torque Reference Through Parameter

Function description

Set b5-13 [Torque reference source] to 0 [Digital reference] to set the value of b5-14 [Digital torque reference] as the active torque source.

Related parameters

Table 9–15 Related parameters

Param.	Name	Default value	Value range
b5-14	Digital torque reference	0	-800.0% to +800.0%

If b5-14 [Digital torque reference] is set to 50.0%, the torque reference is 50.0%.

9.4.4 Setting Torque References Through Multi-references

Application scenarios

This method is suitable for applications that only require several torque references instead of continuous adjustment of the drive torque. That is, scenarios where continuous adjustment of the set frequency is not required, and when the torque reference changes, the corresponding frequency reference changes accordingly.

Function description

Set b5-13 [Torque reference source] to 6 [Multi-reference] to select the multi-reference as the torque reference.

Up to 16 multi-references can be set, which can be selected through b8-03 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit 3] or combinations of input signals from the four DI terminals. You can also use fewer than four DIs as the multi-reference source. In this case, missing digits are populated with 0.

The relationship between the reference quantity and DI quantity is as follows:

- Two multi-references: One DI (K1); b8-04 to b8-06 are set to 0.
- Three to four multi-references: Two DIs (K1 and K2); b8-05 to b8-06 are set to 0.
- Five to eight multi-references: Three DIs (K1, K2, and K3); b8-06 is set to 0.
- Nine to sixteen multi-references: Four DIs (K1, K2, K3, and K4)

Related parameters

The multi-references are set through parameters in group b8, as listed in the following table.

Param.	Name	Default value	Value range	Description
b8-03	Multi-reference selection bit0	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit0. Multi-reference bit1 to bit3 are used together to support 16 multi-references in total. Value description: 0: 0 - The value of multi-reference bit0 is 0. 1: 1 - The value of multi-reference bit0 is 1. 3 to 12: DI1 to DI10 - Depends on the final state of the DI. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Other: B connector - Depends on the B connector, which can be selected through the pop-up window. The setpoint 0 indicates that the multi-reference bit0 is 0. The setpoint 1 indicates that the multi-reference bit0 is 1. Note: A total of 16 multi-reference can be supported through binary combination of b8-03 [Multi-reference selection bit0], b8-04 [Multi-reference selection bit1], b8-05 [Multi-reference selection bit2], and b8-06 [Multi-reference selection bit3]. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.
b8-04	Multi-reference selection bit1	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit1. Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. The value description and the note are the same as b8-03.
b8-05	Multi-reference selection bit2	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit2. Combined with multi-step value selection bit0, bit1,bit3, a total of 16 multi-step values can be selected. The value description and the note are the same as b8-03.
b8-06	Multi-reference selection bit3	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines the source of multi-reference selection bit3. Combined with multi-step value selection bit0, bit1,bit2, a total of 16 multi-step values can be selected. The value description and the note are the same as b8-03.

Param.	Name	Default value	Value range	Description
b8-08 (F0-38)	Source of multi-reference 0	0	0: b8-09 5: PID 6: b5-01/b6-01 Other: F connector	Defines the source of multi-reference 0. Value description: 0: b8-09 - The value of multi-reference 0 is set by b8-09. 5: PID - The value of multi-reference 0 is set by PID. 6: Digital reference of the main frequency (b5-01/b6-01) - The multi-reference 0 is set by the digital reference of the main frequency (b5-01/b6-01), and the corresponding frequency per-unit value is calculated based on the frequency reference. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the main frequency reference. It is used for extension of common sources.
b8-09 (F0-39)	Multi-reference 0	0.00 %	b8-42 and b8-43	Defines the value of multi-references 0 to 15. The multi-reference source is selected by b8-08, and the other multi-references are set by other parameters. Note: 1. The unit of the multi-reference value is percentage (%). The drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states that correspond to 16 frequency setpoints. 2. When multi-reference is used to set the frequency, parameters b8-09 to b8-24 correspond to a total of 16 frequency references (0 to 15). A frequency reference is calculated as a percentage to the rated frequency rather than as a numerical frequency value. The value 100% corresponds to the value of C4-06 [Rated frequency of the motor]. 3. When multi-reference is used as the frequency source, the frequency reference is limited by C4-10 [Max. frequency of the motor] and d1-03 [Digital reference of positive frequency upper limit]. To set the multi-reference to a value higher than 100%, modify these two parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse run. 4. When outputting to a floating-point connector, the multi-reference can be used not only as the frequency reference, but also as the torque, voltage, or other reference input. The multi-reference value is a percentage to the rated value.
b8-10 (F0-40)	Multi-reference 1	0.00 %	b8-42 and b8-43	
b8-11 (F0-41)	Multi-reference 2	0.00 %	b8-42 and b8-43	
b8-12 (F0-42)	Multi-reference 3	0.00 %	b8-42 and b8-43	
b8-13	Multi-reference 4	0.00 %	b8-42 and b8-43	
b8-14	Multi-reference 5	0.00 %	b8-42 and b8-43	
b8-15	Multi-reference 6	0.00 %	b8-42 and b8-43	
b8-16	Multi-reference 7	0.00 %	b8-42 and b8-43	
b8-17	Multi-reference 8	0.00 %	b8-42 and b8-43	
b8-18	Multi-reference 9	0.00 %	b8-42 and b8-43	
b8-19	Multi-reference 10	0.00 %	b8-42 and b8-43	
b8-20	Multi-reference 11	0.00 %	b8-42 and b8-43	
b8-21	Multi-reference 12	0.00 %	b8-42 and b8-43	
b8-22	Multi-reference 13	0.00 %	b8-42 and b8-43	
b8-23	Multi-reference 14	0.00 %	b8-42 and b8-43	
b8-24	Multi-reference 15	0.00 %	b8-42 and b8-43	

Note

F0-39 F0-42 are mapped from b8-09 to b8-12. These two sets of parameters are equivalent.

To use multi-reference as the torque reference source, assign functions 12 to 15 to the DI terminals or set b8-03 [Multi-reference selection bit0] to b8-06 [Multi-reference selection bit3].

Table 9–16 Multi-reference input terminal

Param.	Name	Setpoint	Function description
E0-00 (F4-03)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F4-04)	DI2 function selection	13	Multi-reference terminal 2
E0-02 (F4-05)	DI3 function selection	14	Multi-reference terminal 3
E0-03 (F4-06)	DI4 function selection	15	Multi-reference terminal 4

Note

F4-03 to F4-06 are the mapped from E0-00 to E0-03 in group F, and the two sets of parameters are equivalent.

Application instance

In the following figure, DI1, DI2, DI3, and DI4 are used as the multi-reference input terminals, which form a four-bit binary number. The state combinations of these terminals represent different multi-reference values. When (DI4, DI3, DI2, DI1) = (0, 0, 1, 0), the state combination value is 2, corresponding to the value set by b8-11. The detailed settings are as follows.

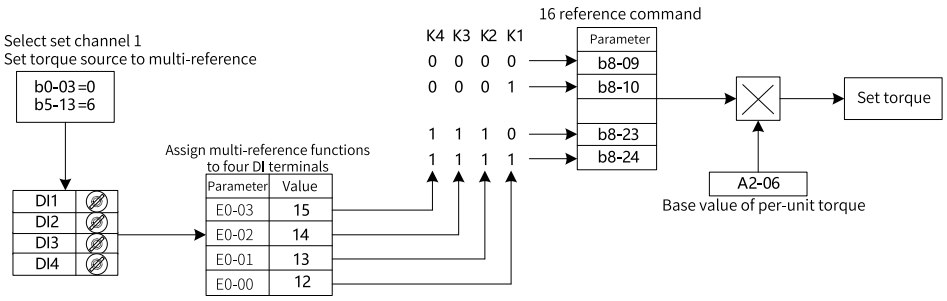


Figure 9-36 Setting torque through multi-reference

The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values, as listed in the following table.

Table 9–17 Description of multi-reference function

K4	K3	K2	K1	Reference	Parameter
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09 (b8-08 = 0)
OFF	OFF	OFF	ON	Multi-reference 1	b8-10
OFF	OFF	ON	OFF	Multi-reference 2	b8-11
OFF	OFF	ON	ON	Multi-reference 3	b8-12
OFF	ON	OFF	OFF	Multi-reference 4	b8-13
OFF	ON	OFF	ON	Multi-reference 5	b8-14

K4	K3	K2	K1	Reference	Parameter
OFF	ON	ON	OFF	Multi-reference 6	b8-15
OFF	ON	ON	ON	Multi-reference 7	b8-16
ON	OFF	OFF	OFF	Multi-reference 8	b8-17
ON	OFF	OFF	ON	Multi-reference 9	b8-18
ON	OFF	ON	OFF	Multi-reference 10	b8-19
ON	OFF	ON	ON	Multi-reference 11	b8-20
ON	ON	OFF	OFF	Multi-reference 12	b8-21
ON	ON	OFF	ON	Multi-reference 13	b8-22
ON	ON	ON	OFF	Multi-reference 14	b8-23
ON	ON	ON	ON	Multi-reference 15	b8-24

In the preceding section, the multi-reference values are determined by assigning functions to terminals through parameters in group E0. You can also set the multi-reference values through parameters in group b8.

9.4.5 Setting Torque References Through Simple PLC

Application scenarios

In industrial applications where the AC motor only needs to execute start/stop, timed segment-based speed regulation, and automatic forward/reverse run, you can use the simple PLC to achieve control functions without a PLC.

The simple PLC can directly set the operating speed, direction, and operating time of each phase. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor operates cyclically within timed period at different speed and direction.

Function description

Set b5-13 [Torque reference source] to 7 [Simple PLC] to select the setpoint of simple PLC as the torque source.

Related parameters

Table 9–18 Related parameters

Param.	Name	Default value	Value range	Description
P1-00	Simple PLC module	0	0: Disable 1: Enable	Used to enable/disable the simple PLC module. Value description: 0: Disable - The simple PLC module is disabled. The current STEP, current STEP operating time (hours and seconds), and STEP per-unit value of the simple PLC module are cleared. 1: Enable - The simple PLC module is enabled, but whether the calculation and output of the PLC module are normal depends on P1-01.
P1-01	Simple PLC calculation enable source	36978	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines the source for enabling simple PLC calculation. Value description: 0: Inactive - The simple PLC calculation function is inactive. 1: Active - The simple PLC calculation function is active. 3 to 12: DI1 to DI10 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI10. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Other: B connector - Whether the simple PLC calculation function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the running time. It also outputs the current STEP and current STEP running time (hours and seconds) of the simple PLC, as well as the output per-unit value obtained in the current step. 2. If the simple PLC calculation is disabled, the output current STEP, current STEP running time (hours and seconds) of the simple PLC is the value when the calculation is stopped. The output per-unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Name	Default value	Value range	Description
P1-02	Simple PLC operation mode	0	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running one cycle 3: Output 0 after running for one cycle	Defines the operation mode of the simple PLC. Value description: 0: Keep multi-reference 0 output after running for one cycle - The output of multi-speed reference 0 is maintained after the end of a single cycle of the simple PLC module. 1: Keep final values after running for one cycle - The final value is output after the simple PLC module runs for one cycle. 2: Repeat after running one cycle - The simple PLC module starts running again from the first STEP after completing a cycle. 3: Output 0 after running for one cycle - The PLC STEP per-unit value is output as 0 after the simple PLC module runs for one cycle. Note: 1. If this parameter is set to 0, 1, or 3, the single-cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2. If this parameter is set to 2, the simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed.
P1-03	Simple PLC function selection	0	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, and recalculated when enabled 1: Current STEP retained when calculation deactivated, and continue when enabled	Defines the simple PLC function. Value description: Ones: Retention upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: Retentive - The current STEP and current STEP operating time of the simple PLC is saved upon power failure. Tens: Calculation enable configuration 0: If P1-01 is disabled, the current STEP is kept. If P1-01 is enabled, operation starts from STEP0 and the operating time is calculated again. 1: When calculation (P1-01) is disabled, the current STEP is kept. When calculation (P1-01) is enabled, the drive runs from the current STEP and the current operating time continues.

Param.	Name	Default value	Value range	Description
P1-04	Simple PLC status reset	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Used to reset the simple PLC status. Value description: 0: Inactive - When the simple PLC state reset is inactive, the simple PLC operates according to the setting. 1: Active - When simple PLC status reset is active, the simple PLC module returns to initial state. The simple PLC outputs the value of multi-speed reference 0 (P1-09) only when the STEP 0 is under execution by simple PLC. 3 to 12: DI1 to DI10 - Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI10. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Others: B connector - Whether the simple PLC state reset function is active depends on the state of the selected B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active.
P1-08	Simple PLC operating time unit	0	0: s (second) 1: h (hour)	Defines the simple PLC operating time unit. Value description: 0: s (second) - The simple PLC operating time is in seconds. 1: h (hour) - The simple PLC operating time is in hours.
P1-09	Multi-reference 0 set by simple PLC	0	-800.0 to +800.0	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Operating time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency. Note: It is recommended to set the operating time of multi-reference i in simple PLC to a value higher than the ramp-up/down time.

Param.	Name	Default value	Value range	Description
P1-11	Ramp-up/down time of multi-reference 0 set by simple PLC	0	0: Ramp-up/down time of ramp 1 (b7-04 [Ramp 1 ramp-up time]/b7-05 [Ramp 1 ramp-down time]) 1: Ramp-up/down time of ramp 2 (b7-10 [Ramp 2 ramp-up time]/b7-11 [Ramp 2 ramp-down time]) 2: Ramp-up/down time of ramp 3 (b7-16 [Ramp 3 ramp-up time]/b7-17 [Ramp 3 ramp-down time]) 3: Ramp-up/down time of ramp 4 (b7-22 [Ramp 4 ramp-up time]/b7-23 [Ramp 4 ramp-down time])	Defines the ramp-up/down time of multi-reference 0 set by simple PLC. Value description: 0: Ramp-up/down time of ramp 1 - The ramp-up/down time of ramp 1 (b7-04/b7-05) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 1: Ramp-up/down time of ramp 2 - The ramp-up/down time of ramp 2 (b7-10/b7-11) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 2: Ramp-up/down time of ramp 3- The ramp-up/down time of ramp 3 (b7-16/b7-17) is used as the ramp-up/down time of multi-reference 0 set by simple PLC. 3: Ramp-up/down time of ramp 4 - The ramp-up/down time of ramp 4 (b7-22/b7-23) is used as the ramp-up/down time of multi-reference 0 set by simple PLC.
P1-12	Multi-reference 1 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-13	Operating time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-14	Ramp-up/down time of multi-reference 1 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-15	Multi-reference 2 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-16	Operating time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Ramp-up/down time of multi-reference 2 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-18	Multi-reference 3 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-19	Operating time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-20	Ramp-up/down time of multi-reference 3 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-21	Multi-reference 4 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-22	Operating time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Ramp-up/down time of multi-reference 4 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-24	Multi-reference 5 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-25	Operating time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-26	Ramp-up/down time of multi-reference 5 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-27	Multi-reference 6 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-28	Operating time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Ramp-up/down time of multi-reference 6 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-30	Multi-reference 7 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-31	Operating time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-32	Ramp-up/down time of multi-reference 7 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-33	Multi-reference 8 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-34	Operating time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Ramp-up/down time of multi-reference 8 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-36	Multi-reference 9 set by simple PLC	0	Same as P1-09	Same as P1-09

Param.	Name	Default value	Value range	Description
P1-37	Operating time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-38	Ramp-up/down time of multi-reference 9 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-39	Multi-reference 10 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-40	Operating time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-41	Ramp-up/down time of multi-reference 10 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-42	Multi-reference 11 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-43	Operating time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-44	Ramp-up/down time of multi-reference 11 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-45	Multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-46	Operating time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-47	Ramp-up/down time of multi-reference 12 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-48	Multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-49	Operating time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-50	Ramp-up/down time of multi-reference 13 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-51	Multi-reference 14 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-52	Operating time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10

Param.	Name	Default value	Value range	Description
P1-53	Ramp-up/down time of multi-reference 14 set by simple PLC	0	Same as P1-11	Same as P1-11
P1-54	Multi-reference 15 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-55	Operating time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-56	Ramp-up/down time of multi-reference 15 set by simple PLC	0	Same as P1-11	Same as P1-11

Application instance

Steps to set the simple PLC as the torque source are as follows.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-13 [Torque reference source] to 7 [Simple PLC] to select PID as the torque reference source of setting channel 1.
2. Set P1-09 [Multi-reference 0 set by simple PLC], P1-12 [Multi-reference 1 set by simple PLC], P1-15 [Multi-reference 2 set by simple PLC], P1-18 [Multi-reference 3 set by simple PLC], P1-21 [Multi-reference 4 set by simple PLC], P1-24 [Multi-reference 5 set by simple PLC], P1-27 [Multi-reference 6 set by simple PLC], P1-30 [Multi-reference 7 set by simple PLC], P1-33 [Multi-reference 8 set by simple PLC], P1-36 [Multi-reference 9 set by simple PLC], P1-39 [Multi-reference 10 set by simple PLC], P1-42 [Multi-reference 11 set by simple PLC], P1-45 [Multi-reference 12 set by simple PLC], P1-48 [Multi-reference 13 set by simple PLC], P1-51 [Multi-reference 14 set by simple PLC], and P1-54 [Multi-reference 15 set by simple PLC]. These 16 multi-reference values correspond to the frequency references of 16 STEPS of simple PLC. Set P1-10 [Operating time of multi-reference 0 set by simple PLC] and P1-11 [Ramp-up/down time of multi-reference 0 set by simple PLC] (and so on for other STEPS) to define the operating time and ramp-up/down time of STEP 0.
3. Set P1-02 to select the simple PLC operation mode.
4. Set the ones of P1-03 to configure whether the current STEP and the current STEP operating time of the simple PLC are retentive upon power-off. Set the tens of P1-03 to set the simple PLC module status when the calculation is disabled and enabled again.
5. Set P1-01 [Simple PLC calculation enable source].
   - If the simple PLC calculation is enabled, the simple PLC module runs according to the operation mode of the simple PLC and calculates the current STEP based on the operating time. It also outputs the current STEP and current STEP operating time (hours and seconds) of the simple PLC, as well as the per-unit value obtained in the current STEP.
   - If the simple PLC calculation is disabled, the current STEP and current STEP operating time (hours and seconds) of the simple PLC are the values when the calculation stops. The per-unit value obtained in the simple PLC step is the value of STEP i when the calculation stops.
6. Set P1-00 [Simple PLC module enable] to 1 [Enable] to enable the simple PLC module.

In this case, when the calculation of the simple PLC is enabled, the simple PLC module starts running from STEP 0. The torque reference is set to the reference of STEP 0, that is, multi-reference 0 (P1-09).

After the current STEP is performed by the simple PLC, the drive switch to the next STEP, and the torque reference is also switched to the reference of the next STEP.

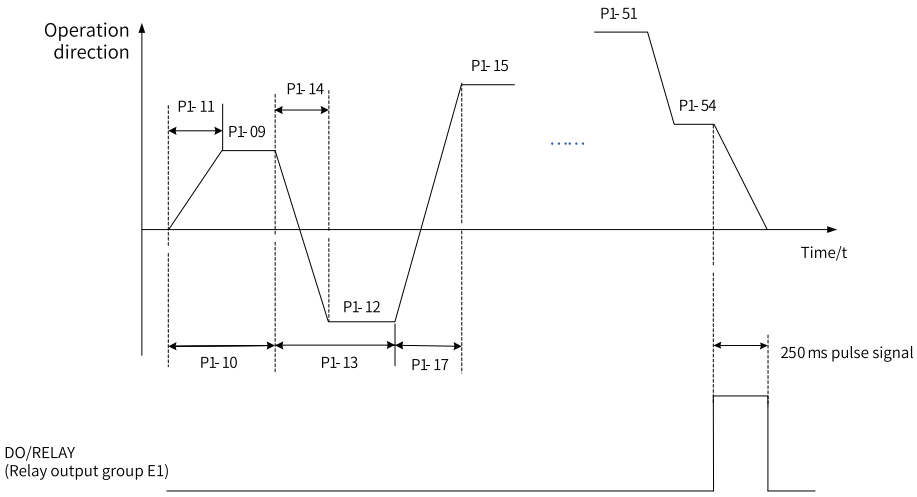


Figure 9-37 Setting torque through simple PLC

9.4.6 Setting Torque Reference Through PID

Application scenarios

The PID control output is used as the operating frequency. The PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

Function description

Set b5-13 [Torque reference source] to 8 [PID] to set the PID output as the torque reference.

PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value. When the PID output is used as the operating frequency, the PID output value 100% corresponds to A2-06 [Per-unit base value of torque].

PID control adjusts the PID output by modifying the proportional, integral, and derivative parameters. The PID control parameters are defined as follows.

- Proportional gain Kp: Once the deviation between the PID output and the input is generated, the PID adjusts the control output so that the controlled value changes to reduce deviation. The speed of the deviation reduction depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
- Integral time Ti: Determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
- Derivative time Td: Determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.

See detailed PID function description in *"11.6.1 Process PID Control" on page 608*.

Related parameters

See *"9.3.2.6 Setting Main Frequency Through PID" on page 335*.

Application instance

The steps for setting PID as the torque source are as follows.

1. Set b0-03 [Setting channel selection] to 0 [Setting channel 1] and b5-13 [Torque reference source] to 8 [PID] to select PID as the torque reference source of setting channel 1.
2. Set P2-00 [General PID enable] to 1 [Enable] to enable PID.
3. Set P2-02 [PID reference source] to select the target PID reference source. When P2-02 [PID reference source] is set to 0 [PID value reference], set P2-03 [PID value reference]. The setpoint 100% of P2-03 corresponds to the value set in P2-05 [PID reference feedback range].

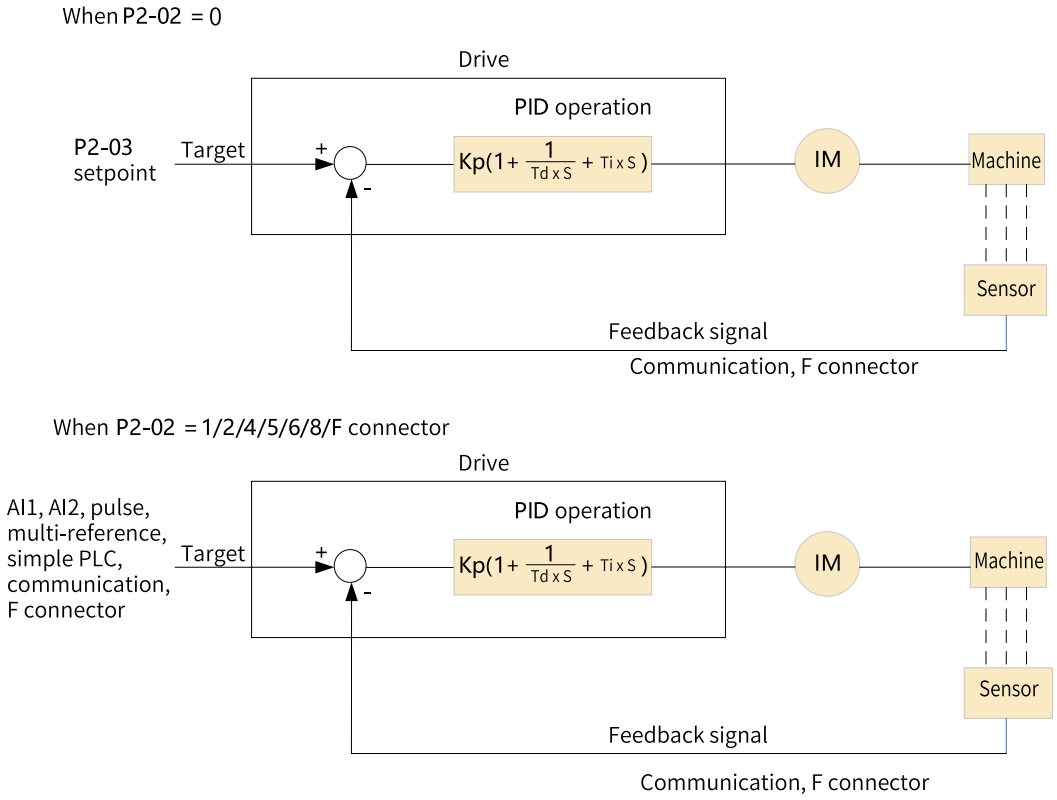


Figure 9-38 Schematic of general PID control

4. Set P2-04 [PID feedback source] to select the PID feedback source.
5. Set P2-01 [PID action direction] to select the PID action direction.
6. Set P2-26 [Maximum output value source] and P2-27 [Minimum output value source] to define the maximum output value and minimum output value of PID respectively. The PID output is between the maximum and minimum values.

In this case, the torque of the drive is set by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback value, with the torque reference of the drive changed accordingly.

9.4.7 Setting Torque Reference Through Communication

Application scenarios

This function applies to applications requiring torque setting through communication, such as applications where wiring conditions cannot be met, where drives are far from the host controller, or where the host controller controls multiple drives simultaneously.

Function description

Set b5-13 [Torque reference source] to 9 to select communication as the torque source.

Communication protocols supported are listed in the table below.

Model	Protocol	Hardware
DT60	EtherNet/IP and PROFINET	M12 port of the drive (LAN1 and LAN2 ports)

Related parameters

The drive supports EtherNet/IP and PROFINET communication, which can be selected through n0-10 [Communication type selection].

Set EtherNet/IP communication parameters in group n5, and PROFINET parameters in group n6.

See communication-related parameters in *"9.2.5 Operation Control Through Communication" on page 306*.

Communication address

Set b5-13 [Torque reference source] to 9 to select communication as the torque source.

When the torque reference is set through communication, you need to configure basic communication parameters to enable the drive to communicate with the host controller. The host controller needs to follow the communication address and format specified by the drive to write communication commands to the drive.

7310H is one of the communication addresses supported by the drive, which is defined as follows.

Comm. address		Description
Speed reference 2 set through communication	7310H	The target frequency can be set through this communication address. The property of values written through this address is switched by n0-14 [7310H speed reference selection]. The setting range of n0-14 is as follows. 0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to rated frequency/signed 16-bit/2 decimal places) 4: Percentage (corresponds to maximum frequency/signed 16-bit/2 decimal places)

Set n0-14 [7310H Speed reference selection] to 3 [Percentage (corresponds to rated frequency/ signed 16-bit/two decimal places)]. In this case, writing 1000 to 7310H sets the torque to 10%. The torque reference can be viewed through U6-11.

Application instance

Procedure for setting "Communication" as the torque source:

1. Set b0-03 to 0 and b5-13 to 9 to set communication as the main torque reference source of setting channel 1.
2. Set n0-14 to define 7310H speed reference configuration.
3. Send a write command to the drive through the host controller.

The following example shows how to set the main frequency through communication, with the Modbus protocol and address 0x7310. For example, when setting the torque to 10.00% (actual transmitted value is 1000) through communication, the write command sent is 01 06 73 10 03 E8 92 35.

The following table describes the definition of each byte.

Byte	Definition
01H (editable)	AC drive address
06H	Write command
7310H	Torque reference address
03E8H (converted to 1000 in decimal)	Target torque
9235H	CRC

Set n0-14 [7310H Speed reference selection] to 3 [Percentage (corresponds to rated frequency/ signed 16-bit/two decimal places)]. In this case, writing 1000 to 7310H sets the torque to 10%. The torque reference can be viewed through U6-11.

9.4.8 Setting Additional Torque Reference

Application scenarios

The additional torque is used in applications that require the torque regulation to be activated directly.

Function description

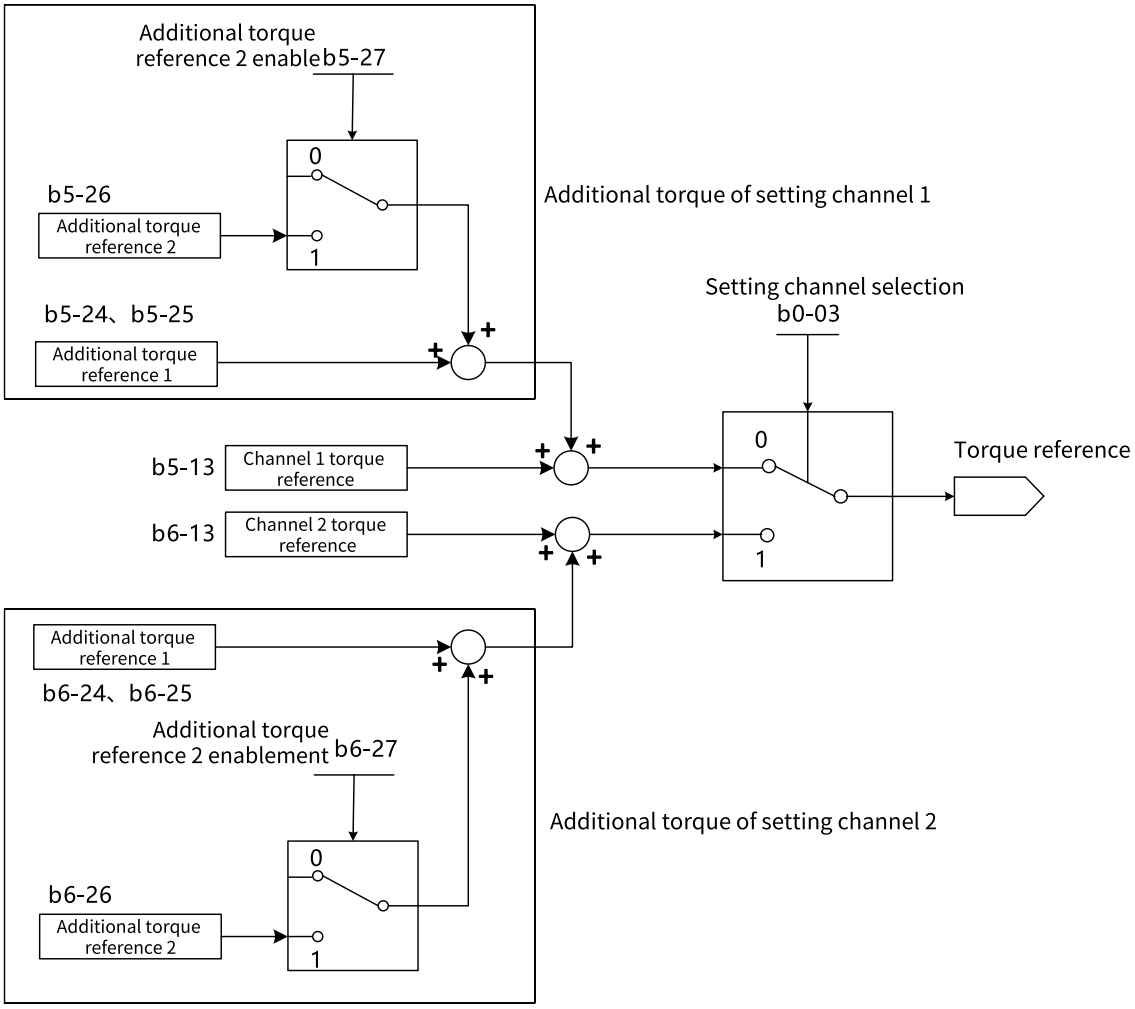


Figure 9-39 Torque reference and additional torque

Related parameters

Table 9–19 Related parameters

Param.	Name	Default value	Value range	Description
b5-24	Source of additional torque reference 1	0	0: b5-25 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of additional torque reference 1. Value description: 0: b5-25 - The source of additional torque reference 1 is set through b5-25. 6: Multi-reference - When multi-reference is used as the source of additional torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The additional torque reference 1 is set through PID. 9: Communication - The additional torque reference 1 is set through communication. In this mode, the additional torque reference 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 1. It is used for extension of common sources.
b5-25	Digital reference of additional torque reference 1	0	-400.0% to +400.0%	Defines the digital reference of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Name	Default value	Value range	Description
b5-26	Source of additional torque reference 2	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of additional torque reference 2. Value description: 0: 0 - The source of additional torque reference 2 is set to "0". 6: Multi-reference - When multi-reference is used as the source of additional torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The additional torque reference 2 is set through PID. 9: Communication - The additional torque reference 2 is set through communication. In this mode, the additional torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 2. It is used for extension of common sources.
b5-27	Additional torque reference 2 enable	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether to enable additional torque reference 2. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Value description: 0: Inhibited - The additional torque reference 2 is disabled. 1: Enabled - The additional torque reference 2 is enabled. 3 to 12: DI1 to DI10 - Depends on the final state of the DI terminal. Other: B connector - Depends on B connector. You can select B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b6-24	Source of additional torque reference 1	0	0: b6-25 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of additional torque reference 1. Value description: 0: b6-25 - The additional torque reference 1 is set through b6-25. 6: Multi-reference - When multi-reference is used as the source of additional torque reference 1, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The additional torque reference 1 is set through PID. 9: Communication - The additional torque reference 1 is set through communication. In this mode, the additional torque reference 1 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 1. It is used for extension of common sources.
b6-25	Digital reference of additional torque reference 1	0	-400.0% to +400.0%	Defines the digital reference of additional torque reference 1. The value is effective when the source of additional torque reference 1 is set to 0.

Param.	Name	Default value	Value range	Description
b6-26	Source of additional torque reference 2	0	0: Inactive 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of additional torque reference 2. Value description: 0: 0 - The source of additional torque reference 2 is set to "0". 6: Multi-reference - When multi-reference is used as the source of additional torque reference 2, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each reference and supports up to 16 speeds. 8: PID - The additional torque reference 2 is set through PID. 9: Communication - The additional torque reference 2 is set through communication. In this mode, the supplementary torque is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the additional torque reference 2. It is used for extension of common sources.
b6-27	Additional torque reference 2 enable	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether to enable additional torque reference 2. When the value is 0, additional torque 2 is disabled. When the value is 1, additional torque 2 is enabled. Value description: 0: Inhibited - The additional torque reference 2 is disabled. 1: Enabled - The additional torque reference 2 is enabled. 3 to 9: DI1 to DI7 - Depends on the terminal state of the DI. Other: B connector - Depends on B connector. You can select B connector through the pop-up window.

9.4.9 Setting Torque Limit

Application scenarios

This function is used to limit the motor speed range by setting a torque limit to prevent the motor from running above or below a certain torque.

Function description

The torque upper limit refers to the maximum torque reference of the motor. The torque lower limit refers to the minimum torque reference of the motor.

The active torque upper limit is the smaller of d1-09 [Digital reference of torque upper limit 1] and d1-11 [Source of torque upper limit 2].

The active torque lower limit is the higher of d1-10 [Digital reference of torque lower limit 1] and d1-12 [Source of torque lower limit 2].

Related parameters

Table 9–20 Related parameters

Param.	Name	Default value	Value range	Description
d1-09 (F2-30)	Digital reference of torque upper limit 1	150.0%	0.0% to 800.0%	Defines the torque upper limit, which is a per-unit value based on the rated torque of the motor. d1-09 [Digital reference of torque upper limit 1] is mapped to F2-30 in group F. These two parameters have the same function. Note: The active positive torque limit is the smaller of d1-09 and d1-11.
d1-10 (F2-31)	Digital reference of torque lower limit 1	-150.0%	-800.0% to 0.0%	Defines the torque lower limit, which is a per-unit value based on the rated torque of the motor. d1-10 [Digital reference of torque lower limit 1] is mapped to F2-31 in group F. These two parameters have the same function. Note: The effective torque lower limit is the higher of d1-10 and d1-12.

Param.	Name	Default value	Value range	Description
d1-11 (F2-32)	Source of torque upper limit 2	0	0: -800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of torque upper limit 2, which is the per-unit value based on the rated torque of the motor. d1-11 [Source of torque upper limit 2] is mapped to F2-32 in group F. These two parameters have the same function. Value description: 0: -800% - The limit is set to -800%. 6: Multi-reference - When multi-reference is used as the source, combinations of different DI states correspond to different values The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. The limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The limit is set through PID. PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The limit is set through communication. You can set the torque lower limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for the floating-point connector, and the value of the connector is used as the limit. It is used for extension of common sources. Note: The effective torque upper limit is the smaller of F2-30 and F2-32.

Param.	Name	Default value	Value range	Description
d1-12 (F2-33)	Source of torque lower limit 2	1	0: -800% 1: Inverted value of d1-11 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the torque lower limit 2, which is the per-unit value based on the rated torque of the motor. d1-12 [Source of torque lower limit 2] is mapped to F2-33 in group F. These two parameters have the same function. Value description: 0: -800% - The limit is set to -800%. 1: Inverted value of d1-11- The inverted value of d1-11 is used as the source. 6: Multi-reference - When multi-reference is used as the source, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed reference that can control the operating time and acceleration/deceleration time. The limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The limit is set through PID. PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The limit is set through communication. You can set the torque lower limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for the floating-point connector, and the value of the connector is used as the limit. It is used for extension of common sources. Note: The effective torque lower limit is the smaller of F2-31 and F2-33.

9.5 Startup/Stop Mode

9.5.1 Startup Mode

The drive supports two startup modes: direct start and flying start. Set d0-02 to select a startup mode of the drive.

9.5.1.1 Flying Start

Application scenarios

If a rotating motor is being started directly, overcurrent may occur due to the inrush current at startup. In this case, you can set d0-02 [Startup mode] to 1 [Flying start] to apply flying start, where the drive detects the motor speed and direct first and then start at the motor frequency tracked.

Speed tracking function is suitable for applications without encoder, and where it is necessary to track and start a rotating motor.

If it is necessary to restart the motor while the rotor is rotating, the flying start mode can be selected. Flying start is applicable to V/f and SVC modes.

Operating principles

In this mode, the drive can automatically track the motor speed and direction and achieve bumpless start of a rotating motor.

As shown in the following figure, after startup, the motor synchronous frequency tracks the motor speed in real time. After tracking is done, the normal operation mode applies.

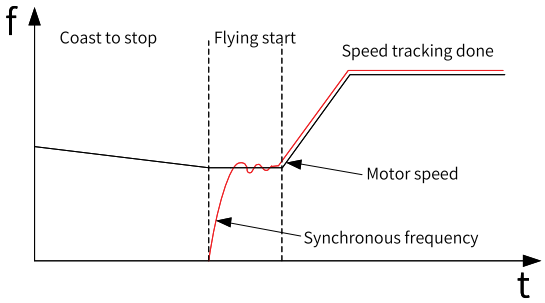


Figure 9-40 Flying start diagram

Note: In field-oriented speed tracking, it is recommended to perform parameter auto-tuning with the motor connected to the drive.

Related parameters

Param.	Name	Default value	Value range	Description
d0-02 (F2-15)	Startup mode	0	0: Direct start 1: Flying start	Defines the startup mode of the motor. Value description: 0: Direct start - The drive starts directly. This mode applies to scenarios where the motor starts from a standstill state. 1: Flying start - In this mode, the drive first determines the motor rotation speed and direction, and then starts at the detected frequency of the motor. Select this mode when the motor starts during rotation. For other scenarios, select direct start.
d0-03 (F2-16)	Speed tracking mode	4	0: Starting from the stop frequency 1: Starting from the power frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	Defines the speed tracking mode when the drive starts. Value description: 0: Starting from the stop frequency - The speed is searched from the last stop frequency. If an external force drives the motor to a higher speed than the stop speed, this mode is not applicable. 1: Starting from the power frequency - The current speed is searched from 50 Hz. This mode is suitable for restart after a long power outage. 2: Starting from the maximum frequency - The current speed is searched from F1-10 [Maximum motor frequency]. This mode is generally used for generating loads. 4: Field-oriented speed tracking - The current speed is searched through field-oriented speed tracking. The searching speed is faster than the first three modes. In this mode, the motor parameters need to be auto-tuned. This mode is suitable for fast speed tracking in V/f control.

Precautions

1. The preceding four speed tracking modes are available for asynchronous motors in V/f mode. In SVC mode, only field-oriented speed tracking is available.
2. The speed tracking methods 0, 1, and 2 take longer time than the other methods but feature lower requirements on motor parameters.
3. No changes are needed for speed tracking method of synchronous motors.
4. After speed tracking start, self-test before startup is not performed.

Application instance

A motor coasts to stop for a long time due to the large system inertia, and the motor needs to be restarted during coast-to-stop. In this case, set d0-02 [Startup mode] to 1 [Flying start] and d0-03 [Speed tracking mode] to 4 [Field-oriented speed tracking], then press the start button to make the motor restart from the current speed smoothly.

Flying start is in high demand in applications such as fans, pumps, air conditioning, and air compressors. For high-power or high-inertia motors, the coast-to-stop process is long after a fault occurs. If the motor needs to be restarted after fault reset, enable the speed tracking function before restart.

9.5.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)

Application scenarios

When multiple asynchronous motors need to be started simultaneously, you can use time-based pre-excitation to make multiple asynchronous motors start simultaneously after pre-excitation is done.

The motor, after receiving a start command, runs at the speed defined by RFG and accelerates based on the set acceleration time. This startup mode is applicable to most load applications.

Operating principles

Set d0-02 [Startup mode] to 0 [Direct start] in V/f mode. The motor, after receiving a start command, runs at the speed defined by RFG.

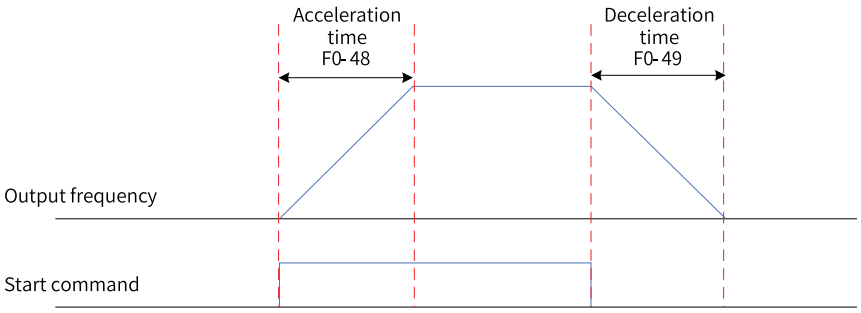


Figure 9-41 Schematic for direct startup

When the asynchronous motor operates in SVC mode, set d0-02 [Startup mode] to 0 [Direct start], and set pre-excitation parameters. The motor needs to enter the pre-excitation state before being started, so that a rotor magnetic field can be established for better control of motor output torque. Pre-excitation can be selected either based on time or current reference. The pre-excitation function is set through d0-17 [Pre-excitation time] to d0-20 [Demagnetization time].

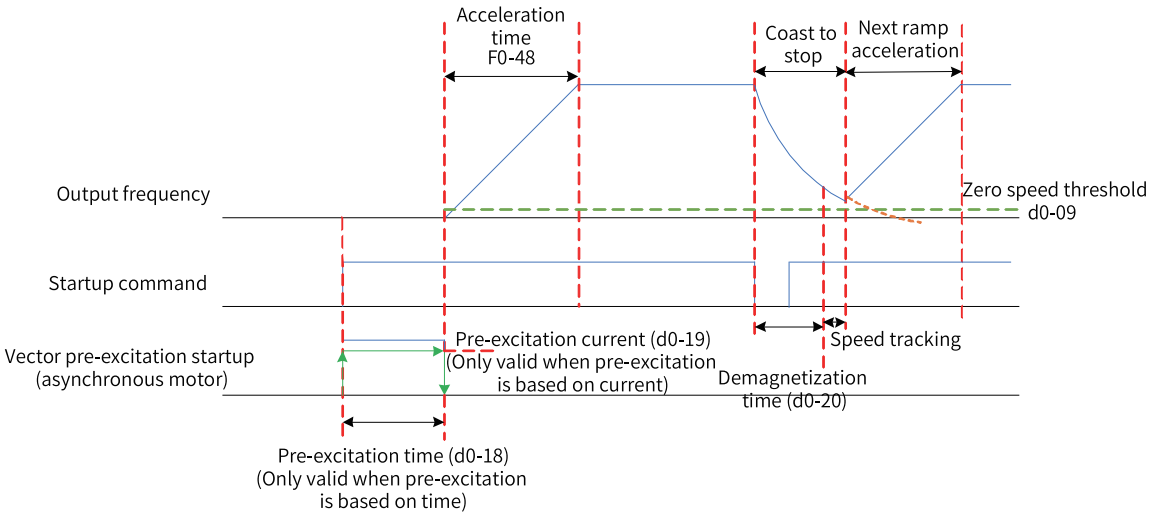


Figure 9-42 Schematic of pre-excitation

Related parameters

Param.	Name	Default value	Value range	Description
d0-02 (F2-15)	Startup mode	0	0: Direct start 1: Flying start	Defines the startup mode of the drive. Value description: 0: Direct start - A motor at a standstill is started directly. 1: Flying start - A motor is started while rotating.
d0-17	Pre-excitation mode	1	0: Time-based pre-excitation 1: Current-based pre-excitation 2: Maximum-current-based pre-excitation	Defines the pre-excitation mode for an asynchronous motor in the vector control mode. Value description: 0: Time-based pre-excitation - After the excitation time before start reaches the time set by d0-18, the drive enters the normal operation state. The excitation current reference is calculated by the system automatically. 1: Current-based pre-excitation - Excitation is performed based on the setting of d0-19. When the flux reaches the target value, the normal operation state applies. 2: Maximum-current-based pre-excitation - Before start, the system calculates the maximum current based on the rated drive current and the rated motor current. This pre-excitation can be done quickly.

Param.	Name	Default value	Value range	Description
d0-18	Pre-excitation time	1000 ms	1 ms to 30000 ms	Defines the pre-excitation time for the asynchronous motor in the vector control mode. Note: This parameter is valid when d0-17 is set to 0.
d0-19	Pre-excitation current	100%	1 % to 800%	Defines the pre-excitation current for the asynchronous motor in the vector control mode. Note: 1. The setpoint is a percentage to the rated motor current. 2. This parameter is valid when d0-17 is set to 1.
d0-20	Demagnetization time	0.5s	0s to 5s	Defines the demagnetization time of the asynchronous motor. Note: To restart after coast-to-stop, wait for the time set by d0-20 before the asynchronous motor is demagnetized before start. Note that an excessively short demagnetization time may result in speed tracking failure.

Precautions

1. Pre-excitation start is applicable only to asynchronous motors in FVC and SVC modes.
2. Quick start in SVC is equivalent to quick pre-excitation start.
3. The excitation time is defined by d0-18 [Pre-excitation time] only when d0-17 [Pre-excitation mode] is set to 0 [Time-based pre-excitation]. The excitation current is calculated dynamically based on the excitation time. After the excitation time is reached, pre-excitation is done.
4. The excitation current is defined by d0-19 [Pre-excitation current] only when d0-17 [Pre-excitation mode] is set to "Current-based pre-excitation". The excitation time changes dynamically.

9.5.1.3 Direct Start of Synchronous Motor (Magnetic Pole Position Auto-tuning)

Application scenarios

The rotor polarity position must be known before direct startup of the synchronous motor. This is to ensure correct motor direction upon startup.

Operating principles

Direct startup of a synchronous motor involves magnetic pole position auto-tuning to obtain the rotor position of the synchronous motor, so that the motor can start running in the correct direction. Auto-tuning helps prevent startup issues such as reverse startup, oscillation, or step loss caused by excessive deviation between the initial pulsing phase angle and the actual position of the motor rotor.

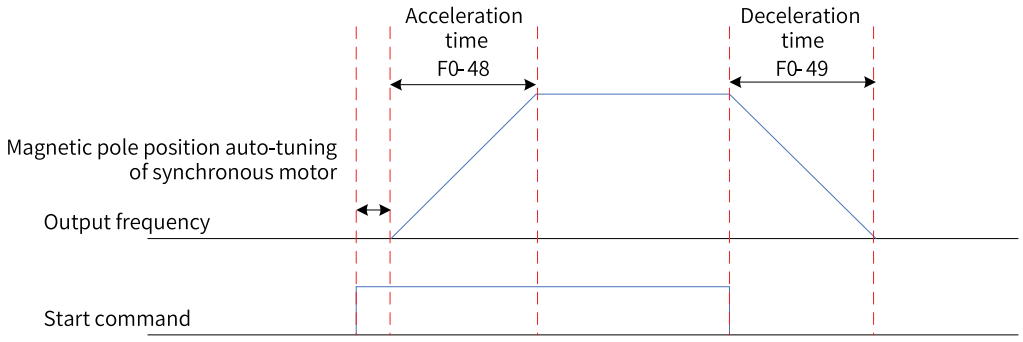


Figure 9-43 Pole position auto-tuning

Related parameters

Param.	Name	Default value	Value range	Description
d0-70	Initial position detection of synchronous motor before startup	0	0: Detected every time upon operation 1: Not detected 2: Detected during initial operation upon power-on	Defines the detection mode of the initial position of the synchronous motor before startup.
d0-71	Initial position detection method of synchronous motor before startup	2	0: Pulse 1: High-frequency injection 2: Adaptive 3: Pre-positioning	Defines the initial position detection method of the synchronous motor before startup. Value description: 0: Pulse - Voltage pulse is used for magnetic pole position auto-tuning before startup. 1: High-frequency injection - High-frequency injection is used for magnetic pole position auto-tuning before startup. 2: Adaptive - Whether to enable high-frequency injection depends on the motor inductance. 3: Pre-positioning - Used to drive the motor to a fixed angle before startup.

Param.	Name	Default value	Value range	Description
d0-75	Initial position detection current of synchronous motor	80	50% to 180 %	Defines the target current for magnetic pole position auto-tuning of the synchronous motor. The lower the current, the lower noise is generated during detection. Note that an excessively low setpoint may cause inaccurate position detection. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
d0-76	Initial position compensation angle	0	0.0°to 359.9°	For a synchronous motor, after auto-tuning of the initial magnetic pole position, set this compensation angle properly to avoid reverse rotation upon startup. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Precautions

1. It is recommended to enable magnetic pole position auto-tuning for direct startup of the synchronous motor. Otherwise, reverse rotation upon startup, oscillation upon sudden acceleration/deceleration, or step loss can occur.
2. During detection upon initial power-on, if the motor speed during coast-to-stop is higher than the zero speed threshold, the position is lost. In this case, the position will be auto-tuned again at next direct startup.
3. The pulse method is generally suitable for non-salient pole motors, high-frequency injection is suitable for salient pole motors, and pre-positioning is suitable for applications where slight rotation of the motor before startup is acceptable.
4. When pulse method is used, a noticeable sound may occur before startup, which is normal. When high-frequency injection method is used, a "hissing" sound may be generated before startup. In noise-sensitive applications, select the magnetic pole position auto-tuning method before startup based on the motor characteristics.
5. Magnetic pole position auto-tuning is performed on the synchronous motor every time upon startup in SVC mode.
6. Pulse-based auto-tuning lasts about 15 ms.
7. Auto-tuning with high frequency injection lasts about 120 ms.
8. Pre-positioning-based auto-tuning lasts about 2s.

9.5.2 Stop Mode

Application scenarios

Stop modes specify the actions upon corresponding stop commands, which include "decelerate to stop", "coast to stop", "stop with maximum capability", and "quick stop". In some special applications, DC braking at stop is also required.

Operating principles

The drive supports three start/stop commands, which include ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

- ON_OFF1 (Start/Stop): The value 0 indicates it is inactive and the value 1 indicates it is active. It is generally used together with OFF2 and OFF3 to control the drive. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered by the rising edge (0→1). When the stop command is triggered by the falling edge (1→0), the drive stops as defined by d0-04 [OFF1 stop mode].
- OFF2 (Coast to stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF3 to control the drive. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers emergency stop upon falling edge (1→0), and the drive stops as defined by d0-05 [OFF2 (coast to stop) mode].
- OFF3 (Quick stop): The value 1 indicates it is inactive and the value 0 indicates it is active. It is generally used together with ON_OFF1 and OFF2 to control the drive. When ON_OFF1 is active and the OFF2 command is inactive, and no fault occurs, the OFF3 command triggers emergency stop upon falling edge (1→0), and the drive stops as defined by d0-06 [OFF3 (coast to stop) mode].

Operation mode	Command type	Setpoint	Result
Start	Normal start	ON_OFF1: 0-1	The drive starts normally.
		OFF2: 1	
		OFF3: 1	
Stop	OFF1 stop command	ON_OFF1: 1-0	The drive stops according to the OFF1 setting. The OFF1 stop mode includes decelerate to stop, coast to stop, and stop with maximum capability.
		OFF2: 1	
		OFF3: 1	
	OFF2 stop command	ON_OFF1: 1	The drive stops according to the mode set by OFF2 (Coast to stop).
		OFF2: 1-0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The drive stops according to the OFF3 setting. The OFF3 stop mode includes quick stop and stop with maximum capability.
		OFF2: 1	
		OFF3: 1-0	

As shown in the preceding table, the stop modes of OFF1 to OFF3 can be set with different commands, as defined below.

- Decelerate to stop
  d0-04 [OFF1 stop mode] is generally set to "decelerate to stop". Once the decelerate-to-stop command is activated, the drive decreases the output frequency to 0 and then stops based on the RFG deceleration time.

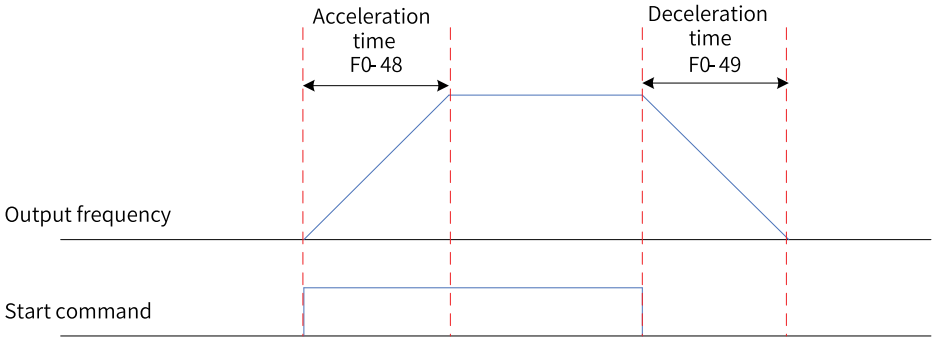


Figure 9-44 Decelerate to stop

- Coast to stop
  d0-05 [OFF2 (coast to stop) mode] is fixed to coast-to-stop. In coast-to-stop, the IGBT output is blocked directly and the motor coasts to stop. For devices with high inertia, the coast-to-stop process lasts for a long time. Coast-to-stop can be triggered upon most of the faults or OFF2 emergency stop.

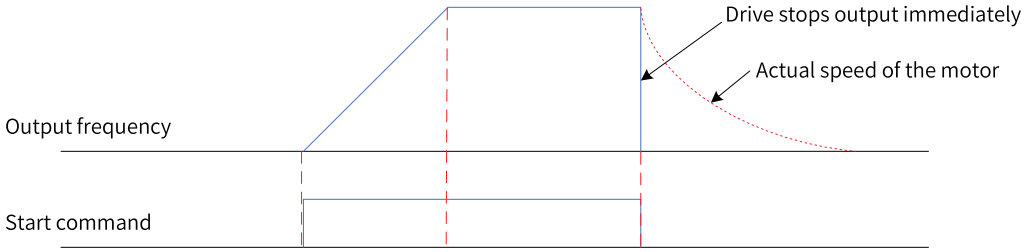


Figure 9-45 Coast to stop

- Stop with maximum capability
  After this command is activated, the speed reference of the motor is set to 0 forcibly, and the motor decelerates to zero speed based on the maximum output capability. During deceleration, the motor torque or current may reach the limit.
- Quick stop
  d0-06 [OFF3 (quick stop) mode] is generally set to "quick stop". The quick stop mode is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34 [Deceleration time in quick stop] to b7-36 [End arc in quick stop].

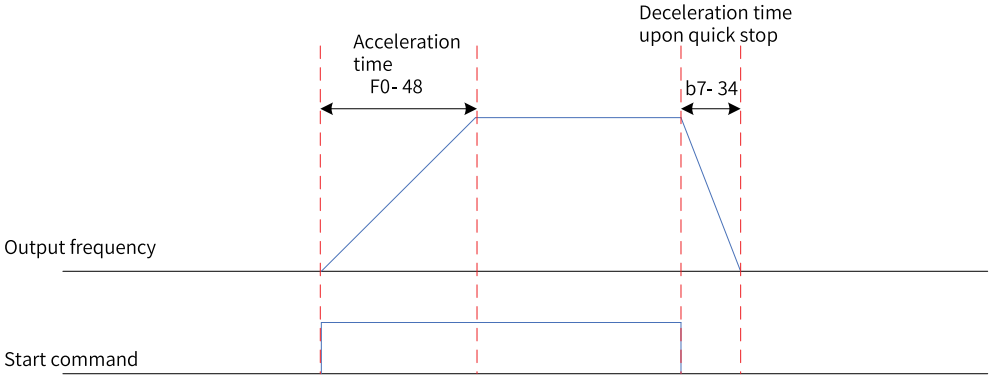


Figure 9-46 Quick stop

If the motor reaches torque or current limit during deceleration, the corresponding deceleration time will be extended.

Related parameters

Param.	Name	Default value	Value range	Description
d0-04 (F2-17)	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop with maximum capability	Defines the OFF1 stop mode. Value description: 0: Decelerate to stop - The stop mode is determined by the active ramp setting. 1: Coast to stop - The drive stops output, which means the power supply of the motor is cut off and the driving system is in the free braking state. 2: Stop with maximum capability - In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.
d0-05	OFF2 (Coast to stop) mode	0	0: Coast to stop	Displays the OFF2 stop mode. The default mode is "coast to stop".
d0-06	OFF3 (Quick stop) mode	0	0: Quick stop 1: Stop with maximum capability	Defines the OFF3 (quick stop) mode. Value description: 0: Quick stop - It is equivalent to the emergency stop function assigned to a terminal. The deceleration time is defined by b7-34/b7-35/b7-36. 1: Stop with maximum capacity - In this mode, the motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The minimum deceleration time is fixed to 50 ms. The output torque or current may reach the limit value during deceleration.

Param.	Name	Default value	Value range	Description
d0-07	Stop mode during operation	1	0: OFF1 Stop 1: OFF2 (coast to stop) mode 2: OFF3 (quick stop) mode	Defines the stop mode after the operation permission signal is deactivated. It is equivalent to the operation pause or operation enable function that assigned to the terminal. Value description: 0: OFF1 mode - The stop mode is defined by d0-04. 1: OFF2 (coast to stop) mode - The stop mode is coast-to-stop. 2: OFF3 (quick stop) mode - The stop mode is defined by d0-06.
d0-08	Stop mode in torque control	1	0: Coast to stop forcibly 1: Switched to speed mode and stop 2: Staying in torque mode until reaching zero speed and then stop	Defines the stop mode in torque control. Value description: 0: Coast to stop forcibly - The motor coasts to stop, and the driving system is in the free braking state. 1: Switched to speed mode and stop - The drive switches to speed control mode and stops according to the stop mode currently effective in speed control mode. 2: Staying in torque mode until reaching zero speed and then stop - The speed limit in the torque mode is reduced to 0 according to the set deceleration time, but the motor is still running in the torque mode. When the actual motor speed reaches 0 rpm, the motor stops.

9.5.3 Starting Frequency

Application scenarios

When starting torque is needed or when smooth motor startup is needed, the starting frequency can be set, and the set starting frequency can be maintained for a certain period of time.

Operating principles

Set the starting frequency through d0-23 [Starting frequency] and d0-24 [Starting frequency hold time]. When d0-24 is set to 0, the starting frequency is inactive. When d0-24 [Starting frequency hold time] is set to a non-zero value, the drive outputs the value defined by d0-23 [Starting frequency] directly upon receiving a startup command and keeps the starting frequency within the time defined by d0-24 [Starting frequency hold time] before acceleration.

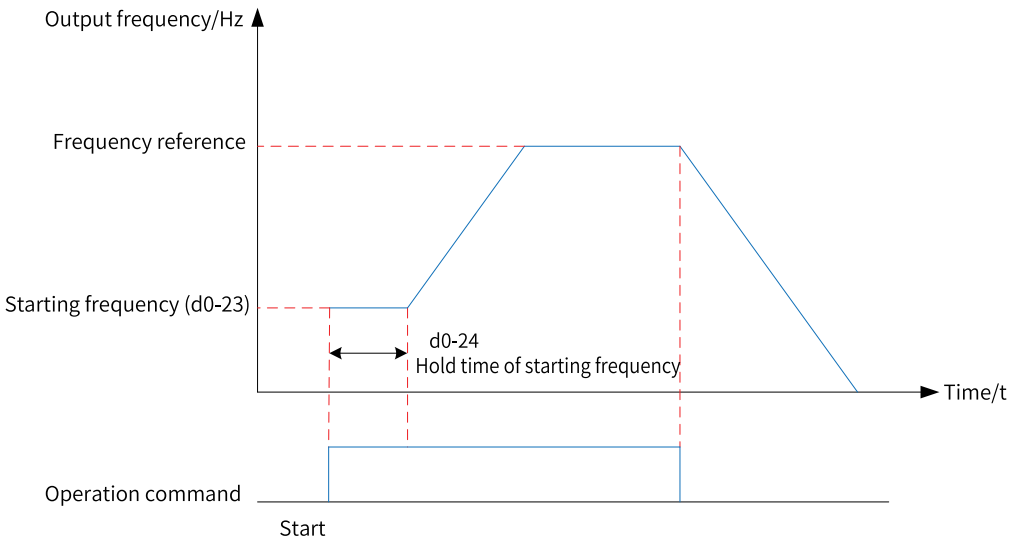


Figure 9-47 Diagram of starting frequency

Related parameters

Param.	Name	Default value	Value range	Description
d0-23	Starting frequency	0	0.00 Hz to 10.00 Hz	Defines the starting frequency. Note: The starting frequency is outputted once the system is started. After the starting frequency remains unchanged for the time defined by d0-24, the drive accelerates.
d0-24	Starting frequency hold time	0	0.0s to 1000.0s	Defines the hold time of the starting frequency. Note: The setpoint 0 indicates that this function is inactive.

Note: This section only introduces the first set of motor parameters, which also applies to other motor parameter sets.

9.5.4 DC Braking

9.5.4.1 DC Braking at Start

Application scenarios

The setting of DC braking time at startup applies to applications where the motor may rotate at start.

When the asynchronous motor is started in V/f mode, the DC braking function can help increase the starting torque.

Operating principles

When DC braking is enabled, a DC current is applied to the motor stator winding to generate a braking force that brings the motor to a standstill. Set the start DC braking at startup through d0-25

[DC braking time at startup] and d0-26 [DC braking current at startup]. When d0-25 is set to 0, this function is disabled. Additionally, the current loop during DC braking can be adjusted through d0-31 [Current loop Kp adjustment in DC braking] and d0-32 [Current loop Ti adjustment in DC braking].

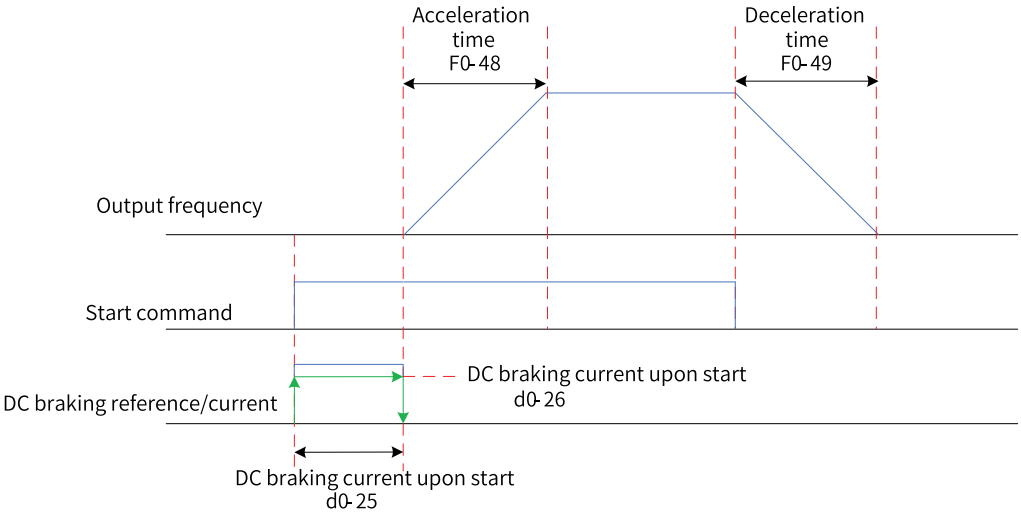


Figure 9-48 Diagram for DC braking at startup

Related parameters

Param.	Name	Default value	Value range	Description
d0-25	DC braking time at start	0s	0s to 100s	Defines the DC braking time at startup. Note: This parameter is valid when d0-02 is set to 0 [Direct startup]. The setpoint 0 indicates this function is disabled. When this parameter is set to a non-zero value, the drive outputs DC current (d0-26) continuously to generate a braking force before the motor starts. When the time defined by d0-25 is reached, the normal operation state applies.
d0-26	DC braking current at start	50%	0% to 800%	Defines the DC braking current at startup. The higher the DC braking current, the stronger the braking force can be. Note: The setpoint is a percentage to the rated current of the motor.
d0-31	DC braking current loop Kp adjustment	100.0%	0.1% to 800.0%	Defines the current loop Kp adjustment coefficient during DC braking.
d0-32	DC braking current loop Ti adjustment	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

Precautions

1. Note that the current and action time of DC braking must be lower than the overload limits of the motor and drive.
2. Long-term braking can keep the asynchronous motor at the zero speed but may result in motor overtemperature.
3. Do not use the DC braking function as a replacement of the brake function configured in the mechanical device.

Warning

Do not use DC braking on traction loads. Pulling the load can cause the motor to rotate, which may result in personal injury or death.

9.5.4.2 DC Braking at Stop

Application scenarios

In applications where braking with DC current is needed at stop, you can enable DC braking at stop to ensure the load stops properly after the drive stops.

Operating principles

During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state.

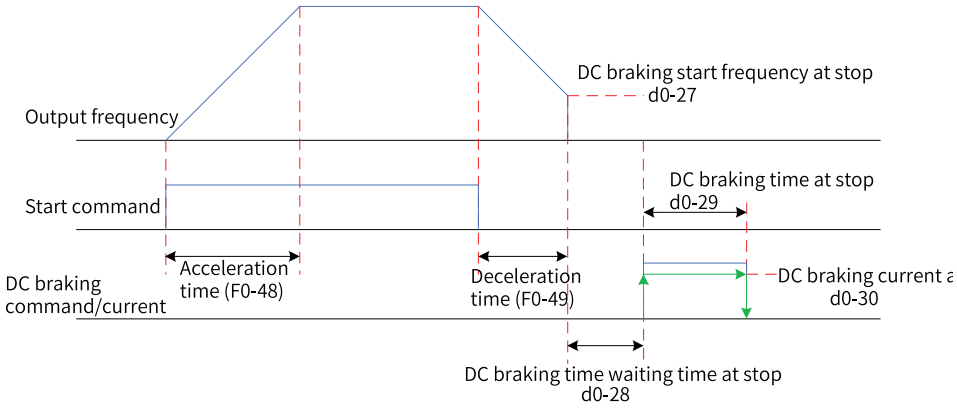


Figure 9-49 DC braking at stop

Related parameters

Param.	Name	Default value	Value range	Description
d0-27	Starting frequency of DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz	Defines the starting frequency of DC braking at stop. Note: 1. During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state. 2. Do not set this parameter to an excessively high value. Failure to comply can result in overcurrent of the drive.
d0-28	Waiting time of DC braking at stop	0.0s	0.0s to 100.0s	Defines the waiting time of DC braking at stop. Note: 1. During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state. 2. The waiting time is used to allow the asynchronous motor to demagnetize. If the waiting time is too short, overcurrent may easily occur.
d0-29	DC braking time at stop	0.0s	0.0s to 100.0s	Defines the DC braking time at stop. Note: During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state.
d0-30	DC braking current at stop	50%	0% to 800%	Defines the DC braking current at stop. Note: 1. During decelerate-to-stop, when the operating frequency is reduced to d0-27 [Starting frequency for DC braking at stop], the drive blocks the output. When such state lasts for the time defined by d0-28 [DC braking waiting time at stop], the current defined by d0-30 [DC braking current at stop] is kept outputting for the time defined by d0-29 [DC braking time at stop]. After the time defined by d0-29 elapses, the drive enters the stop state. 2. The current percentage is based on the rated current of the motor. The higher the setpoint, the higher the braking intensity.

Param.	Name	Default value	Value range	Description
d0-31	Kp adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Kp adjustment coefficient during DC braking.
d0-32	Ti adjustment of DC braking current loop	100.0%	0.1% to 800.0%	Defines the current loop Ti adjustment coefficient during DC braking.

Precautions

1. The starting frequency for DC braking at stop cannot be set to an excessively high value. Otherwise, overcurrent may occur on the drive.
2. For asynchronous motors, if the waiting time for DC braking at stop is set to an excessively low value, overcurrent may easily occur on the drive.
3. Note that the current and action time of DC braking must be lower than the overload limits of the motor and drive.

9.5.5 Timed Stop

Application scenarios

To make the drive stop automatically after operating for a certain period of time, you can set the timed operation period through P0-13 [Timing function selection] to P0-15 [Timed operation period]. Each time the drive starts, timing starts from 0. When the timed operation period expired, the drive stops automatically.

When the RO or DO is assigned with function "30 [Timed operation arrival]," the corresponding RO or DO outputs an active signal once the operating time of the drive reaches the set time.

Operating principles

Set whether to enable timed operation of the drive through P0-13 (Timing function). When timed operation is enabled, the timer starts from 0 upon startup of the drive. When the timing period expires, the drive stops automatically. The remaining operating time can be viewed through U0-20 [Remaining time of timed operation].

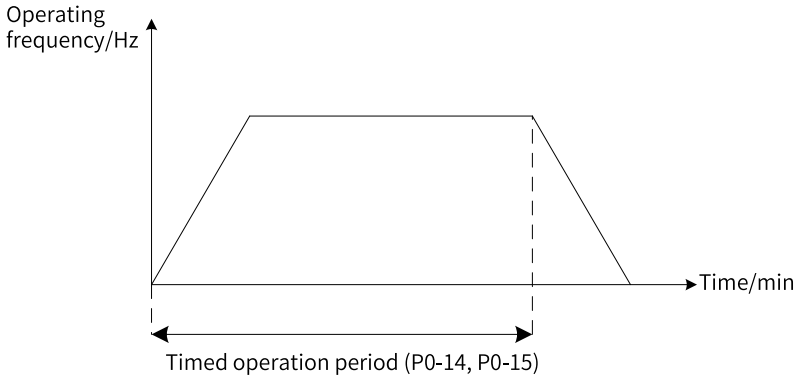


Figure 9-50 Timed operation

Set the timed operation period (min) through P0-14 [Timed operation period source] and P0-15 [Digital reference of timed operation period]. When the timed operation period is set to 0, the timed operation is inactive. Set the source of timed operation period through P0-14.

1. When P0-14 [Timed operation period source] is set to 0 [P0-15], the timed operation period is defined by P0-15.
2. When P0-14 [Timed operation period source] is set to "Other [F Connector]", the timed operation period = floating-point connector value x P0-15.

When no special requirements are needed, P0-14 [Timed operation period source] is set to 0 [P0-15] by default, and the timed operation period is set through P0-15.

Related parameters

Param.	Name	Default value	Value range	Description
P0-13	Timer selection	0	0: Inactive 1: Active	Defines whether the timer of the drive is enabled. Value description: 0: Inactive 1: Active - The timer starts upon startup of the drive. When the set timing period expires, the drive stops automatically, with the corresponding multi-function DO outputs ON signal. Note: 1. The timing period is set by P0-14 and P0-15 in units of minute. 2. The drive starts timing from 0 upon start every time, and the remaining timing period can be viewed in U0-20.
P0-14	Timed operation period source	0	0: P0-15 Other: F connector	Defines the source of the timed operation period. Value description: 0: P0-15 - The timed operation period is set by P0-15. Other: F connector - The timed operation period is set by the F connector value and P0-15.
P0-15	Digital reference of timed operation period	0.0 min	0.0 min to 6500.0 min	Defines the local digital value of the timed operation period.
U0-20	Remaining time of timed operation period	0.0 min	0.0 min. to 6553.5 min.	Defines the remaining time of timed operation period in units of min.

9.5.6 Sleep and Wake-up

Application scenarios

You can set a sleep time within any 24-hour period. During the sleep period, the drive stops and enters the sleep state.

Wake-up is a process that the drive wakes up from the sleep state and starts to run.

Operating principles

To use the sleep and wake-up functions, set the sleep frequency and wake-up frequency. As shown in the following figure, set the sleep function through P0-24 [Sleep frequency] and P0-25 [Sleep delay]. During operation of the drive, when the frequency reference is lower than or equal to the P0-24 [Sleep frequency], the drive enters the sleep state and decelerates to stop after the sleep delay defined by P0-25 elapses. Set the wake-up function through P0-22 (Wake-up frequency) and P0-23 (Wake-up delay). In the sleep state, when the frequency reference is equal to or greater than P0-22 (Wake-up frequency), the drive wakes up after the delay defined by P0-23 elapses.

Generally, set P0-22 [Wake-up frequency] to a value equal to or higher than P0-24 [Sleep frequency]. The sleep and wake-up functions are invalid if both the wake-up frequency and sleep frequency are set to 0.0 Hz.

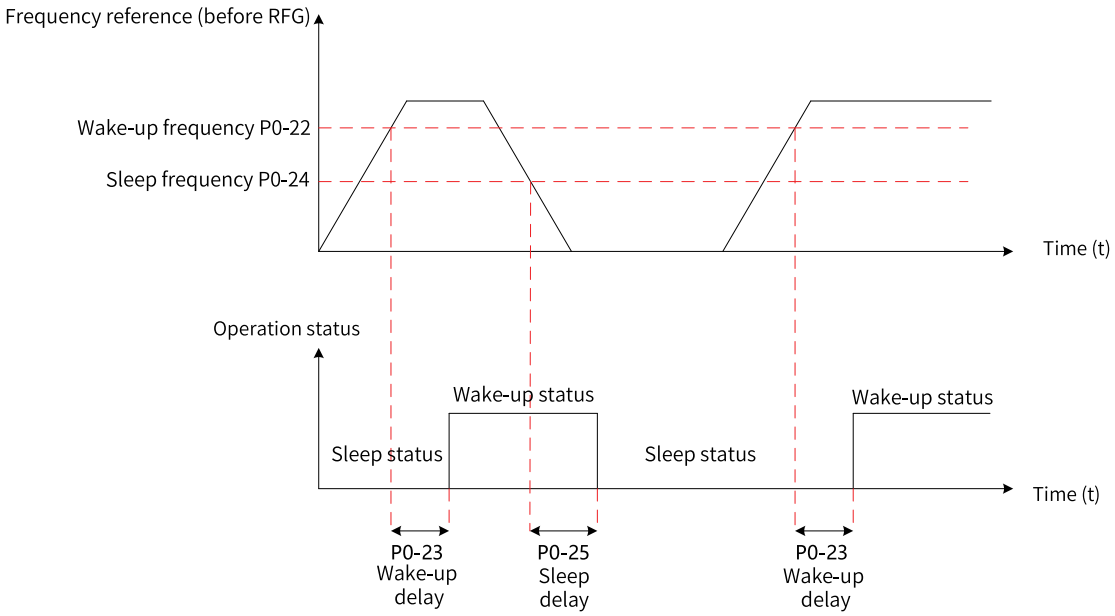


Figure 9-51 Sleep and wake-up function setting

Note:

(1) The upper limit of the sleep frequency can be set to a value equal to the wake-up frequency. Set P0-22 [Wake-up frequency] first and then P0-24 [Sleep frequency].

(2) When the sleep function is enabled during PID operation, you can set P2-33 [Selection of PID operation at stop] to 1 to continue the PID operation or to 0 to stop PID operation.

Related parameters

Param.	Name	Default value	Value range	Description
P0-22	Wake-up frequency	0.00 Hz	P0-24 to A2-17	Defines the wake-up frequency of the drive to exit the sleep state. Note: If the drive is in the sleep state and the current operation command is active, when the frequency reference is greater than or equal to P0-22 [Wake-up frequency], the drive starts directly after the delay defined by P0-23 elapses.
P0-23	Wake-up delay	0.0s	0.0s to 6500.0s	Defines the effective time of wake-up delay. Note: Same as P0-22
P0-24	Sleep frequency	0.00 Hz	0.00Hz to P0-22	Defines the sleep frequency of the drive. During operation of the drive, setting the frequency to a value lower than the sleep frequency triggers the sleep state. Note: During operation of the drive, when the frequency reference is lower than or equal to the P0-24 [Sleep frequency], the drive enters the sleep state and decelerates to stop after the sleep delay defined by P0-25 elapses.
P0-25	Sleep delay	0.0s	0.0s to 6500.0s	Defines the sleep delay of the AC drive. Note: Same as P0-24

9.5.7 Startup Protection

Application scenarios

This function is used to apply protection upon start of the drive to prevent dangers caused by inadvertent motor responses to the operation commands. The startup protection applies to the following conditions.

1. If the operation command is active when the drive is powered on (for example, an input terminal is ON before power-on), the drive does not respond to the command. The drive responds only after the operation command is activated again.
2. If the operation command is active during fault reset, the drive does not respond to the operation command. In this case, the startup protection can be disabled only after the operation command is deactivated. The drive starts to run when the operation command is activated again.

Operating principles

You can activate startup protection through P0-21 [Startup protection selection]. When P0-21 is set to 1, this function is active. If the operation command is inactive upon power-on or fault reset, the drive does not respond to the operation command. In this case, the startup protection can be disabled only after the operation command is deactivated. The drive starts to run when the operation command is activated again.

Related parameters

Param.	Name	Default value	Value range	Description
P0-21	Startup protection selection	1	0: Disable 1: Enable	Defines whether the startup protection is enabled. Value description: 0: Disable 1: Enable Note: 1. When this parameter is set to 1 and the operation command is active upon power-on (for example, the terminal that used to send an operation command is closed before power-on), the drive does not respond to the operation command. The drive responds only after the operation command is activated again. 2. When this parameter is set to 1 and the operation command is active upon fault reset, the drive does not respond to the operation command. The operation command must be deactivated first to disable the operation protection state.

Note: This parameter is inactive during fault reset, and the protection always applies.

9.6 Jog

9.6.1 Jog

Jog

In some applications, the drive needs to run at a low speed temporarily to facilitate equipment testing. You can use the jog mode in this case.

Operating principles

This drive can be set with up to two jog commands. Take the setting channel 1 and control channel 1 as an example. Set jog 1 frequency through b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]. Set jog 2 frequency through b5-09 [Jog 2 frequency source selection] and b5-10 [Jog 2 frequency reference]. Set E1-00 [DI1 terminal function selection] to 4 - Jog 1 (JOG1), E1-01 [DI2 terminal function selection] to 5 - Jog (JOG2), and F0-03 [Control channel 1 main command source] to 1 - Terminal.

Same as normal operation, the base frequency is set by b7-01 [Ramp-up/down time base]. Set the jog ramp-up/down time source through b7-31 [Jog ramp source selection]. When b7-31 is 0, the jog ramp-up/down time is the same as the normal ramp-up/down time. When b7-31 is 1, the jog ramp-up/down time is defined by b7-32 [Jog ramp-up time] and b7-33 [Jog rampd-down time]. The following figure shows the relationship between the output frequency and ramp-up/down time during jogging.

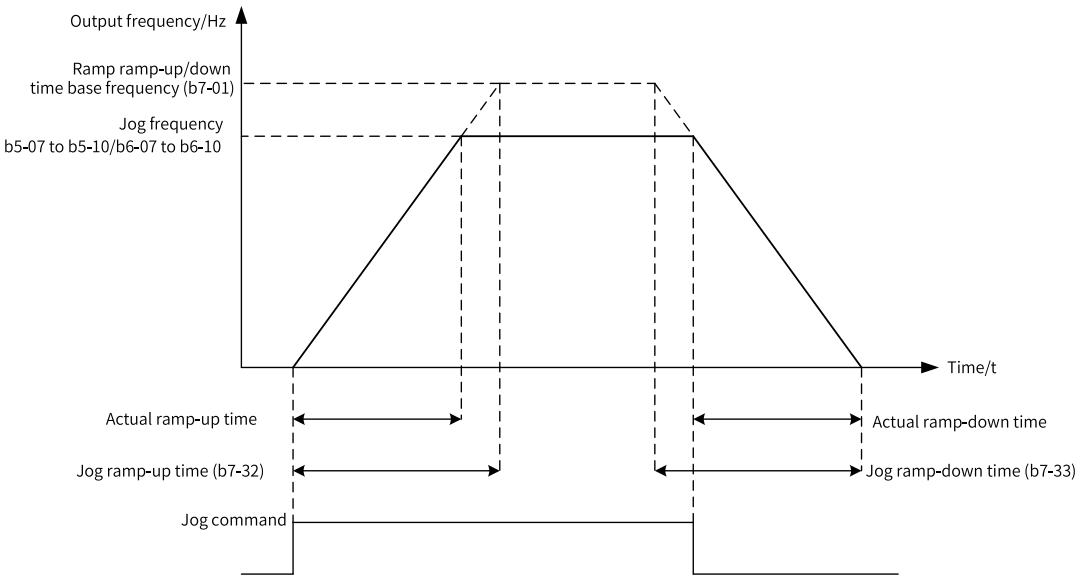


Figure 9-52 Jog

When both jog 1 and jog 2 commands are sent simultaneously, the drive responds to jog 1 command firstly. As shown in the figure below, when both jog 1 and jog 2 commands are input to the drive simultaneously, the drive starts at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). If the jog 1 command is deactivated, the drive responds to the jog 2 command and starts at the jog 2 frequency reference (b5-09 [Jog 2 frequency source selection] and b5-10 [Jog 2 frequency reference]).

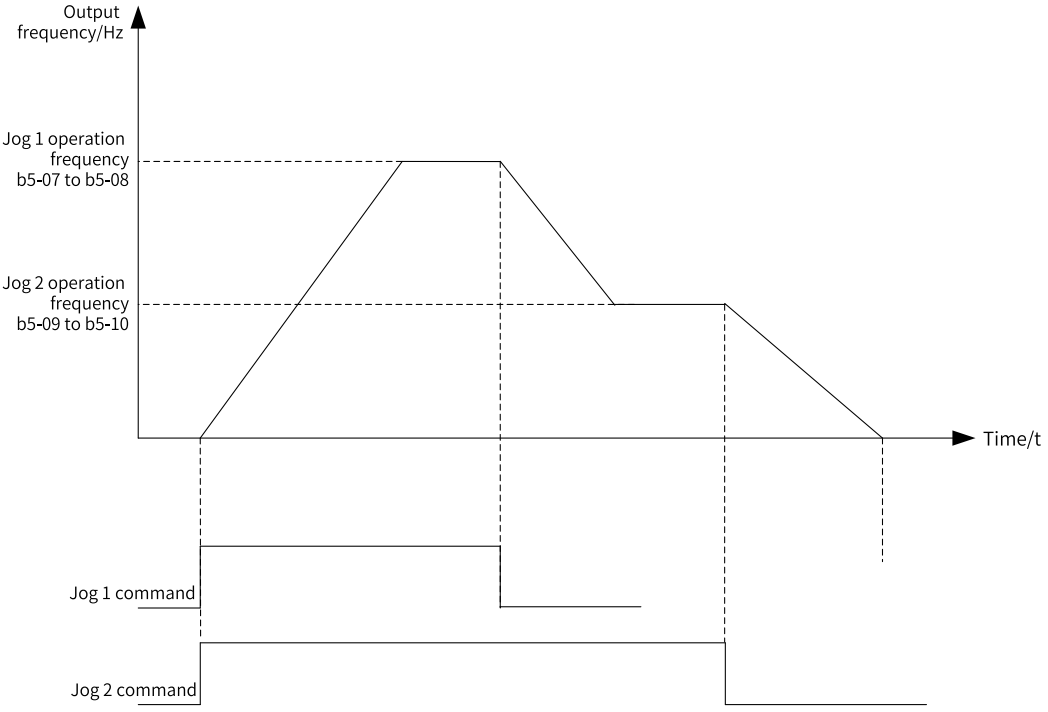


Figure 9-53 Relationship diagram between jog 1 and jog 2 commands

Additionally, the priority between jog and normal operation commands can be set through b1-09 [Jog/ON_OFF1 priority mode selection].

- When b1-09 is set to 0, priority is not differentiated, which means the command that comes first will be responded to first and the command that comes later will not be responded to. As shown in the figure below, the jog 1 command is input to the drive first, and the drive starts at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). Therefore, when the jog 1 command is active, even if the ON_OFF1 normal operation command is active, the drive does not respond.

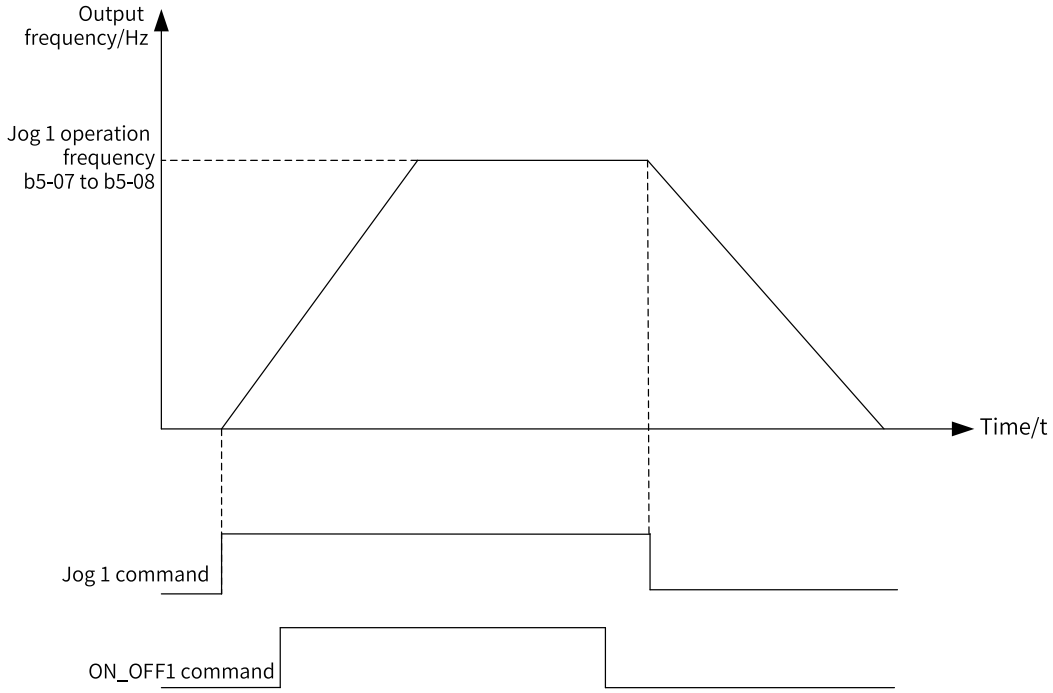


Figure 9-54 Jog command sent first upon non-priority distinction

As shown in the figure below, the ON_OFF1 normal operation command is input to the drive first, and the drive starts at the normal frequency set by ON_OFF1 (b5-00 to b5-06). Therefore, when the ON_OFF1 command is active, even if the jog 1 command is active, the drive does not respond.

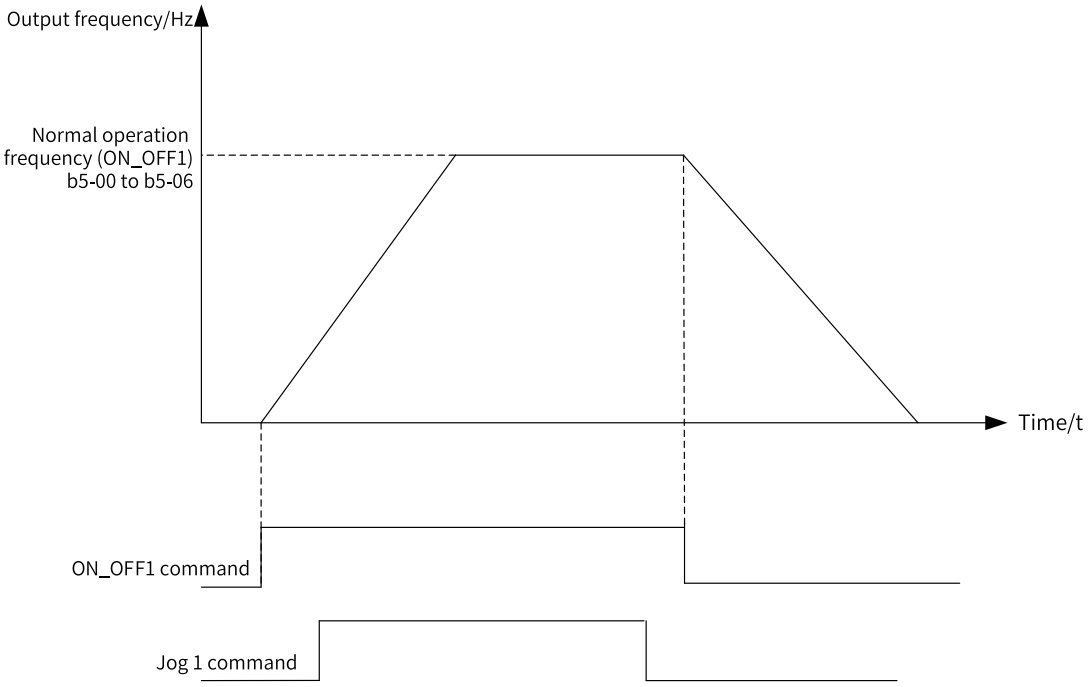


Figure 9-55 ON_OFF1 command sent first upon non-priority distinction

- When b1-09 is set to 1, jog commands are responded to first. Normal operation can be interrupted by the jog command. That is, as long as the jog command is active, the drive runs at the jog frequency defined by b5-07 [Jog 1 frequency source] and b5-08 [Jog 1 frequency reference].
  As shown in the figure below, when the ON_OFF1 command is active and the drive is running at the normal frequency reference (b5-00 to b5-06), if the jog 1 command is active, the drive immediately responds and switches to the jog 1 frequency (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency setting]) until the jog 1 command is deactivated.

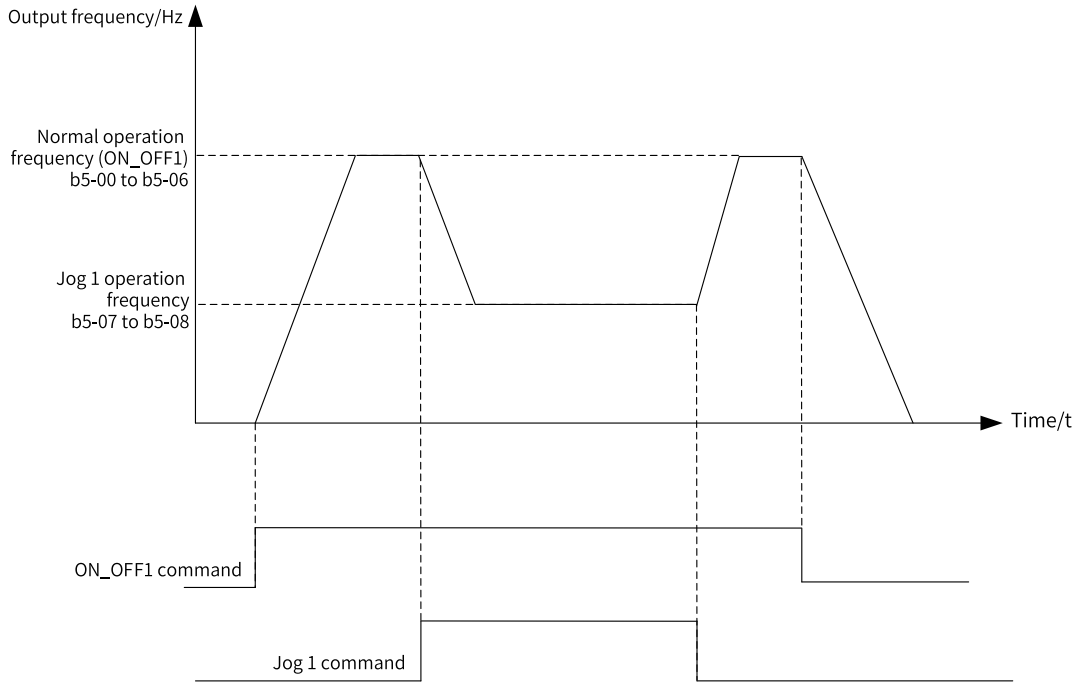


Figure 9-56 Jog command responded to first

- When b1-09 is set to 2, normal operation commands are responded to first. Normal operation can be interrupted by the jog command. That is, as long as the ON_OFF1 command is active, the drive runs at the frequency defined by b5-00 to b5-06.
  As shown in the figure, when the jog 1 command is active, the drive runs at the jog 1 frequency reference (b5-07 [Jog 1 frequency source selection] and b5-08 [Jog 1 frequency reference]). If the ON_OFF1 command is active, the drive immediately responds and switches to the normal operation set frequency (b5-00 to b5-06) until the ON_OFF1 command is deactivated.

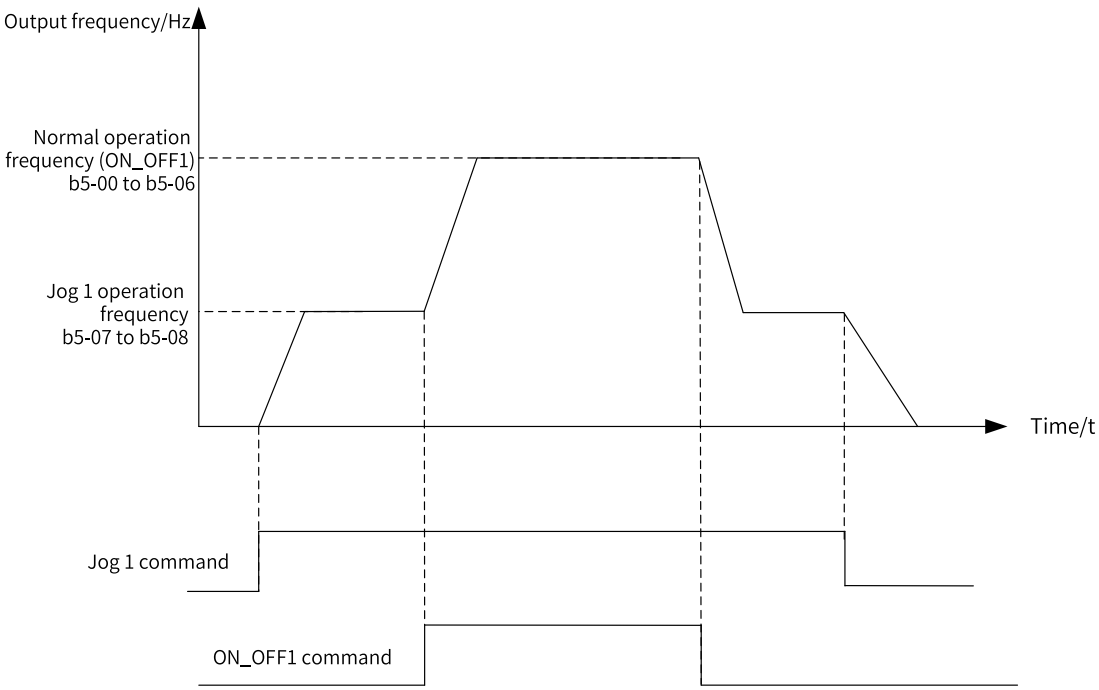


Figure 9-57 Normal operation (ON_OFF1) commands responded to first

Related parameters

Param.	Name	Default value	Value range	Description
b7-01 (F0-46)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Defines the ramp-up/down time base. Value description: 0: Rated frequency - The rated frequency is used as the ramp-up/down time base. 1: Max. frequency - The max. frequency is used as the ramp-up/down time base. 2: 100 Hz - 100 Hz is used as the ramp-up/down time base. 3: Frequency reference - The frequency reference is used as the ramp-up/down time base. Note: This parameter is used to set the ramp-up/down time base frequency. The ramp-up time indicates time required by the drive to accelerate from 0 Hz to the base frequency. The ramp-down time indicates time required by the drive to decelerate from the base frequency to 0 Hz.
b7-31 (F0-62)	Jog ramp source	0	0: Ramp time in normal operation 1: Ramp time in jog	Defines the jog ramp source. Value description: 0: Ramp time of normal operation - The jog ramp time is the same as the ramp-up/down time during normal operation. 1: Ramp time of jog - The ramp time in the jog mode is set separately (b7-32 and b7-33).
b7-32 (F0-63)	Ramp-up time in jog	20.00s	0.00s to 650.00s	Defines the time required for the output frequency to rise from 0 to b7-01 [Base frequency for acceleration/deceleration] in the jog mode. It determines the frequency rise rate in the jog mode. Note: The ramp-up current must be limited to a value below the overcurrent capacity of the drive, preventing the drive from tripping due to overcurrent stall.
b7-33 (F0-64)	Ramp-down time in jog	20.00s	0.00s to 650.00s	Defines the time required for the output frequency to decline from b7-01 [Base frequency for acceleration/deceleration] to 0 in the jog mode. It determines the frequency decline rate in the jog mode. Note: The ramp-down time must be set to a value that prevents excessively high smoothing circuit voltage, preventing the drive from tripping due to regenerative overvoltage stall.

Param.	Name	Default value	Value range	Description
b5-07/b6-07	Source of jog frequency 1	0	0: b5-08 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 1. Value description: 0: b5-08 - The jog 1 frequency is defined by b5-08. 6: Multi-reference - When multi-reference is used as the jog 1 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - The jog 1 frequency is set through PID. 9: Communication - The jog 1 frequency is set through communication. The jog 1 frequency can be input through remote communication. The drive must be installed with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. It is used for extension of common sources.
b5-08/b6-08	Jog 1 frequency	2.00	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 1. b5-08 is active when b5-07 is set to 0.

Param.	Name	Default value	Value range	Description
b5-09/b6-09	Source of jog frequency 2	0	0: b5-10 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of jog frequency 2. Value description: 0: b5-10 - The jog 2 frequency is set through b5-10. 6: Multi-reference - When multi-reference is used as the jog 2 frequency source, different combinations of DI terminal states correspond to different frequency references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - The jog 2 frequency is set through PID. 9: Communication - The jog 2 frequency is set through communication. The jog 2 frequency can be input through remote communication. The drive must be installed with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. It is used for extension of common sources.
b5-10/b6-10	Jog 2 frequency	-2.00	-50.00 Hz to +50.00 Hz	Defines the digital reference of jog frequency 2. b5-10 is active when b5-09 is set to 0.
b1-06/b3-06	User-defined JOG1 source	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines user-defined jog (JOG1) source. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. Value description: 0: Invalid - Indicates that jog is invalid. 3 to 12: DI1 to DI10 - Depends on the final state of the DI terminals. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.

Param.	Name	Default value	Value range	Description
b1-07/b3-07	User-defined JOG2 source	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the user-defined jog 2 source. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. Value description: 0: Invalid - Indicates that jog is invalid. 3 to 12: DI1 to DI10 - Depends on the final state of the DI terminals. Other: B connector - Depends on the B connector. You can select the B connector through the pop-up window.
b1-09/b3-09	Jog/ON_OFF1 priority mode selection	0	0: Priority not differentiated 1: Jog command responded to first 2: ON_OFF1 (start/stop) command responded to first	Defines the priority level of jog and normal operation commands. Value description: 0: Non-priority distinction - The drive responds only to the operation command that arrives first. 1: Jog command responded to first - The jog commands are responded to first, which may interrupt normal operation. 2: ON_OFF1 (start/stop) responded to first - Normal operation commands are responded to first, which can interrupt jogging.

9.6.2 Jog Frequency Source

The frequency references for jog 1 and jog 2 can be controlled separately. The jog frequency can be set through two channels, as shown below.

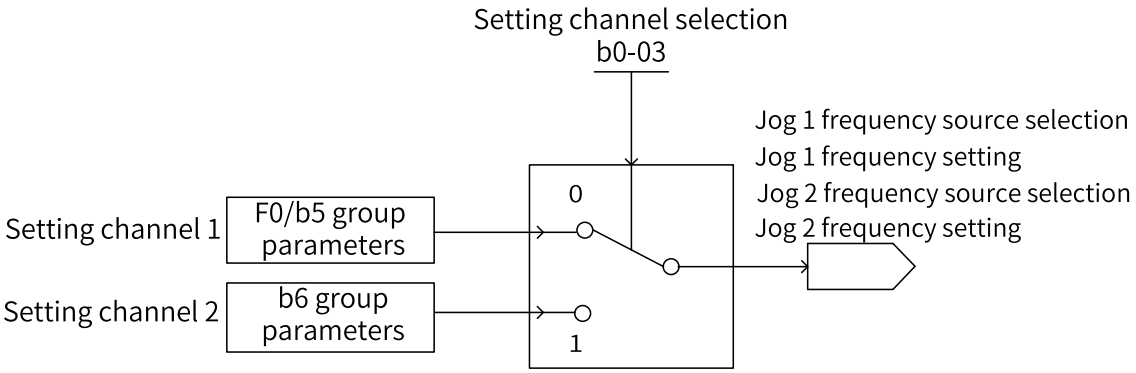


Figure 9-58 Jog frequency source

9.7 Ramp-up/down Time

9.7.1 Ramp-up/down Time Setting

Application scenarios

In scenarios where gradual ramp-up/down is required, set the ramp-up/down time to a high value. In scenarios where quick ramp-up/down is required, set the ramp-up/down time to a low value.

Operating principles

The ramp-up time indicates the time required for the drive to ramp up from 0 Hz to b7-01 [Ramp ramp-up/down time base frequency]. The ramp-down time indicates the time required for the drive to decelerate from b7-01 [Ramp ramp-up/down time base frequency] to 0 Hz. To set the ramp-up/down time properly, set b7-01 [Ramp ramp-up/down time base frequency] first. Then, set the ramp-up/down time. In default settings, the ramp-up/down time is set by b7-04 [Ramp 1 ramp-up Time] and b7-05 [Ramp 1 ramp-down Time].

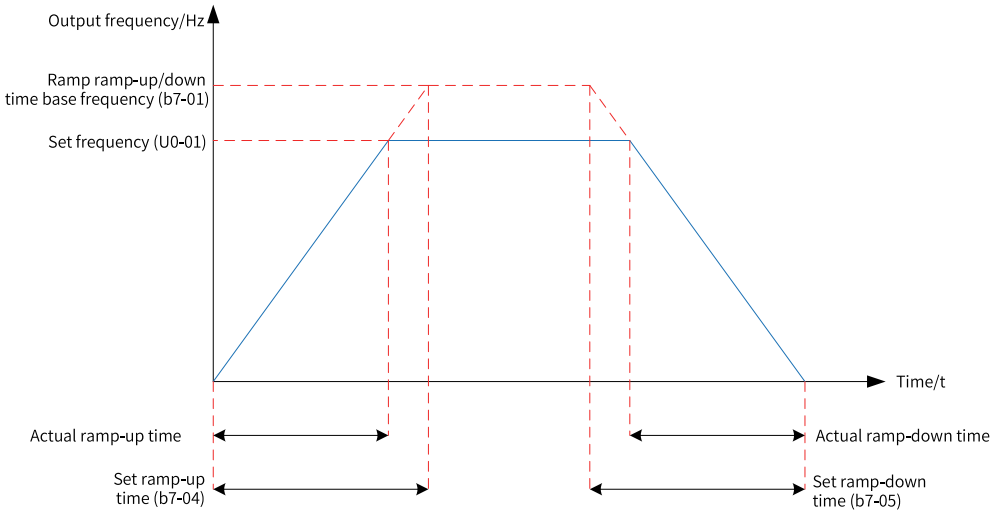


Figure 9-59 Ramp-up/down time base

For example, if the ramp-up/down time base is set to maximum frequency [50 Hz], and b7-04 [Ramp 1 ramp-up time] is set to 10 s, then the ramp-up rate during ramp-up is 50 Hz/10s = 5 Hz/s; if b7-05 [Ramp 1 ramp-down time] is set to 25s, then the ramp-up rate during ramp-down is 50 Hz/25s = 2 Hz/s.

Set the frequency to 25 Hz and start the drive. The drive ramps up to 25 Hz at the speed of 5 Hz/s and then run at the frequency of 25 Hz. The actual ramp-up time is 5s. Stop the drive. The drive will ramp down to zero frequency at the speed of 2 Hz/s and then stop. The actual ramp-down time is 12.5s.

Ramp-up/down time selection

The drive can set up to 4 sets of ramp-up/down time, which are configured through the following parameters.

1. 1st set: b7-04 [Ramp 1 ramp-up time] and b7-05 [Ramp 1 ramp-down time], time unit: 0.1s
2. 2nd set: b7-10 [Ramp 2 ramp-up time] and b7-11 [Ramp 2 ramp-down time], time unit: 0.1s.
3. 3rd set: b7-16 [Ramp 3 ramp-up time] and b7-17 [Ramp 3 ramp-down time], time unit: 0.01s.
4. 4th set: b7-22 [Ramp 4 ramp-up time] and b7-23 [Ramp 4 ramp-down time], time unit: 0.01s.

You can select the effective ramp-up/down time through b7-02 [Ramp selection bit0] and b7-03 [Ramp selection bit1]. The relationship between parameter setpoints and selection results is as follows.

b7-02 [Ramp selection bit0]	b7-03 [Ramp selection bit1]	Ramp-up/down time selection
0	0	1st set (b7-04 and b7-05)
1	0	2nd set (b7-10 and b7-11)
0	1	3rd set (b7-16 and b7-17)
1	1	4th set (b7-22 and b7-23)

Related parameters

Param.	Name	Default value	Value range	Description
b7-01 (F0-46)	Ramp-up/down time base	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Defines the base frequency of the ramp ramp-up/down time. Value description: 0: Rated frequency - The rated frequency is used as the ramp-up/down time base. 1: Max. frequency - The max. frequency is used as the ramp-up/down time base. 2: 100 Hz - 100 Hz is used as the ramp-up/down time base. 3: Frequency reference - The frequency reference is used as the ramp-up/down time base. Note: This parameter is used to set the ramp-up/down time base frequency. The ramp-up time indicates time required by the drive to accelerate from 0 Hz to the base frequency. The ramp-down time indicates time required by the drive to decelerate from the base frequency to 0 Hz.
b7-02	Ramp selection bit0	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Defines ramp selection bit0. When the bit signal is 0, this function is inactive. When the bit signal is 1, this function is active. The drive supports four sets of ramp-up/down time, which can be switched by combining the states of ramp (RFG) selection bit0 and bit1 in four ways. Value description: 0: 0 - Indicates that the value of ramp selection bit0 is 0. 1: 1 - Indicates that the value of ramp selection bit0 is 1. 3 to 12: DI1 to DI10 - Depends on the final state of the DI1 to DI10. Other: B connector - Depends on B connector, which can be selected through the pop-up window. Note: This parameter is invalid when b7-28 is 1 and b7-29 or b7-30 is not set to zero. After the DI is assigned with function 16 [Ramp-up/down time selection terminal 1], the value of b7-02 is automatically switched to the corresponding DI terminal connector parameter (L0484 to L0490).
b7-03	Ramp selection bit1	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Same as b7-02

Param.	Name	Default value	Value range	Description
b7-04 (F0-48)	Ramp-up time of ramp 1	20.0 s	0.0s to 6500.0s	Defines ramp 1 ramp-up time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp-up/down time base frequency (b7-01). The time is used to set the ramp-up speed. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-up time. Ramp-up time setting requirement: The ramp-up current must be limited to a value below the overcurrent capacity of the drive, preventing the drive from tripping due to overcurrent stall
b7-05 (F0-49)	Ramp-down time of ramp 1	20.0 s	0.0s to 6500.0s	Defines the ramp-down time of ramp 1. Note: It indicates the time required for the output frequency to decrease from b7-01 [Ramp-up/down base frequency] to 0. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-down time.
b7-10	Ramp-up time of ramp 2	20.0 s	0.0s to 6500.0s	Defines the ramp-up time of ramp 2. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-up time.
b7-11	Ramp-down time of ramp 2	20.0 s	0.0s to 6500.0s	Defines the ramp-down time of ramp 2. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-down time.
b7-16	Ramp-up time of ramp 3	20.00s	0.00s to 650.00s	Defines the ramp-up time of ramp 3. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the third set of ramp-up time.
b7-17	Ramp-down time of ramp 3	20.00s	0.00s to 650.00s	Defines the ramp-down time of ramp 3. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the 3rd set of ramp-down time.

Param.	Name	Default value	Value range	Description
b7-22	Ramp-up time of ramp 4	20.00s	0.00s to 650.00s	Defines the ramp-up time of ramp 4. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the fourth set of ramp-up time.
b7-23	Ramp-down time of ramp 4	20.00s	0.00s to 650.00s	Defines the ramp-down time of ramp 4. Note: b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the fourth set of ramp-down time.

Note: b7-01, b7-04, and b7-05 are mapped to F0-46, F0-48, and F0-49 in group F. The settings of the two sets of parameters are equivalent.

Application instance

The following shows the setting procedure by taking DI1 and DI2 for ramp-up/down time switchover.

1. Set E0-00 [DI1 terminal function selection] and E0-01 [DI2 terminal function selection] to select DI1 and DI2 as ramp-up/down time switchover terminals.

Param.	Name	Setpoint	Description
E0-00	DI1 function selection	16	Ramp-up/down selection terminal 1
E0-01	DI2 function selection	17	Ramp-up/down selection terminal 2

2. Set b7-01 [Ramp-up/down time base] to 1 [Maximum frequency].
3. Set the four sets of ramp-up/down time parameters (b7-04 to b7-23) respectively.
4. Select the active ramp-up/down time by switching the DI terminal state.

DI1 state	DI2 state	Ramp-up/down time selection
OFF	OFF	1st set (b7-04 and b7-05)
ON	OFF	2nd set (b7-10 and b7-11)
OFF	ON	3rd set (b7-16 and b7-17)
ON	ON	4th set (b7-22 and b7-23)

9.7.2 Setting Ramp-up/down Mode

Application scenarios

In linear ramp-up/down, the output frequency increases or decreases linearly. This mode applies to most applications.

In S-curve ramp-up/down, the target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth operation and quick response in real time.

Operating principles

Set b7-00 [Ramp-up/down mode] to select the frequency change mode during start/stop of the drive.

When b7-00 [Ramp-up/down mode] is set to 0 [Linear ramp-up/down], the output frequency changes linearly according to the set ramp-up/down time.

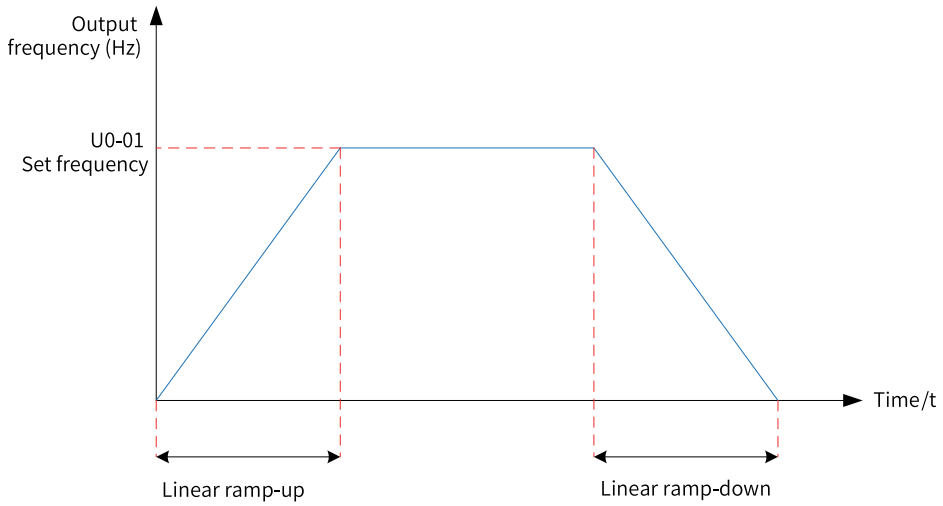


Figure 9-60 Linear ramp-up/down

When b7-00 [Ramp-up/down mode] is set to 1 [S-curve], the output frequency increases or decreases based on the S-curve. You can set S-curve parameters for each group of ramp-up/down time. Take the first set of ramp-up/down time as an example. Set the S-curve change time through b7-06 [Ramp-up start arc of ramp 1] to b7-09 [Ramp-down end arc of ramp 1].

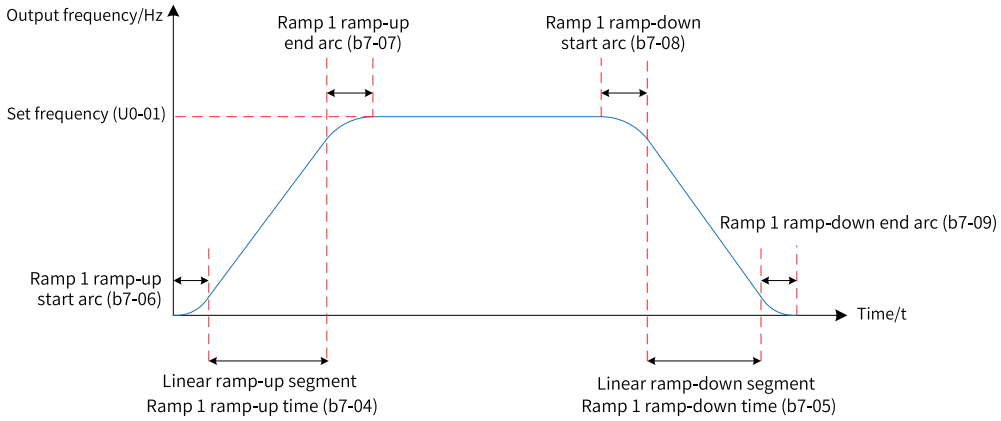


Figure 9-61 S-curve ramp-up/down

You can select the arc type through b7-43 [Ramp arc mode]. b7-43 = 0 [Non-continuous smoothing]: When the ramp-up/down trend changes, the curve switches to the new target direction

immediately. b7-43 = 1 [Continuous smoothing]: When the ramp-up/down trend changes, the curve follows the end arc of current ramp-up/down and then switches to the reference direction.

Related parameters

Param.	Name	Default value	Value range	Description
b7-00 (F0-45)	Ramp-up/down mode	0	0: Linear 1: S-curve	Defines the ramp-up/down mode. Value description: 0: Linear - The output frequency increases or decreases linearly. 1: S-curve - In S-curve ramp-up/down, the target frequency changes dynamically in real time, and the output frequency increases or decreases based on the S-curve. This mode is applicable to applications requiring smooth operation and quick response in real time.
b7-06	Ramp-up start arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of the ramp-up start arc of ramp 1. Note: The arc time at the start of output frequency ramp-up determines the jerk of the arc at start of reference ramp-up. This parameter is the first set of ramp-up start arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping up to the set frequency, then the arc motion applies in the first 2s and linear motion applies in the last 8s during ramp-up. In addition, the linear motion is executed according to the set linear ramp-up/down time.
b7-07	Ramp-up end arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of the ramp-up end arc of ramp 1. Note: The arc time at the end of output frequency ramp-up determines the jerk of the arc at the end of reference ramp-up. This parameter is the first set of ramp-up end arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in accelerating to the set frequency, then the linear motion applies in the first 8s and arc motion applies in the last 2s during ramp-up. In addition, the linear motion is performed based on the set linear ramp-up/down time.

Param.	Name	Default value	Value range	Description
b7-08	Ramp-down start arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time during increasing ramp-down start arc of ramp 1. Note: The arc time at the start of output frequency ramp-down determines the jerk of the arc at start of reference ramp-down. This parameter is the first set of ramp-down start arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping down from the set frequency to 0, then the arc motion applies in the first 2s and linear motion applies in the last 8s during ramp-down. In addition, the linear motion is executed according to the set linear ramp-up/down time.
b7-09	Ramp-down end arc of ramp 1	0.00s	0.00s to 650.00s	Defines the motion time of ramp-down end arc of ramp 1. Note: The arc time at the start of output frequency ramp-down determines the jerk of the arc at start of reference ramp-down. This parameter is the first set of ramp-down end arc. This function is active only in the S-curve ramp-up/down mode (b7-00 = 1). For example, if this parameter is set to 2s and 10s is taken in ramping down from the set frequency to 0, then the linear motion applies in the first 8s and arc motion applies in the last 2s during ramp-down. In addition, the linear motion is executed according to the set linear ramp-up/down time.
b7-43	Ramp arc mode	0	0: Non-continuous smoothing 1: Continuous smoothing	Defines the ramp arc mode, which is the arc ramp-up change mode when the ramp-up/down trend changes. Value description: 0: Non-continuous smoothing - When the ramp-up/down trend changes, the new target direction applies immediately. 1: Continuous smoothing - When the ramp-up/down trend changes, wait for the current ramp-up/down to be done before the reference direction applies. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.

Note:

(1) b7-00, b7-04, and b7-05 are mapped to F0-45, F0-48, and F0-49 in group F. These two sets of parameters are equivalent.

(2) The 2nd, 3rd, and 4th sets of S-curve arc parameters are set in the same way as the 1st set, which is activated when the corresponding ramp-up/down time set is selected.

9.7.3 Low-Speed Gain

Application scenarios

In case of a heavy load and high acceleration, acceleration at a high speed is normal, but step loss may occur due to insufficient torque at a low speed. Alternatively, the acceleration rate is reduced to ensure stable operation at a low speed, but the acceleration time is prolonged.

Operating principles

Set b7-42 [Threshold of low-speed range]. When the operating frequency is lower than this threshold, the drive is in the low-speed range. In this case, b7-41 [Acceleration time gain coefficient in low-speed range] takes effect. The acceleration time in the low-speed range is the product of the original acceleration time and the gain coefficient (b7-41). The default value of b7-41 is 100%, which means the acceleration time remains unchanged in the low-speed range. When the output frequency exceeds b7-42 [Threshold of low-speed range], the acceleration time reverts to the original setpoint, and the drive accelerates normally to the set frequency.

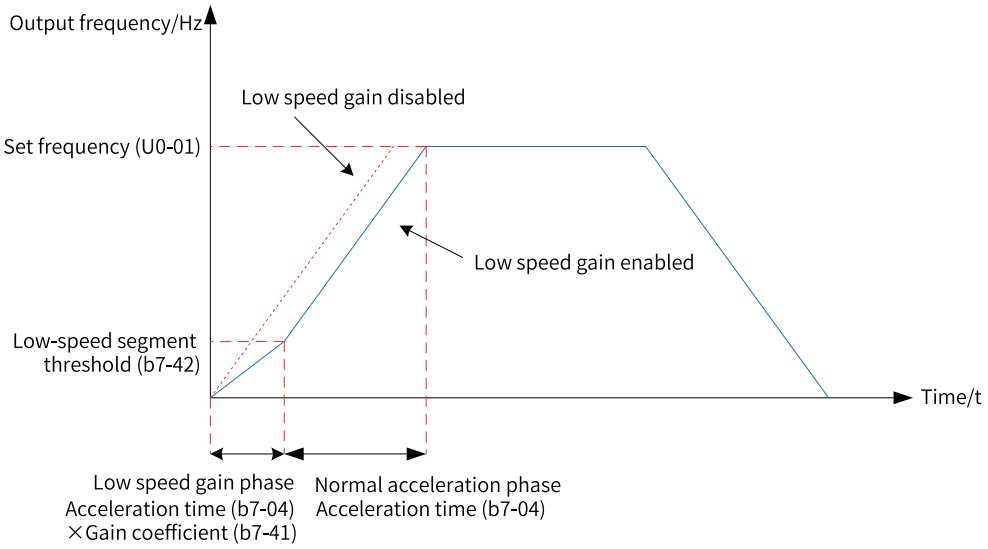


Figure 9-62 Low-speed gain

Related parameters

Param.	Name	Default value	Value range	Description
b7-41	Ramp-up time gain coefficient in low-speed range	100.0%	1.0% to 1000.0%	Defines the ramp-up time gain coefficient in low-speed range. Note: When the output frequency is lower than b7-42 [Threshold of low-speed range], b7-41 takes effect, and the actual acceleration time in the low-speed range is the product of the original acceleration time and b7-41.
b7-42	Threshold of low-speed range	15.00 %	0.00% to 100.00%	Defines the threshold of low-speed range. Note: When the output frequency is lower than this threshold, b7-41 [Acceleration time gain coefficient in low-speed range] takes effect.

9.7.4 Switching Ramp-up/down Time Automatically Based on Operating Frequency

Application scenarios

This function is used to select different ramp-up/down time based on the operating frequency range during operation of the drive.

Operating principles

You can enable automatic switchover of ramp-up/down time through b7-28 [Ramp 1/2 frequency switchover], and set the frequency threshold for ramp-up/down time switchover through b7-29 [Frequency threshold for ramp-up switchover of ramp 1/2] and b7-30 [Frequency threshold for ramp-down switchover of ramp 1/2].

The diagram for ramp-up/down time switchover is shown below.

During ramp-up, if the operating frequency is lower than b7-29 [Frequency threshold for ramp 1/2 ramp-up switchover], b7-10 [Ramp 2 ramp-up time] applies. If it is higher than b7-29 [Frequency threshold for ramp-up switchover of ramp 1/2], b7-04 [Ramp 1 ramp-up time] applies.

During ramp-down, if the operating frequency is higher than b7-30 [Frequency threshold for ramp 1/2 ramp-down], b7-05 [Ramp 1 ramp-down time] applies. If it is lower than b7-30 [Frequency threshold for ramp-down switchover of ramp 1/2], b7-11 [Ramp 2 ramp-down time] applies.

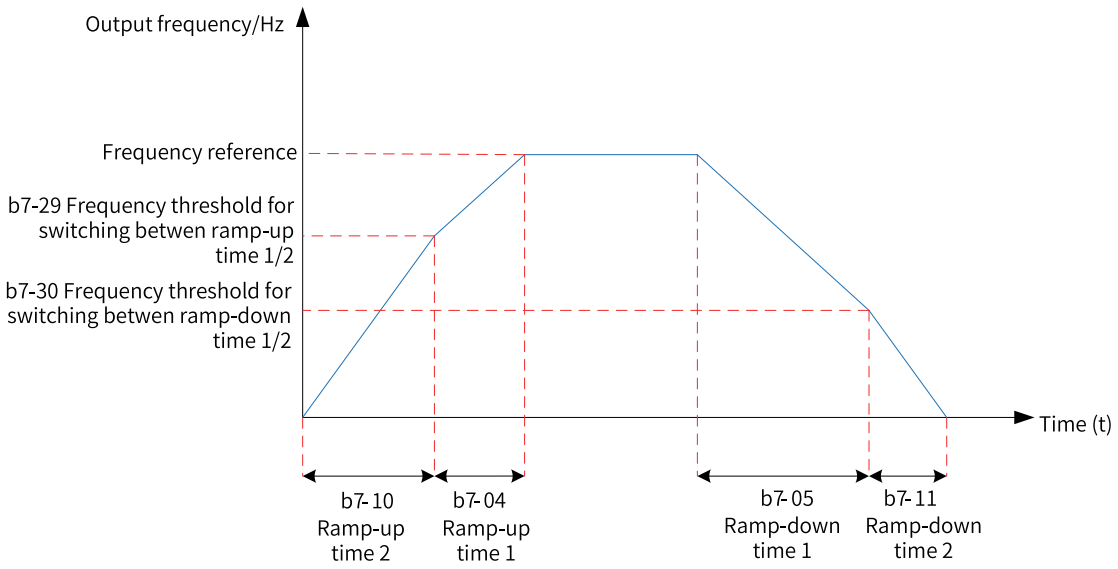


Figure 9-63 Automatic switchover of ramp-up/down time

Related parameters

Param.	Name	Default value	Value range	Description
b7-28	Ramps 1/2 frequency switchover	0	0: Inhibited 1: Enable	Defines whether ramp 1/2 frequency switchover is enabled. When this function is enabled, ramp selection bit1/bit0 (b7-02/b7-03) are inactive. Note: This parameter is generally used together with b7-29 and b7-30 to apply different ramp-up/down time (ramp-up rate) during ramp-up/down.
b7-29	Frequency threshold for ramp-up time 1/2 switchover	0.0 Hz	0.0 Hz to A2-18	Defines the frequency threshold for ramp 1/2 ramp-up switchover. During ramp-up, if the output frequency is greater than or equal to this setpoint, the ramp 1 ramp-up time is active. Otherwise, the ramp 2 ramp-up time is active.
b7-30	Frequency threshold for ramp-down time 1/2 switchover	0.0 Hz	0.0 Hz to A2-18	Defines the frequency threshold for ramp-down switchover of ramp 1/2. During ramp-down, if the output frequency is greater than or equal to the value of this parameter, ramp 1 ramp-down time is active. Otherwise, ramp 2 ramp-down time is active.
b7-04	Ramp-up time of ramp 1	20.0	0.0 to 6500.0	Defines ramp 1 ramp-up time. Note: It indicates the time required for the output frequency to increase from 0 to the ramp-up/down time base frequency (b7-01). The time is used to set the ramp-up speed. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-up time.

Param.	Name	Default value	Value range	Description
b7-05	Ramp-down time of ramp 1	20.0	0.0 to 6500.0	Defines the ramp-down time of ramp 1. Note: It indicates the time required for the output frequency to decrease from b7-01 [Ramp-up/down base frequency] to 0. The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter specifies the first set of ramp-down time.
b7-10	Ramp-up time of ramp 2	20.0	0.0 to 6500.0	Defines the ramp-up time of ramp 2. Note: Same as b7-04 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-up time.
b7-11	Ramp-down time of ramp 2	20.0	0.0 to 6500.0	Defines the ramp-down time of ramp 2. Note: Same as b7-05 The drive provides four sets of ramp-up/down time, which can be selected through b7-02, b7-03, or DI. This parameter defines the second set of ramp-down time.

9.7.5 Ramp Tracking Enable

Application scenarios

In certain operating conditions, if the load torque is excessive during acceleration, the actual motor speed cannot keep up with the speed output by the ramp function generator (set target speed). In this case, you can enable the ramp tracking function.

Operating principles

The motor cannot decelerate immediately under excessive load torque because the speed output by the ramp function generator deviates greatly from the actual speed. If the ramp function generator tracking function is not enabled, the speed setpoint is n_2 at time t_0, and reduced to n_1 at t_1, but the motor still accelerates at t_2. A deceleration command is sent at t1, but it still takes $\Delta t = t_2 - t_1$ before deceleration actually begins, as shown in *"Figure 9-64 Ramp function generator output speed (ramp tracking function not enabled)" on page 434*.

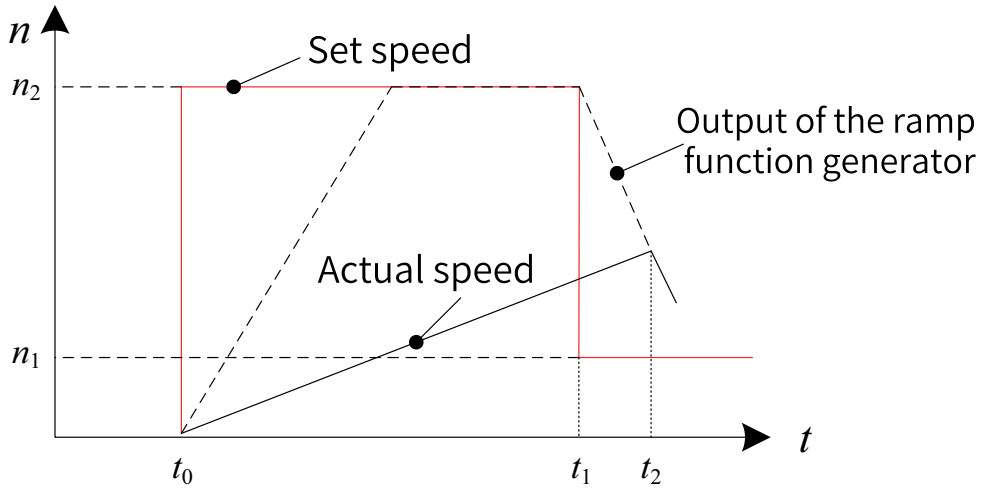


Figure 9-64 Ramp function generator output speed (ramp tracking function not enabled)

As shown by *"Figure 9-65 Ramp function generator output speed (ramp tracking function enabled)" on page 434*, when the tracking function of ramp function generator is enabled, the speed output by the ramp function generator actively follows the actual speed when the deviation between the output speed and the actual speed reaches the set error value.

When b7-46 is set to 1 [Enable], the tracking function of ramp function generator is activated when the actual speed is lower than the output speed of the ramp function generator by Δn (Δn can be set according to actual conditions). After which, the output speed of ramp function generator is kept at actual speed + Δn forcibly. If the specified condition is not met, the tracking state is exited.

When b7-46 is set to 2 [Torque limit reached], the ramp function generator tracking function is activated only when the torque reaches the limit value. The ramp function generator output speed is then forced to be at actual speed + Δn. The tracking state is exited if the condition is not met.

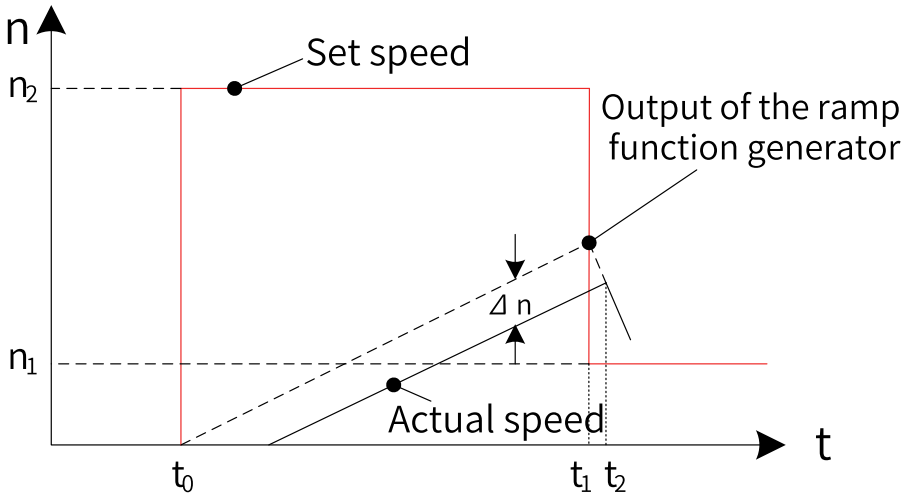


Figure 9-65 Ramp function generator output speed (ramp tracking function enabled)

Related parameters

Param.	Name	Default value	Value range	Description
b7-46	Ramp tracking enable	0	0: Inhibited 1: Enable 2: Torque limit reached Other: B connector	Defines whether to enable ramp tracking. With this function enabled, when the torque reaches the limit and the deviation between the frequency reference and the feedback frequency is greater than b7-47 [Ramp tracking error], the frequency reference is limited to the actual value plus the error. 0: Disabled - Ramp tracking disabled 1: Enabled - Ramp tracking enabled 2: Torque limit reached – Whether ramp tracking is enabled depends on whether the current motor torque limit is reached. Other: B connector – Whether ramp tracking is enabled depends on the B connector status.
b7-47	Ramp tracking error	10.0%	0.0% to 100.0%	Defines the ramp tracking error.

9.8 Motor Parameter Set

Application scenarios

This function is suitable for applications where one drive is used to drive multiple motors. You can select different motor parameter set and save parameters for different motors to improve usage flexibility, and directly use the pre-set motor parameter sets without reconfiguration or motor parameter auto-tuning.

Function description

The drive supports four motor parameter sets, with each set saving specific motor parameters such as basic parameters and control parameters.

Motor parameter sets are defined by b0-00 [Motor parameter set selection 1] and b0-01 [Motor parameter set selection 2]. The active motor parameter set is achieved through binary combination of bits. See details in the following table. Additionally, the active motor parameter set can be viewed through U2-00.

Table 9–21 Example for motor parameter set selected by parameters

Parameter setting			Active motor parameter set
b0-00	b0-01	U2-00	-
0	0	0	Motor parameter set 1
0	1	1	Motor parameter set 2
1	0	2	Motor parameter set 3
1	1	3	Motor parameter set 4

Motor parameter set can also be selected through DI terminal functions, using DI terminal functions 41 [Motor selection terminal 1] and 76 [Motor selection terminal 2]. Similar to setting via b0-00 and b0-01, the active motor parameter set can also be determined using binary bit combination. The following takes DI1 terminal function 41 [Motor selection terminal 1] and DI2 terminal function 76 [Motor selection terminal 2] as an example.

Table 9–22 Selecting motor parameter set through DI terminal

Parameter setting			Active motor parameter set
DI1 state	DI2 state	U2-00	-
0	0	0	Motor parameter set 1
0	1	1	Motor parameter set 2
1	0	2	Motor parameter set 3
1	1	3	Motor parameter set 4

Note that the priority of DI terminal selection is higher than that of parameter selection. When DI terminal functions 41 [Motor selection terminal 1] and 76 [Motor selection terminal 2] are assigned, b0-00 and b0-01 are inactive and read-only. For example, when DI1 terminal function is set to 41 [Motor selection terminal 1], b0-00 becomes read-only, and the motor parameter set can only be set via DI terminals, with b0-00 and b0-01 deactivated.

Related parameters

Param.	Name	Default value	Value range	Description
b0-00	Motor parameter set selection 1	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines motor parameter set selection 1. Value description: 0: Inactive - This function is inactive. 1: Active - This function is active. 3 to 12: Depends on the final state of DI1 to DI10 (0: Inactive; 1: Active). Other: B connector - Depends on the B connector. You can select B connector through the pop-up window. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: The selection of the motor parameter set is determined by the combination of b0-00 [Motor parameter set selection 1] and b0-01 [Motor parameter set selection 2] in the form of binary bits. When b0-00 is 0 and b0-01 is 0, the combination is 0x0, indicating that motor parameter set 1 is selected. When b0-00 is 0 and b0-01 is 1, the combination is 0x1, indicating that motor parameter set 2 is selected. When b0-00 is 1 and b0-01 is 0, the combination is 0x2, indicating that motor parameter set 3 is selected. When b0-00 is 1 and b0-01 is 1, the combination is 0x3, indicating that motor parameter set 4 is selected. The motor parameter set that activated at last can be viewed through U2-00.
b0-01	Motor parameter set selection 2	0	0: Inactive 1: Active 3 to 12: DI1 to DI10 Other: B connector	Defines motor parameter set selection 2. Value description: Same as b0-00 Note: Same as b0-00
U2-00	Current motor parameter set	0	0: Motor parameter set 1 1: Motor parameter set 2 2: Motor parameter set 3 3: Motor parameter set 4	Displays the active motor parameter set. Value description: 0 to 3: Motor parameter set 1 to motor parameter set 4

9.9 Changing Motor Direction

9.9.1 Inhibition on Motor Operating Direction

Application scenarios

This function is used to inhibit the motor from running forwardly or reversely, allowing the motor to rotate in one direction only.

Function description

You can limit the motor operating direction through d1-01 [Positive speed permission] and d1-02 [Negative speed permission].

- When d1-01 is set to 0 (Invalid), the motor runs at zero frequency when a forward run command is received by the drive.
- When d1-02 is set to 0 (Invalid), the motor runs at zero frequency when a reverse run command is received by the drive.

Related parameters

Table 9–23 Parameters related to reverse frequency inhibition

Param.	Name	Default value	Value range	Description
d1-01	Positive speed permission	1	0: Inhibited 1: Allowed 3 to 12: DI1 to DI10 Other: B connector	Defines whether the drive allows forward operation. d1-01 [Positive speed] is mapped to F2-20 in group F. These two parameters have the same function. Value description: 0: Inhibited - Forward operation is not allowed. 1: Allowed - Forward operation is allowed. 3 to 12: DI1 to DI10 - Depends on the final DI terminal status. The value 0 indicates that forward run is inhibited, and the value 1 indicates that forward run is allowed. Other: B connector - Depends on the B connector state. The value 0 indicates that forward run is inhibited, and the value 1 indicates that forward run is allowed. Note: After the DI is assigned with function 78 [Forward run permission], the value of d1-01 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
d1-02	Negative speed selection	1	0: Inhibited 1: Allowed 3 to 12: DI1 to DI10 Other: B connector	Defines whether the drive allows reverse operation. d1-02 [Negative speed permission] is mapped to F2-21 in group F. These two parameters have the same function. Value description: Same as d1-01

Note: The drive supports four sets of motor parameters. The parameters related to motor parameter set 2 are d9-01/d9-02, those related to motor parameter set 3 are y1-01/y1-02, and those related to motor parameter set 4 are y9-01/y9-02.

9.9.2 Changing Motor Direction Directly

Application scenarios

This function allows you to change the motor direction without altering the motor wiring.

Function description

It is equivalent to swapping any two of the motor (U, V, W) cables to reverse the motor rotation direction.

Note: The drive supports four sets of motor parameters. The parameter related to motor parameter set 1 is d0-14, those related to motor parameter sets 2 to 4 are d8-14 and y0-14, and y8-14 respectively.

Related parameters

Table 9–24 Parameters for changing motor direction

Param.	Name	Default value	Value range	Description
F2-14 (d0/-14)	Motor direction selection	0	0: Default direction 1: Opposite direction	Defines the motor operating direction.

9.9.3 Dead Zone Time of Forward/Reverse Run Switchover

Application scenarios

When switching between forward and reverse run, the direction can be changed only after a transition period elapses. This transition period is dead zone time of forward/reverse run switchover. Within this period, the output frequency is 0 Hz.

Operating principles

The transition period at 0 Hz output is the dead zone time during switchover between forward run and reverse run, which can be set through P0-26.

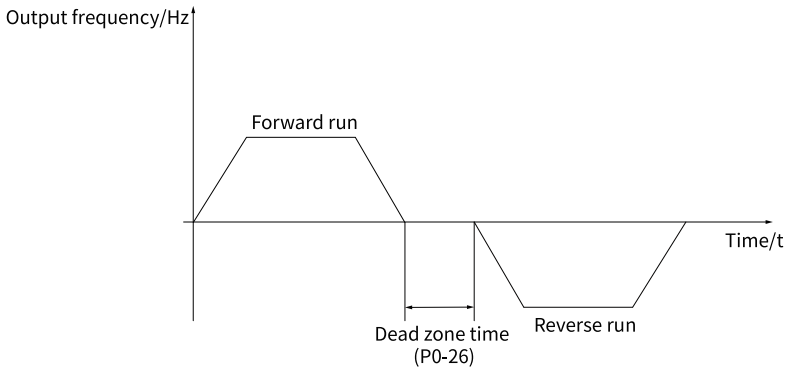


Figure 9-66 Dead zone time of forward/reverse run switchover

Related parameters

Table 9–25 Parameters related to dead zone time of forward/reverse run switchover

Param.	Name	Default value	Value range	Description
P0-26	Dead zone time of forward/reverse run switchover	0.0s	0.0s to 3000.0s	Defines the transition time at 0 Hz output during switchover between forward run and reverse run.

9.10 Switching Between Speed Control and Torque Control

Application scenarios

The drive supports two motor control methods: speed control and torque control. This function is suitable for applications requiring control mode switchover.

Function description

In speed control, the speed reference is converted to the actual speed reference only after being processed with a series of limits, ramp function generator (RFG), and additional speed reference. Speed control applies to all control methods (V/f and SVC). Most of the applications require the motor speed to be controlled. In vector control, the speed can be controlled accurately.

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control consists of two parts: torque reference and overspeed control. Torque references include torque instruction, gain calculation, filtering, and acceleration/deceleration time. Overspeed control includes speed limit, filtering and acceleration/deceleration time, and speed offset mode setting.

Torque control must be used together with overspeed control. When the motor output torque is lower than or equal to the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent overspeed of the motor, the motor speed must be limited under torque control. When the motor speed exceeds the limit, the speed control mode applies. When the motor speed is recovered to a value below the speed limit, the torque control mode applies.

The two control modes can be switched through d0-01 (Motor parameter set 1), d8-01 (Motor parameter set 2), y0-01 (Motor parameter set 3), and y8-01 (Motor parameter set 4).

Related parameters

Table 9–26 Parameters for speed/torque mode switchover

Param.	Name	Default value	Value range	Description
F0-02 (Motor parameter set 1) d0-01 (Motor parameter set 1) d8-01 (Motor parameter set 2) y0-01 (Motor parameter set 3) y8-01 (Motor parameter set 4)	Motor control mode	0	0: Speed control 1: Torque control 3 to 12: DI1 to DI10 Other: B connector	Defines the motor control target. Value description: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 12: Depends on the final terminal status of DI1 to DI10 - The value 0 indicates speed control and the value 1 indicates torque control. Other: B connector - Depends on the status of B connector (0: Speed control; 1: Torque control). Note: The torque control mode is inactive in V/f mode.

Note: d0-01 is mapped to F0-02. When F0-02 changes, d0-01 changes accordingly.

9.11 Control Terminals

9.11.1 Overview of Control Terminals

Overview of control terminals

The drive supports 5 types of control terminals, as shown below.

1. Four digital input (DI) terminals
2. Six digital input/output (DIO) terminals
3. One three-phase 380 V brake output terminal (RO)
4. Six virtual digital input (VDI) terminals
5. Six virtual digital output (VDO) terminals

Note

Digital Input/Output terminals (DIO) are multi-functional terminals that can be used either as DI terminals or DO terminals. Their function is selected through E0-59/E0-60. Only one function can be used at a time, and simultaneous use as both DI and DO is not supported.

Related parameters

Param.	Name	Default value	Value range	Description
E0-59	DIO mode selection 1	0	Ones to ten-thousands: Mode selection of DIO1 to DIO5 0: DI 1: DO	Used to select the mode of DIO1 to DIO5.
E0-60	DIO mode selection 2	0	Ones: DIO6 mode selection 0: DI 1: DO Tens to Ten-thousands: Reserved	Used to select the mode of DIO6.

9.11.2 Digital Input (DI) Terminals

List of functions

DI refers to digital input terminals. Each DI can be assigned with any function. A maximum of ten DIs are provided (4 general-purpose DIs and six DIOs that used as DIs).

Table 9–27 List of DI function assignment

Function	DI terminal									
	DI1	DI2	DI3	DI4	DI5 (DIO1)	DI6 (DIO2)	DI7 (DIO3)	DI8 (DIO4)	DI9 (DIO5)	DI10 (DIO6)
DI function selection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time 1	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time 2	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Input filter time selection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ON delay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
OFF delay	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Forced enable	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Terminal activation mode (active level)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Function description

DI refers to digital input terminals. Each DI can be assigned one DI function, but DI functions cannot be duplicated.

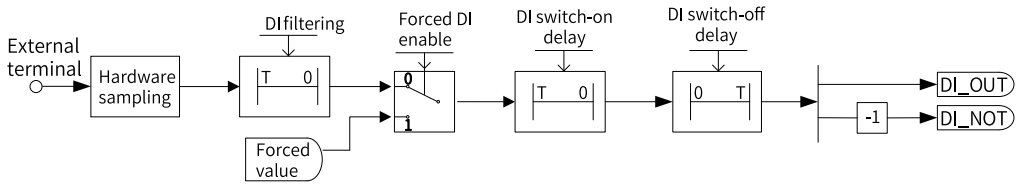


Figure 9-67 DI data flow diagram

DI terminal layout

The drive supports up to 10 DIs (four general-purpose DIs and six DIOs).

DI terminals are arranged on IO1 to IO5 of the terminal board.

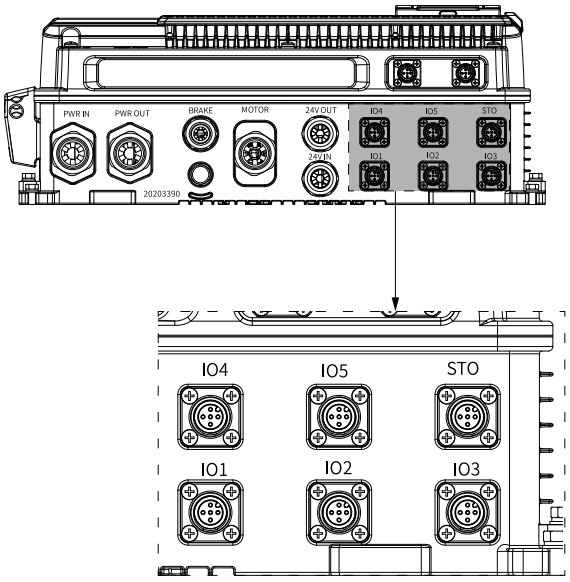


Figure 9-68 Terminal layout

The hardware wiring is shown below.

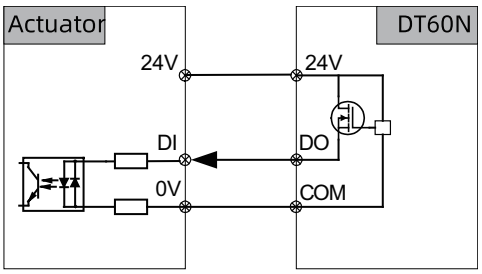


Figure 9-69 Wiring of DI terminals

DI function

1. DI function selection

   Each DI terminal can be assigned with a function number through E0-00 to E0-08. Each function number represents a function to be achieved when the DI terminal is closed or opened. See "Related parameters" column in *"Table 9-29 DI terminal function description" on page 445* for parameters that may need to be configured.

   To achieve complex functions, multiple DIs may need to be selected with multiple function numbers. For example, for terminal start/stop in two-wire control mode, set E0-00 [DI1 terminal function selection] to 1 [Terminal start/stop module A_IN1] and E0-01 [DI2 terminal function selection] to 2 [Terminal start/stop module A_IN2].

   Function numbers can be assigned arbitrarily to each DI terminal, but cannot be duplicated. For example, when E0-00 [DI1 terminal function selection] is set to 1 [Terminal start/stop module A_IN1], DI1 is assigned with the function of [Terminal start/stop module A_IN1]. In this case, other DIs cannot be configured as [Terminal start/stop module A_IN1].

Table 9–28 DI terminal function parameter list

Terminal	Param.	Value range	Default	Description
DI1	E0-00 (F4-03)	0 to 80	1	See details in "Table 9-29 DI terminal function description" on page 445.
DI2	E0-01 (F4-04)		4	
DI3	E0-02 (F4-05)		9	
DI4	E0-03 (F4-06)		12	
DI5 (DIO1)	E0-04 (F4-07)		13	
DI6 (DIO2)	E0-05 (F4-08)		0	
DI7 (DIO3)	E0-06 (F4-09)		0	
DI8 (DIO4)	E0-07 (F4-10)		0	
DI9 (DIO5)	E0-08 (F4-11)		0	
DI10 (DIO6)	E0-09 (F4-12)		0	

Table 9–29 DI terminal function description

Function number	Name	Function	Related parameters	Function link
0	No function	Set 0 for reserved terminals to avoid malfunction.	-	-
1	Terminal start/ stop module A_ IN1	Terminal module A input 1, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-02	-
2	Terminal start/ stop module A_ IN2	Terminal module A input 2, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-03	-
3	Terminal start/ stop module A_ IN3	Terminal module A input 3, with function defined by terminal module mode. (This function is active in terminal control.)	F0-03 (b1-00), b9-00, b9-01, b9-04	-
4	JOG1 source of terminal start/ stop module A	Used to make the drive operate in forward jog mode. In jog mode, the drive runs at a low speed briefly, which is generally used for maintenance and commissioning of on-site equipment (active only in terminal control).	F0-03 (b1-00), b9-07	-

Function number	Name	Function	Related parameters	Function link
5	JOG2 source of terminal start/ stop module A	Used to make the drive operate in reverse jog mode. In jog mode, the drive runs at a low speed briefly, which is generally used for maintenance and commissioning of on-site equipment (active only in terminal control).	F0-03 (b1-00), b9-08	-
6	Function as UP key for frequency adjustment	Used to increase the frequency when the frequency is set through the terminal. Activating the terminal is equivalent to keeping  pressed down. Deactivating the terminal is equivalent to releasing this key.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89	-
7	Function as DOWN key for frequency adjustment	Used to decrease the frequency when the frequency is set through the terminal. Activating the terminal is equivalent to keeping  pressed down. Deactivating the terminal is equivalent to releasing this key.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89	-
8	Coast to stop	In this mode, the drive stops the motor through stopping output, which cuts off the power supply of the motor and brings the driving system to the free braking state. The drive immediately stops output after the terminal is active, and the load coasts to stop based on the mechanical inertia.	b2-00, b4-00	-
9	Fault reset (RESET)	Used to reset the drive faults (rising edge-triggered). This terminal acts in the same way as the STOP/RES key on the operating panel. Remote fault reset can be implemented through this terminal.	b2-04, b4-04	-
10	Operation pause (terminal control)	When the terminal is active, the drive pauses operation and stops as defined by d0-07. When the terminal is inactive, the drive operates normally. (This function is active in terminal control.)	d0-07	-
11	External fault normally open (NO) input	When the terminal is active, it is equivalent to an external fault signal. When the terminal is active, the drive is in normal state. After receiving the external signal, the drive reports E015.1, and acts as defined by H1-02 (Protective action selection upon fault).	H1-02, H2-00	-
12	Multi-reference terminal 1	Multi-reference is used as the main frequency source. 16 speeds or references can be set through combinations of sixteen states of these four terminals. This function is applicable to scenarios that need only several frequency references instead of continuous adjustment of the operating frequency.	F0-29 (b5-00), b6-00, b8-03	-
13	Multi-reference terminal 2		F0-29 (b5-00), b6-00, b8-04	-
14	Multi-reference terminal 3		F0-29 (b5-00), b6-00, b8-05	-
15	Multi-reference terminal 4		F0-29 (b5-00), b6-00, b8-06	-

Function number	Name	Function	Related parameters	Function link
16	Ramp-up/down selection terminal 1	Four sets of ramp-up/down time can be selected through combinations of four states of these two terminals. The ramp-up time indicates the time taken to ramp up from 0 Hz to "Ramp-up/down base frequency" (F0-46). The ramp-down time indicates the time taken to ramp up from 0 Hz to "Ramp-up/down base frequency" (F0-46).	b7-04 to b7-30	-
17	Ramp-up/down selection terminal 2		b7-04 to b7-30	-
19	Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key	When the main frequency is set through the operating panel and this function applies, the frequency set by  or  on the operating panel or by terminal functioning as the UP/DOWN key (6 or 7) can be cleared, and the frequency reference will be reset to the value of b5-01 or b6-01.	F0-03 (b1-00), b3-00, P0-87, P0-88, P0-89	-
21	Acceleration/ Deceleration inhibited	The frequency cannot be adjusted during operation of the drive (except stop commands). The drive runs at the current operating frequency without being affected by external input frequency when the terminal is active.	b7-04 to b7-30	-
22	PID pause	PID calculation pauses, with the current output maintained. When the terminal is active, the drive maintains the current PID output and stops PID regulation. When the terminal is inactive, PID calculation continues based on the current output.	P2-00 to P2-38	-
23	Simple PLC status reset	When the terminal is active, the simple PLC is restored to the initial state.	P1-04	-
29	Torque control inhibited	When the terminal is active, the drive switches from torque control to speed control mode. When the terminal is inactive, the drive switches to the torque control mode.	-	-
32	Immediate DC Braking	When the terminal is active, the drive directly switches to the DC braking state. DC braking indicates that the drive outputs direct current to the stator winding of the asynchronous motor to form a static magnetic field, enabling the motor to brake with energy consumption. In this state, the rotor cuts the static magnetic field to generate braking torque, which stops the motor quickly.	d0-25 to d0-34	-
33	External fault normally closed (NC) input	When the terminal is active, it is equivalent to an external fault input signal. When the terminal is active, the drive is in normal state. When an external signal is sent to the drive, the drive reports E015.2, and acts as defined by H1-02 (Protective action selection upon fault).	H1-02, H2-01	-

Function number	Name	Function	Related parameters	Function link
34	Frequency modification enable	When the terminal is active, the RFG input frequency can be modified. When the terminal is inactive, the RFG input frequency cannot be modified.	-	-
35	PID action direction inversion	When the terminal is active, the PID action direction is opposite to the direction set by P2-01 [PID action direction].	P2-01	-
36	External stop terminal 1	When the terminal is active, the drive stops. This terminal functions in the same way as the STOP/RES key on the operating panel.	-	-
38	PID integral pause	When the terminal is active, the PID integral regulation function pauses. However, the proportional and derivative regulation functions are still active.	P2-34	-
41, 76	Motor terminal selection	The function is used to select motor parameters. For example, when DI1 is assigned with function 41 and DI2 is assigned with function 76, motor 1 applies when DI1 and DI2 are inactive; motor 2 applies when DI1 is active and DI2 is inactive; motor 3 applies when DI1 is inactive and DI2 is active; motor 4 applies when DI1 and DI2 are both active.	b0-00, b0-01	-
43	PID parameter switchover	When the PID parameter switchover condition is set to "DI-based switchover" (P2-11 = 1), if the terminal is inactive, setpoints of P2-14 to P2-16 (proportional gain Kp1, integral time Ti1, derivative time Td1) are used as PID parameters. If the terminal is active, setpoints of P2-17 to P2-19 (proportional gain Kp2, integral time Ti2, derivative time Td2) are used as PID parameters.	P2-11 to P2-19	-
44	Source of user-defined fault 1	The drive reports E027.1, and acts as defined by H1-04 [Protective action selection upon fault].	H2-02	-
45	Source of user-defined fault 2	The drive reports E027.2, and acts according to the value of H1-04 [Protective action selection upon fault].	H2-03	-
46	Speed control/ Torque control selection	Speed control/Torque control selection The terminal is used to enable the drive to switch between speed control mode and the torque control mode. When F0-02 [Speed/Torque control mode] is set to 0, the speed control mode is used when the terminal is active, and the torque control mode is used when the terminal is inactive. When F0-02 [Speed/Torque control mode] is set to 1, the speed control mode is used when the terminal is active, and the torque control mode is used when the terminal is inactive.	F0-02	-
47	Emergency stop	When the terminal is active, the drive stops as defined by d0-06 [OFF3 (Quick stop) mode].	d0-06	-

Function number	Name	Function	Related parameters	Function link
49	Decelerate to DC braking	The drive decelerates to the value defined by d0-27 (Starting frequency for DC braking at stop) and then enters the DC braking state.	d0-27	-
50	Clear the current operating time	Used to clear the current operating time of the drive. If the current operating time is shorter than the time (greater than 0) set by P0-18 and P0-19 and the terminal is active, the current operating time is cleared. If the current operating time is longer than or equal to the time (greater than 0) set by P0-18 and P0-19, the current operating time is not cleared even if the terminal is active.	P0-18, P0-19, P0-20	-
51	Positive position limit	① E150.1 is reported when the positive position limit is reached or exceeded. ② During forward operation, if event ① occurs, OFF3 (quick stop) is triggered. ③ Forward operation is inhibited when event ① occurs.	P0-99	
52	Negative position limit	① E150.2 is reported when the negative position limit is reached or exceeded. ② During reverse operation, if event ① occurs, OFF3 (quick stop) is triggered. ③ Reverse operation is inhibited when event ① occurs.	P0-99	
61	Terminal start/ stop module B_ IN1	Defines input 1 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-10	-
62	Terminal start/ stop module B_ IN2	Defines the input 2 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-11	-
63	Terminal start/ stop module B_ IN3	Defines the input 3 of terminal module B. The function is determined by terminal module mode (active in terminal control).	b3-00, b9-00, b9-09, b9-12	-
64	JOG1 source of terminal start/ stop module B	When the terminal is active, the drive runs at low speed in jog mode 1 briefly, with operating frequency and direction determined by jog 1 frequency (positive frequency by default). This mode is generally used for maintenance and commissioning of on-site equipment. (This function is active in terminal control.)	b3-00, b9-15	-
65	JOG2 source of terminal start/ stop module B	When the terminal is active, the drive runs at low speed in jog mode 2 briefly, with operating frequency and direction determined by jog 1 frequency (negative frequency by default). This mode is generally used for maintenance and commissioning of on-site equipment. (This function is active in terminal control.)	b3-00/b9-16	-

Function number	Name	Function	Related parameters	Function link
66	Forced local control	In any other control mode, if the terminal is active, forced local control applies.	-	-
67	Forced terminal control	In any other control mode, if the terminal is active, forced terminal control applies.	-	-
68	Forced communication control	In any other control mode, if the terminal is active, forced communication control applies.	-	-
69	Forced user-defined control	In any other control mode, if the terminal is active, forced user-defined control applies.		-
70	Control channel selection	Used to select the control channel. When the terminal is inactive, control channel 1 applies. When the terminal is active, control channel 2 applies.	b0-02	-
71	Setting channel selection	Used to select the setting channel. When the terminal is inactive, the setting channel 1 applies. When the terminal is active, the setting channel 2 applies.	b0-03	-
72	Terminal module A/B selection	Used to select the terminal start/stop module. When the terminal is inactive, terminal start/stop module A applies. When the terminal is active, terminal start/stop module B applies.	b9-00	-
77	Operation enable (all modes)	When the terminal is active, the drive is allowed to run. When the terminal is inactive, operation is inhibited and the drive stops as defined by d0-07.	d0-07	-
78	Forward operation permission	When the terminal is active, the frequency reference is allowed to be positive. When the terminal is inactive, if the frequency reference is positive, the drive runs at 0 Hz.	-	-
79	Reverse operation permission	When the terminal is active, the frequency reference is allowed to be negative. When the terminal is inactive, if the frequency reference is negative, the drive runs at 0 Hz.	-	-
80	RFG input clear	When the terminal is active, the drive runs at the set frequency. When the terminal is inactive, the target frequency is set to zero, and the drive runs at 0 Hz.	-	-

2. DI terminal for function selection

The DI terminals are used as the source of parameters to control functions through the DI state. For example, when b0-02 [Control channel selection] is set to 3 [DI1], the active control channel is selected through DI1. When the DI1 receives a high level signal (the DI1 terminal is active), the control channel 2 command takes effect. When the DI1 receives a low level signal (the DI1 terminal is inactive), the control channel 1 command takes effect.

For the same DI terminal, two options may be involved: DI terminal function selection and function selection DI terminal. For example, in the options of E0-00 [DI1 terminal function selection], the option "1: Terminal start/stop module A_IN1" exists, and in b9-02 [Terminal start/stop module A_IN1] also involves terminal start/stop module A_IN1.

The following table lists all parameters involving the two options: DI terminal function selection and function selection DI terminal. For these parameters, the function number selected for each DI function is associated and mapped to one parameter. If the DI function is set to the function number in the first column of the table, the system automatically maps and associates the corresponding parameter in the second column of the table to the DI through the connector, and writes the mapped contents to the connector parameter, such as the function mapping parameter in *"Table 9-30 Terminal function selection and function selection terminal" on page 452*. After the mapping is done, the DI function DI terminal parameters listed in the following table become non-editable.

"Table 9-31 Function mapping parameters for terminal function selection and function selection terminal" on page 453 shows the values automatically associated and written into the parameter in the second column in *"Table 9-30 Terminal function selection and function selection terminal" on page 452* when setting the function number for the DI function. Only connector parameters can be written automatically, and these parameters are used exclusively for mapping between terminal function selection and function selection terminal.

For example, when E0-01 [DI2 function selection] is set to 4 [Terminal start/stop module A jog 1], the value of the corresponding parameter b9-07 [Source of terminal start/stop module A jog 1] is switched to L0485 [DI2 (modified by E0-01 forcibly)] and the number of connector L0485 is displayed on the operating panel. The value of b9-07 cannot be modified. In this case, DI2 controls whether the jog 1 signal of the start/stop module is active. After E0-01 [DI2 terminal function selection] is set to another function, b9-07 [Source of terminal start/stop module A jog 1] reverts to default value, allowing arbitrary selection of input source.

The following table shows all parameters that set forcibly after DI function selection.

Table 9–30 Terminal function selection and function selection terminal

Options for DI terminal function selection	Parameters related to function selection DI terminal	Description
1: Terminal start/stop module A_ IN1	b9-02 [Terminal start/stop module A_IN1]	After DI1 to DI10 are set to the functions listed in this table, the corresponding parameters connectors are L0484 to L0490. See details in *"Table 9-31 Function mapping parameters for terminal function selection and function selection terminal" on page 453*.
2: Terminal start/stop module A_ IN2	b9-03 [Terminal start/stop module A_IN2]	
3: Terminal start/stop module A_ IN3	b9-04 [Terminal start/stop module A_IN3]	
4: Source of terminal start/stop module A (jog 1)	b9-07 [Source of terminal start/stop module A jog 1]	
5: Source of terminal start/stop module A (jog 2)	b9-08 [Source of terminal start/stop module A jog 2]	
8: Coast to stop	b2-00 [OFF2 (coast to stop) source 2] b4-00 [OFF2 (coast to stop) source 2]	
9: Fault reset (RESET)	b2-04 [Fault reset source 2] b4-04 [Fault reset source 2]	
10: Operation pause (terminal control)	b9-05 [Operation permission source of terminal start/stop module A] b9-13 [Operation permission source of terminal start/stop module B]	
11: External fault NO input	H2-00 [External fault NO source]	
12: Multi-reference terminal 1	b8-03 [Multi-reference selection bit0]	
13: Multi-reference terminal 2	b8-04 [Multi-reference selection bit1]	
14: Multi-reference terminal 3	b8-05 [Multi-reference selection bit2]	
15: Multi-reference terminal 4	b8-06 [Multi-reference selection bit3]	
16: Acceleration/Deceleration selection terminal 1	b7-02 [Ramp selection bit0]	
17: Acceleration/Deceleration selection terminal 2	b7-03 [Ramp selection bit1]	
21: Acceleration/Deceleration inhibited	b2-07 [Ramp pause source] b4-07 [Ramp pause source]	
23: Simple PLC status reset	P1-04 [Simple PLC state reset]	
33: External fault normally closed (NC) input	H2-01 [External fault NC input]	
44: User-defined fault 1	H2-02 [Source of user-defined fault 1]	
45: User-defined fault 2	H2-03 [Source of user-defined fault 2]	
47: Emergency stop	b2-02 [OFF3 (quick stop) source 2] b4-02 [OFF3 (quick stop) source 2]	
61: Terminal start/stop module B_ IN1	b9-10 [Terminal start/stop module B_IN1]	

Options for DI terminal function selection	Parameters related to function selection DI terminal	Description
62: Terminal start/stop module B_ IN2	b9-11 [Terminal start/stop module B_IN2]	After DI1 to DI10 are set to the functions listed in this table, the corresponding parameters connectors are L0484 to L0490. See details in *"Table 9-31 Function mapping parameters for terminal function selection and function selection terminal" on page 453*.
63: Terminal start/stop module B_ IN3	b9-12 [Terminal start/stop module B_IN3]	
64: Source of terminal start/stop module B jog 1	b9-15 [Source of terminal start/stop module B jog 1]	
65: Source of terminal start/stop module B jog 2	b9-16 [Source of terminal start/stop module B jog 2]	
70: Control channel selection	b0-02 [Control channel selection]	
71: Setting channel selection	b0-03 [Setting channel selection]	
72: Terminal module A/B selection	b9-00 [Terminal start/stop module A/B selection]	
78: Forward run permission	d1-01 [Positive speed permission]	
79: Reverse run permission	d1-02 [Negative speed permission]	
80: RFG input set to zero	b2-08 [Source for setting ramp reference to 0] b4-08 [Source for setting ramp reference to 0]	

Function mapping parameters for terminal function selection and function selection terminal

Table 9-31 Function mapping parameters for terminal function selection and function selection terminal

Param.	Name	Default value	Value range	Description
L0484	DI1 (modified by E0-00 forcibly)	-	-	When parameter setpoint displays L0484, it indicates that DI1 is assigned with this function.
L0485	DI2 (modified by E0-01 forcibly)	-	-	When parameter setpoint displays L0485, it indicates that DI2 is assigned with this function.
L0486	DI3 (modified by E0-02 forcibly)	-	-	When parameter setpoint displays L0486, it indicates that DI3 is assigned with this function.
L0487	DI4 (modified by E0-03 forcibly)	-	-	When parameter setpoint displays L0487, it indicates that DI4 is assigned with this function.
L0488	DI5 (modified by E0-04 forcibly)	-	-	When parameter setpoint displays L0488, it indicates that DI5 is assigned with this function.
L0489	DI6 (modified by E0-05 forcibly)	-	-	When parameter setpoint displays L0489, it indicates that DI6 is assigned with this function.
L0490	DI7 (modified by E0-06 forcibly)	-	-	When parameter setpoint displays L0490, it indicates that DI7 is assigned with this function.
L0491	DI8 (modified by E0-07 forcibly)	-	-	When parameter setpoint displays L04918, it indicates that DI8 is assigned with this function.
L0492	DI9 (modified by E0-08 forcibly)	-	-	When parameter setpoint displays L0492, it indicates that DI9 is assigned with this function.
L0493	DI10 (modified by E0-09 forcibly)	-	-	When parameter setpoint displays L0493, it indicates that DI10 is assigned with this function.

The following table shows the commonly used parameters that can select DI terminals as input sources. Different parameters may select the same DI terminal as an input source. Set them

flexibly according to application requirements. The table below shows the parameters for function selection DI terminal.

Table 9–32 Parameters for function selection DI terminal

Param.	Name	Default value	Value range	Description
b0-02	Control channel selection	0	0: Control channel 1 1: Control channel 2 3 to 12: DI1 to DI10 Other: B connector	Defines the active control channel. The setpoint 0 indicates the control channel 1. The setpoint 1 indicates the control channel 2. Value description: 0: Inactive - Channel 1 applies. 1: Active - Channel 2 applies. 3 to 12: DI1 to DI10 - The selected channel depends on the final state of DI. Other: B connector - The channel selected depends on the B connector.
b0-03	Setting channel selection	0	0: Setting channel 1 1: Setting channel 2 3 to 12: DI1 to DI10 Other: B connector	Defines the active setting channel. The setpoint 0 indicates the setting channel 1. The setpoint 1 indicates the setting channel 2. Value description: 0: Inactive - Channel 1 applies. 1: Active - Channel 2 applies. 3 to 12: DI1 to DI10 - The channel selected depends on the state of the DI. Other: B connector - The channel selected depends on the B connector.
b8-03	Multi-reference selection bit0	0	0: 0 1: 1 3 to 12: DI1 to DI10 Other: B connector	Multi-reference bit0 to bit3 are used together to support 16 multi-references in total. Value description: 0: 0 - The value of multi-reference bitx is 0. 1: 1 - The value of multi-reference bitx is 1. 3 to 12: DI1 to DI10 - The channel selected depends on the state of the DI. Other: B connector - Depending on the B connector Note: A total of 16 multi-reference can be supported through binary combination of b8-03 [Multi-reference selection bit0], b8-04 [Multi-reference selection bit1], b8-05 [Multi-reference selection bit2], and b8-06 [Multi-reference selection bit3]. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.
b8-04	Multi-reference selection bit1			
b8-05	Multi-reference selection bit2			
b8-06	Multi-reference selection bit3			

Param.	Name	Default value	Value range	Description
b9-02	Terminal start/ stop module A_ IN1	0	0: Inactive 3 to 12: DI1 to DI10 Other: B connector	Defines the source of the INX signal in terminal control mode. When the bit signal is 0, the INX signal is inactive. When the bit signal is 1, the INX signal is active. The bit signal can be defined by DI or bit connector. For example, if the parameter is set to 3 [DI1], DI1 = 0 indicates that bit signal is 0 and DI1 = 1 indicates that bit signal is 1. Value description: 0: Inactive 3 to 12: DI1 to DI10: The signal source is DI1 to DI10. When DI1 to DI10 are active, INX is active. Other: B connector - The signal is from the selected connector B. When the bit signal is active, INX is active.
b9-03	Terminal start/ stop module A_ IN2			
b9-04	Terminal start/ stop module A_ IN3			
d0-01 (F0-02)	Motor control mode	0	0: Speed control 1: Torque control 3 to 12: DI1 to DI10 Other: B connector	Defines the motor control target. Value description: 0: Speed control - The speed is the control target. 1: Torque control - The torque is the control target. 3 to 12: DI1 to DI10 - The channel selected depends on the state of the DI. Other: B connector - The control method depends on the status of B connector (0: Speed control; 1: torque control). Note: The torque control mode is inactive in V/f mode.

3. Terminal status connector

"Table 9-33 DI terminal status connector" on page 455 shows the current status of each DI terminal. The main functions of terminal status connectors are as follows.

a. Display the status of the DI terminal. The value 0 indicates that the DI terminal opens and the value 1 indicates that the DI terminal closes.

b. You can configure the parameter labeled "Other: B connector" in the drop-down menu as the DI terminal status connector.

For *"Table 9-32 Parameters for function selection DI terminal" on page 454*, control logic is achieved by inputting 0 or 1. The DI states are divided into "open (0)" and "close (1)". Therefore, the DI terminal status connector can be used as an input for these parameters. That is, when configuring the parameter option as "Other: B connector," the DI terminal status can also be selected as an input through the "Other: B connector" option. See *" Parameter Interconnection" on page 779* for details.

Table 9-33 DI terminal status connector

Param.	Name	Default value	Value range	Description
L0002	DI1	0	0 to 1	Bit connector: Displays the final level state of DI1.
L0003	DI2	0	0 to 1	Bit connector: Displays the final level state of DI2.
L0004	DI3	0	0 to 1	Bit connector: Displays the final level state of DI3.
L0005	DI4	0	0 to 1	Bit connector: Displays the final level state of DI4.

Param.	Name	Default value	Value range	Description
L0006	DI5	0	0 to 1	Bit connector: Displays the final level state of DI5.
L0007	DI6	0	0 to 1	Bit connector: Displays the final level state of DI6.
L0008	DI7	0	0 to 1	Bit connector: Displays the final level state of DI7.
L0009	DI8	0	0 to 1	Bit connector: Displays final level state option of DI8.
L0010	DI9	0	0 to 1	Bit connector: Displays final level state option of DI9.
L0011	DI10	0	0 to 1	Bit connector: Displays final level state option of DI10.

4. Other function setting

Table 9–34 DI parameter list

Param.	Name	Default value	Value range	Description
E0-16	DI input filter time 1	0.010s	0.000s to 1.000s	Defines the filter time 1 for the drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000s to 1.000s	Defines filter time 2 for the drive to respond to changes in DI status.
E0-18	DI input filter time selection	0	bit0 to bit9: Filter time of DI1 to DI10 bit9: DI10 filter time 0: Filter time 1 1: Filter time 2 bit10 to bit15: Reserved	Defines the filter time of which DI is active. Value description: bit0 to bit9: - The filter time of DI1 to DI10 applies. 0: Filter time 1 - The filter time of DI1 to DI10 is defined by E0-16. 1: Filter time 2 - The filter time of DI1 to DI10 is defined by E0-17.

Param.	Name	Default value	Value range	Description
E0-20	DI1 switch-on delay	0.0s	0.0s to 3600.0s	Defines the delay variation coefficient when each terminal is switched on/off. Note: 1. It can be superimposed with the filter time. 2. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-21	DI1 switch-off delay	0.0s	0.0s to 3600.0s	
E0-22	DI2 switch-on delay	0.0s	0.0s to 3600.0s	
E0-23	DI2 switch-off delay	0.0s	0.0s to 3600.0s	
E0-24	DI3 switch-on delay	0.0s	0.0s to 3600.0s	
E0-25	DI3 switch-off delay	0.0s	0.0s to 3600.0s	
E0-26	DI4 switch-on delay	0.0s	0.0s to 3600.0s	
E0-27	DI4 switch-off delay	0.0s	0.0s to 3600.0s	
E0-28	DI5 switch-on delay	0.0s	0.0s to 3600.0s	
E0-29	DI5 switch-off delay	0.0s	0.0s to 3600.0s	
E0-30	DI6 switch-on delay	0.0s	0.0s to 3600.0s	
E0-31	DI6 switch-off delay	0.0s	0.0s to 3600.0s	
E0-32	DI7 switch-on delay	0.0s	0.0s to 3600.0s	
E0-33	DI7 switch-off delay	0.0s	0.0s to 3600.0s	
E0-34	DI8 switch-on delay	0.0s	0.0s to 3600.0s	
E0-35	DI8 switch-off delay	0.0s	0.0s to 3600.0s	
E0-36	DI9 switch-on delay	0.0s	0.0s to 3600.0s	
E0-37	DI9 switch-off delay	0.0s	0.0s to 3600.0s	
E0-38	DI10 switch-on delay	0.0s	0.0s to 3600.0s	
E0-39	DI10 switch-off delay	0.0s	0.0s to 3600.0s	
E0-40	DI source	0	bit0 to bit9: Source of DI1 to DI10 0: Hardware sampling 1: Forced setpoint bit10 to bit15: Reserved	Defines the signal source of DI1 to DI10. 0: Hardware sampling 1: Forced setpoint

Param.	Name	Default value	Value range	Description
E0-56	Forced DI data	0	bit0 to bit9: Setting of DI1 to DI10 0: Inactive level 1: Active level bit10 to bit15: Setting of VDI1 to VDI6 0: Inactive level 1: Active level	Used to set the level state of DI1 to DI10, and VDI1 to VDI6 (in bit sequence). If the bit value is 0, the level is forced to be inactive; otherwise, the level is active. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-57	DI active mode selection	0	bit0 to bit9: Active mode of DI1 to DI10 0: Active high 1: Active low bit10 to bit15: Active mode of VDI1 to VDI6 0: Active high 1: Active low	Use the bits of this parameter to set the active mode for terminals DI1 to DI10 and VDI1 to VDI6 separately. 0: Active high - DI terminals (DI1 to DI10) are active when connected to 24V, and inactive when disconnected from 24V. VDI1 to VDI6 are directly set to the corresponding active mode. 1 - Low level active: DI terminal (DI1 to DI10) is inactive when connected to 24V, and active when disconnected from 24V. VDI1 to VDI6 are directly set to the corresponding active mode.

Application instance

When the DI1 and DI2 active mode selection (E0-57) is set to "Active high" (0x0000), to perform the function "DI1 starts in the forward direction and DI2 starts in the reverse direction", do as follows.

1. Set b9-01 to 3 [IN1 for forward start, IN2 for reverse start].
2. Set the DI1 function to "Terminal control IN1" (E0-00 = 01).
3. Set the DI2 function to "Terminal control IN2" (E0-01 = 02).
4. Set terminals as the main command source of control channel (b1-00 = 1).
5. Set DI terminal active mode (E0-57 = 0), under which the DI terminal is active when closed and inactive when open. If opposite logic is required, set the corresponding bit of E0-58 to 1.

After preceding steps are done, when DI1 is active and DI2 is inactive, the drive is in forward run. When DI2 is active and DI1 is inactive, the drive is in reverse run.

9.11.3 Digital Output (DO) Terminal

List of functions

The following table describes the standard functions of the RO and DO terminals.

Table 9–35 List of terminal functions

Function	Terminal	
	RO	DO
Output function selection	Yes	Yes
ON delay	Yes	Yes
OFF delay	Yes	Yes
Output source	Yes	Yes
Forced data	Yes	Yes

Function	Terminal	
	RO	DO
Output terminal polarity selection	Yes	Yes
Communication output	Yes	Yes

Function description

The DO/RO function refers to the digital output terminal.

The drive provides one RO (three-phase 380 V brake output) terminal and supports up to six DOs (all six DIOs used as DOs) as standard. Each DO/RO terminal can be selected with an output function.

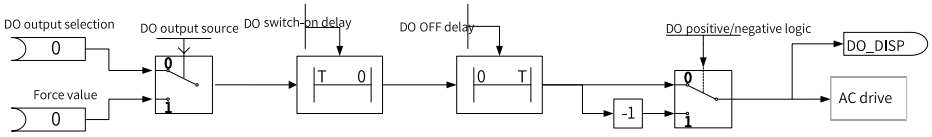


Figure 9-70 DO data flow diagram

DO terminal layout

The drive provides one RO (three-phase 380 V brake output) terminal and supports up to six DOs (all six DIOs used as DOs).

The RO (three-phase 380V brake output) terminal locate at MB1/2/3 of J5 on the terminal board, and the six DOs are arranged on terminal boards IO3-5.

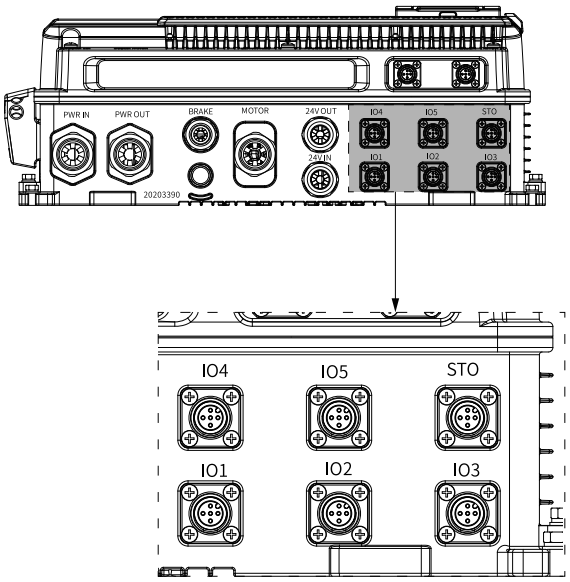


Figure 9-71 Terminal layout

The hardware wiring is shown below.

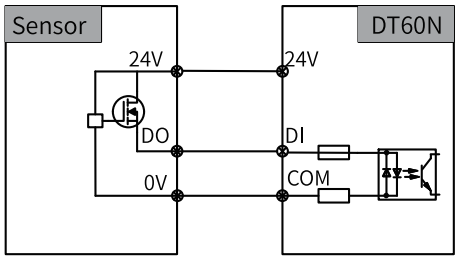


Figure 9-72 Wiring of DO terminals

DO function

1. DO function selection

The DO/RO terminals can be set through parameter (E1-00 to E1-38). For a list of related parameters, see E1-00 to E1-38. For DO/RO terminal function selection, see parameters E1-00 to E1-04.

Param.	Name	Default value	Value range	Description
E1-00	RO output selection	21	0 to 43	Defines the function of RO/DO1 to DO6.
E1-01	DO1 function selection	0		
E1-02	DO2 function selection	0		
E1-03	DO3 function selection	0		
E1-04	DO4 function selection	0		
E1-05	DO5 function selection	0		
E1-06	DO6 function selection	0		

DO/RO terminals can be configured with the following functions.

Table 9–36 DO terminal functions

Setpoint	Function	Description	Related parameters
0	No function	The terminal has no function.	-
1	In operation	When the drive is operating and outputs frequency (can be zero), an active signal is outputted.	-
2	Fault output	When the drive stops due to a fault (coast to stop, stop with maximum capability, quick stop, or decelerate to stop), an active signal is outputted.	-
3	Frequency level detection FDT1	When the operating frequency exceeds the frequency detection value, an active signal is outputted. When the operating frequency falls below the sum of the frequency detection value minus the FDT hysteresis (P0-34 x P0-35), the DO terminal stops outputting the active signal.	P0-34/P0-35
4	Frequency arrival	When the operating frequency of the drive is within the (target frequency±P0-38 x A2-04), the DO outputs an active signal.	P0-38
5	Operating at zero speed (no output at stop)	When the output frequency is 0 during operation of the drive, an active signal is outputted. When the drive is in the stop state, this signal is inactive.	-
6	Motor overload pre-alarm	Before motor overload protection, the drive determines whether the motor load exceeds the overload pre-alarm threshold according to the overload pre-alarm coefficient (d1-47). If the threshold is exceeded, an active signal is outputted. (For calculation of the pre-alarm threshold, see the description of motor overload protection.)	d1-47

Setpoint	Function	Description	Related parameters
7	Drive overload pre-alarm	When the cumulative overload value of the drive reaches the pre-overload threshold (A3-53), an active signal is outputted.	A3-53
11	Cyclic operation of simple PLC	When simple PLC completes one cycle, the terminal outputs a pulse signal with width of 250 ms.	P1-00
12	Accumulative operating time reached	If the cumulative operating time of the drive exceeds the time set by the combination of P0-18 and P0-19, an active signal is outputted.	P0-18, P0-19
14	Torque Limited	When the output torque of the drive reaches the toque limit in the speed control mode, an active signal is outputted.	F2-30 to F2-33
15	Ready to run	When no exception occurs on the drive after power-on, an active signal is outputted.	-
17	Frequency upper limit arrival	In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or greater than the maximum positive frequency (L3068) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or greater than the maximum negative frequency (L3072) multiplied by the per-unit frequency, an active signal is outputted.	U0-00 and U0-01 F1-10 F2-22 to F2-25 L3068/L3072
18	Frequency lower limit arrival (no output at stop)	When P0-11 [Operation mode when frequency reference < frequency lower limit] is set to 1 [Stop], an inactive signal is outputted no matter whether the operating frequency reaches the lower limit. When P0-11 [Operation mode when frequency reference lower than the lower limit] is set to 0 [Operating at the frequency lower limit] or 2 [Operating at zero speed] and the operating frequency reaches the effective lower limit, an active signal is outputted. In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum positive frequency (L3070) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum negative frequency (L3074) multiplied by the per-unit frequency, an active signal is outputted.	U0-00 and U0-01 F1-10 F2-26/F2-27 L3070/L3074
19	Undervoltage state output	When undervoltage occurs on the drive, an active signal is outputted.	-
20	Communication	The terminal state is controlled by the setpoint of communication address 0x2001 or 0x7312. (n0-12 (Compatibility mode) must be enabled to write address 0x2001.)	n0-12 U3-18
21	Brake output	When the brake function is enabled (P4-00 set to a non-zero value), the brake output is controlled according to brake parameters. When the brake function is disabled (P4-00 set to a non-zero value), this DO function is deactivated forcibly.	P4-00 to P4-20
23	Operating at zero speed 2 (output generated even at stop)	When the output frequency is 0 during operation or when the drive is in the stop state, an output signal is outputted.	-
24	Cumulative power-on time reached	When the cumulative power-on time of the drive (Ad-02/Ad-03) exceeds the time defined by P0-16/P0-17, an output signal is outputted.	Ad-02/Ad-03 P0-16, P0-17

Setpoint	Function	Description	Related parameters
25	Frequency level detection FDT2	When the operating frequency is higher than the frequency detection value, the DO outputs an "active" signal. When the operating frequency is lower than the result of the detection value minus the FDT hysteresis value (P0-36 x P0-37), the active signal outputted by the DO terminal is deactivated.	P0-36/P0-37
26	Frequency 1 arrival	When the operating frequency of the drive is within the detection range of P0-39 (Frequency detection value 1), an active signal is outputted. Frequency detection range = (P0-39 to P0-40) x A2-04 (Per-unit frequency base value) to (P0-39 + P0-40) x A2-04 (Per-unit frequency base value)	P0-39/P0-40
27	Frequency 2 arrival	When the operating frequency of the drive is within the detection range of P0-41 (Frequency detection value 2), an active signal is outputted. Frequency detection range = (P0-41 to P0-42) x A2-04 (Per-unit frequency base value) to (P0-41 + P0-42) x A2-04 (Per-unit frequency base value)	P0-41/P0-42
28	Current 1 arrival	When the output current of the drive is within the detection range of P0-43 (Current detection value 1), an active signal is outputted. Current detection range = (P0-43 - P0-44) x C4-03 (Rated motor current) to (P0-43 + P0-44) x C4-03	P0-43/P0-44
29	Current 2 arrival	When the output current of the drive is within the detection range of P0-45 (Current detection value 2), an active signal is outputted. Current detection range = (P0-45 - P0-46) x C4-03 (Rated motor current) to (P0-45 + P0-46) x C4-03	P0-45/P0-46
30	Timed operation arrival	When the timing function set by P0-13 is enabled and the operating time reaches the set timing period, an active signal is outputted. The timed operation is defined by P0-14 and P0-15.	P0-13 to P0-15
32	Three-phase loss	When the drive encounters phase loss, an active signal is outputted.	-
33	Reverse run	When the drive is in reverse run, an active signal is outputted.	-
34	Zero current state	When the output current of the drive is within the zero-current range for a time exceeding P0-48 (Delay time for zero current detection), an active signal is outputted. Zero current detection range = 0 to (P0-47 x C4-03)	P0-47/P0-48
35	Heatsink temperature arrival	When U0-82 (Heatsink temperature of the inverter module) reaches the value of P0-33 (Module temperature threshold), an active signal is outputted.	P0-33/U0-82
36	Output Current Limit Violation	When the output current of the drive is greater than P0-49 (output current limit) for a time exceeding P0-50 (delay time for detecting output current overrun), an active signal is outputted.	P0-49/P0-50
37	Frequency lower limit arrival (output generated even at stop)	In forward run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum positive frequency (L3070) multiplied by the per-unit frequency, an active signal is outputted. In reverse run, when U0-00 [Operating frequency] and U0-01 [Frequency reference] are equal to or lower than the minimum negative frequency (L3074) multiplied by the per-unit frequency, an active signal is outputted. When the set frequency is lower than the absolute value of the minimum effective frequency, an active signal is outputted in the stop state.	U0-00 and U0-01 F1-10 F2-26/F2-27 L3070/L3074

Setpoint	Function	Description	Related parameters
38	Error (fault/minor fault/alarm)	When a fault occurs and the drive continues operating upon fault, an active signal is outputted. For protective action selection upon fault, see parameters H1-00 to H1-13.	-
40	Current Operating Time Arrival	When the current operating time of the drive exceeds the time defined by P0-20 (Current operating time arrival), an active signal is outputted.	P0-20/U0-26
41	Fault output (excluding undervoltage)	When a fault (other than the undervoltage fault) occurs on the drive, an active signal is outputted.	-
42	STO output	When STO is triggered, an active signal is outputted.	-
43	Minor fault or alarm	When a minor fault that restricts the operation of the drive occurs, the operating panel of the drive displays "LXXX.XX" or "Axxx.xx", with an active signal outputted.	-

2. Other function setting

Table 9–37 List of DO/RO-related parameters

Param.	Name	Default value	Value range	Description
E1-00	RO output selection	21	0 to 43	Defines the function of RO/DO1 to DO6.
E1-01	DO1 function selection	0		
E1-02	DO2 function selection	0		
E1-03	DO3 function selection	0		
E1-04	DO4 function selection	0		
E1-05	DO5 function selection	0		
E1-06	DO6 function selection	0		
E1-16	RO switch-on delay time	0.0s	0.0s to 3600.0s	Defines the RO output delay. The RO outputs an active signal only after the set delay elapses. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than “Extended”.
E1-17	RO switch-off delay time	0.0s	0.0s to 3600.0s	

Param.	Name	Default value	Value range	Description
E1-18	DO1 output switch-on delay	0.0s	0.0s to 3600.0s	Defines the DO output delay. The DO outputs an active signal only after the set delay elapses. Defines the DO switch-off delay time. The DO stops outputting an active signal only after the set delay elapses. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E1-19	DO1 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-20	DO2 output switch-on delay	0.0s	0.0s to 3600.0s	
E1-21	DO2 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-22	DO3 output switch-on delay	0.0s	0.0s to 3600.0s	
E1-23	DO3 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-24	DO4 output switch-on delay	0.0s	0.0s to 3600.0s	
E1-25	DO4 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-26	DO5 output switch-on delay	0.0s	0.0s to 3600.0s	
E1-27	DO5 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-28	DO6 output switch-on delay	0.0s	0.0s to 3600.0s	
E1-29	DO6 output switch-off delay time	0.0s	0.0s to 3600.0s	
E1-36	DO/RO/VDO output source	0	bit0: RO output source bit1 to bit6: Output sources of DO1 to DO6 0: Output function 1: Forced setpoint bit7 to bit9: Reserved bit10 to bit15: Output sources of VDO1 to VDO6 bit value: 0: Output function 1: Forced setpoint	Defines the output source of RO, DO, and VDO1 to VDO6 (in bit sequence). Value description: 0: Output function - DO/RO/VDO output depends on E1-00 to E1-06 and E1-10 to E1-15. 1: Forced value - The DO/RO/VDO output depends on E1-37. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".

Param.	Name	Default value	Value range	Description
E1-37	Force value of DO/RO/VDO	0	bit0: RO reference bit1 to bit6: Settings of DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15: Settings of VDO1 to VDO6 bit value: 0: Low level 1: High level	Used to set the level state of RO/DO/VDO1 to VDO6 (in bit sequence) forcibly. Value description: 0: Low level - RO, DO, and VDO output low level forcibly. 1: High level - RO, DO, FMR, and VDO output high level forcibly. Note: This parameter is valid when the corresponding bit of E1-36 is set to 1. In this case, the output is not related to the hardware. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E1-38	DO/RO/VDO terminal polarity selection	0	bit0: RO output logic bit1 to bit6: Output logic of DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15: Output logic of VDO1 to VDO6 bit value: 0: Positive logic 1: Negative logic	The following describes the polarity options of RO, DO, and VDO1 to VDO6 (in bit sequence). 0: Positive logic - The output levels of RO, DO, and VDO are set to positive logic. That is, when the output function of the selected terminal is active, RO, DO, and VDO generate output. Otherwise, RO, DO, and VDO do not generate output. 1: Negative logic - The output levels of RO, DO, and VDO are set to negative logic. That is, when the output function of the selected terminal is inactive, RO, DO, and VDO generate output. When the output function of the selected terminal is active, RO, DO, and VDO does not generate output.

3. Terminal status connector

The following table shows the current status of each DO terminal. The DO terminal state connector has the following functions.

a. Displays current DO state. The value 0 indicates no output from the DO terminal. The value 1 indicates that output is generated from the DO terminal.
b. You can configure the parameter labeled "Other: B connector" in the drop-down menu as the DO terminal status connector.

The DO terminal only supports two states, namely 0 (No output) and 1 (With output), which can be configured through the drop-down menu in parameters with option "Other: Connector B", as shown in *"14.1.2.1 Connector Introduction" on page 745*.

Table 9–38 DO terminal status connector

Param.	Name	Default value	Value range	Description
L0034	RO	0	0 to 1	Bit connector: Displays the final level state of RO terminal.
L0035	DO1	0	0 to 1	Bit connector: Displays the final level state of DO terminal.
L0036	DO2	0	0 to 1	Bit connector: Displays the final level state of DO2.
L0037	DO3	0	0 to 1	Bit connector: Displays the final level state of DO3.
L0038	DO4	0	0 to 1	Bit connector: Displays the final level state of DO4.
L0039	DO5	0	0 to 1	Bit connector: Displays the final level state of DO5.
L0040	DO6	0	0 to 1	Bit connector: Displays the final level state of DO6.

Application instance

When the DO1 output source (bit1 of E1-36 = 0) is set to "Output function (0x0000)", to perform the following function: "DO1 outputs an active signal during operation of the drive", do as follows.

1. Assign DO1 with function "In operation" (E1-01 = 1).
2. Set the polarity (bit1 of E1-38 = 0000) of the RO, DO, and VDO terminals (in bit sequence).
   Value description:

   0: Positive logic

   Set the output levels of RO, DO, and VDO to positive logic. That is, when the output function of the selected terminal is active, RO, DO, and VDO generate output. Otherwise, they do not generate output.

   1: Negative logic

   Set the output levels of RO, DO, and VDO to negative logic. When the output function of the selected terminal is inactive, RO, DO, FMR, and VDO generate output. When the output function of the selected terminal is active, RO, DO, and VDO does not generate output.

   If negative logic is selected, DO does not generate output during operation.
3. Set the output source of the DO1 to "Output function setting" (bit1 of E1-36 = 0000), that is, whether the DO1 generates output depends on the function selected by E1-01.

After preceding steps are done, DO1 outputs active level when the drive is running. When the drive stops, DO1 outputs inactive level.

9.11.4 Virtual Digital Input (VDI) Terminals

List of functions

The following table describes the standard functions of VDI1 to VDI6.

Function	VDI terminal					
	VDI1	VDI2	VDI3	VDI4	VDI5	VDI6
VDI function selection	Yes	Yes	Yes	Yes	Yes	Yes
Whether the VDI source can be set	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes
Terminal activation mode (active level)	Yes	Yes	Yes	Yes	Yes	Yes

Function description

The VDI terminal, which is similar to the DI function, can be used as a multi-function digital input terminal.

The drive provides six multi-functional DI terminals (VDI1 to VDI6) as standard. Each VDI terminal can be assigned with a specific function like DI.

The VDI source can be set through E0-50 to E0-55, and function selection can be set through E0-10 to E0-15. When the VDI source set in parameter groups E0-50 to E0-55 is active, the functions selected in parameter groups E0-10 to E0-15 are active. The VDI source set by E0-50 to E0-55 can simulate analog DI terminals to be used for extended function of DI when the number of DIs are insufficient.

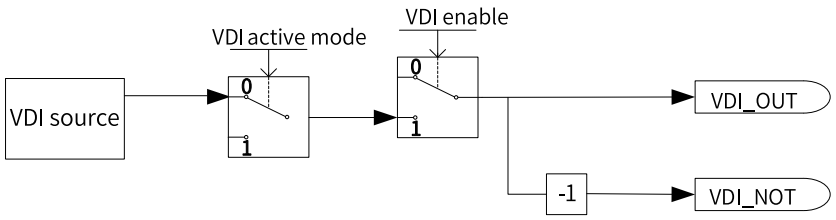


Figure 9-73 VDI data flow diagram

Layout of VDI terminals

VDI is the virtual DI terminal. The VDI source can be the actual physical terminal signals such as DI, DO/RO that set through E0-50 to E0-55.

After selecting the actual physical terminal signal, see the corresponding physical terminal in the hardware wiring diagram. For example, if the VDI source is DI1, perform wiring according to *"9.11.2 Digital Input (DI) Terminals" on page 442*.

VDI function

1. VDI function selection

   The VDI terminals can be set through E0-10 to E0-15 as shown below. The optional functions are the same as those of the DI, as shown in *"9.11.2 Digital Input (DI) Terminals" on page 442*.

Param.	Name	Default value	Value range	Description
E0-10	VDI1 function selection	0	0 to 80	See "9.11.2 Digital Input (DI) Terminals" on page 442. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
E0-11	VDI2 function selection	0		
E0-12	VDI3 function selection	0		
E0-13	VDI4 function selection	0		
E0-14	VDI5 function selection	0		
E0-15	VDI6 function selection	0		

2. VDI source

The VDI source can be set through E0-50 to E0-55.

Param.	Description	Default value	Value range
E0-50	VDI1 source	1	1: Forced value 11 to 20: DI1 to DI10 22 to 26: VDI2 to VDI6 51: RO 55 to 60: DO1 to DO6 61 to 66: VDO1 to VDO6
E0-51	VDI2 source	1	Same as E0-50
E0-52	VDI3 source	1	Same as E0-50
E0-53	VDI4 source	1	Same as E0-50
E0-54	VDI5 source	1	Same as E0-50
E0-55	VDI6 source	1	Same as E0-50

3. Other function setting

Param.	Name	Default value	Value range	Description
E0-56	Forced DI data	0	bit0 to bit9: Setting of DI1 to DI10 bit10 to bit15: Setting of VDI1 to VDI6 bit value: 0: Inactive level 1: Active level	Used to set the level state of DI1 to DI10, and VDI1 to VDI6 (in bit sequence). If the bit value is 0, the level is forced to be inactive; otherwise, the level is active. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than "Extended".
E0-57	DI active mode selection	0	bit0 to bit9: Active mode of DI1 to DI10 bit10 to bit15: Active mode of VDI1 to VDI6 bit value: 0: Active high 1: Active low	Use the bits of this parameter to set the active mode for terminals DI1 to DI10 and VDI1 to VDI6 separately. 0 - Active high: DI terminals (DI1 to DI10) are active when connected to 24 V, and inactive when disconnected from 24 V. VDI1 to VDI6 are directly set to the corresponding active mode. 1 - Active low: DI terminals (DI1 to DI10) are inactive when connected to 24 V, and active when disconnected from 24 V. VDI1 to VDI6 are directly set to the corresponding active mode.

4. Terminal status connector

The following table shows the current status of each VDI terminal. The main functions of the VDI terminal connector are as follows.

a. Display the status of the VDI terminal. The value 0 indicates that the VDI terminal has no input and the value 1 indicates that the VDI terminal has input.
b. You can configure the parameter with option "Other: B connector" in the drop-down menu as the VDI terminal status connector.

The VDI terminal can be configured through a parameter with a drop-down menu containing "Other: B connector", as shown in *" Parameter Interconnection" on page 779*.

Table 9–39 VDI terminal status connector

Param.	Name	Default value	Value range	Description
L0012	VDI1	0	0 to 1	Bit connector: Displays the final level state of VDI1.
L0013	VDI2	0	0 to 1	Bit connector: Displays the final level state of VDI2.
L0014	VDI3	0	0 to 1	Bit connector: Displays the final level state of VDI3.
L0015	VDI4	0	0 to 1	Bit connector: Displays the final level state of VDI4.
L0016	VDI5	0	0 to 1	Bit connector: Displays the final level state of VDI5.
L0017	VDI6	0	0 to 1	Bit connector: Displays the final level state of VDI6.

Application instance

When E0-57 (Active mode of VDI1 and VDI2) is set to 00000, to perform the function "VDI1 starts in the forward direction and VDI2 starts in the forward direction", do as follows.

1. Set the VDI1 function to "Terminal control IN1" (E0-10 = 1).
2. Set the VDI2 function to "Terminal control IN2" (E0-11 = 2).
3. Set the VDI1 source to "VDO1" (E0-50 = 61).
4. Set the VDI2 source to "VDO2" (E0-51 = 62).
5. Set the command source to "Terminal" (b1-00 = 1).
6. Set the start/stop module mode (b9-01 = 3).
7. Set VDO1 and VDO2 output source to "Forced value" (E1-36 = 0x0C00).

After preceding steps are done, when the forced VDO1 output is active level, E1-37 = 0x0400 (VDI1 input is active level), and VDO2 does not generate output (VDI2 input is inactive level), the drive is in forward run state. When the forced VDO2 output is active level, E1-37 = 0x0800 (VDI2 input is active), and VDO1 does not generate output (VDI1 input is inactive level), the drive is in reverse run state.

9.11.5 Virtual Digital Output (VDO) Terminals

List of functions

The following table describes the standard functions of VDO1 to VDO6.

Table 9-40 List of VDO terminal function assignment

Function	VDO terminal					
	VDO1	VDO2	VDO3	VDO4	VDO5	VDO6
VDO function selection	Yes	Yes	Yes	Yes	Yes	Yes
Output source	Yes	Yes	Yes	Yes	Yes	Yes
Forced data	Yes	Yes	Yes	Yes	Yes	Yes
Output terminal polarity selection	Yes	Yes	Yes	Yes	Yes	Yes

Function description

The drive is equipped with six multi-function relay output terminals (VDO1 to VDO6) as standard. Each VDO terminal can be assigned with a specific function. The VDI and VDO can be used together to implement flexible control and simple logic control.

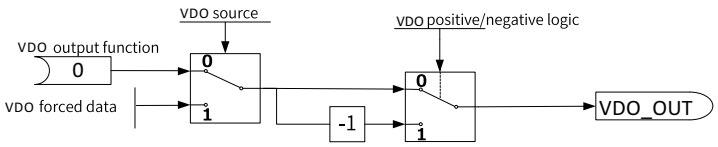


Figure 9-74 VDO data flow diagram

VDO terminal layout

VDI is the virtual DI terminal.

VDO function

1. VDO function selection

   VDO terminals can be set through E1-10 to E1-15. See E1-00 to E1-38 for details. For details on VDO function selection, see E1-10 to E1-15.

Param.	Name	Default value	Value range	Description
E1-10	VDO1 function selection	0	0 to 43	For details, see *"Table 9-36 DO terminal functions" on page 460*.
E1-11	VDO2 function selection	0	Same as E1-10	Same as E1-10
E1-12	VDO3 function selection	0	Same as E1-10	Same as E1-10
E1-13	VDO4 function selection	0	Same as E1-10	Same as E1-10
E1-14	VDO5 function selection	0	Same as E1-10	Same as E1-10
E1-15	VDO6 function selection	0	Same as E1-10	Same as E1-10

2. Other function setting

Table 9–41 VDO-related parameter list

Param.	Name	Default value	Value range	Description
E1-37	Force value of DO/ RO/VDO	0	bit0: RO reference bit1 to bit6: Settings of DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15: Settings of VDO1 to VDO6 bit value: 0: Low level 1: High level	Defines the level state of forced values of RO, DO, and VDO1 to VDO6 (in bit sequence). Value description: 0: Low level - RO, DO, FMR, and VDO are forced to output low level. 1: High level - RO, DO, and VDO are forced to output high level. Note: This parameter is valid when the corresponding bit of E1-36 is set to 1. In this case, the output is not related to the hardware. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is higher than “Extended”.
E1-38	DO/RO/VDO terminal polarity selection	0	bit0: RO output logic bit1 to bit6: Output logic of DO1 to DO6 bit7 to bit9: Reserved bit10 to bit15: Output logic of VDO1 to VDO6 bit value: 0: Positive logic 1: Negative logic	Defines RO, DO, and VDO1 to VDO6 (in bit sequence). Description of terminal polarity options: 0: Positive logic - The output levels of RO, DO, and VDO are set to positive logic. That is, when the output function of the selected terminal is active, RO, DO, and VDO generate output. Otherwise, RO, DO, and VDO do not generate output. 1: Negative logic - The output levels of RO, DO, and VDO are set to negative logic. That is, when the output function of the selected terminal is inactive, RO, DO, and VDO generate output. When the output function of the selected terminal is active, RO, DO, and VDO does not generate output.

3. Terminal status connector

The table below shows the current status of each VDO terminal. The VDO terminal status connector is used for the following purpose.

Display current VDO state. The value 0 indicates no output from the VDO terminal. The value 1 indicates that output is generated from the VDO terminal.

You can configure the parameter labeled "Other: B connector" in the drop-down menu as the VDO terminal status connector.

The VDO terminal only supports two states, namely 0 (No output) and 1 (With output), which can be configured through the drop-down menu in parameters with option "Other: B connector", as shown in *" Parameter Interconnection" on page 779*

Table 9–42 VDO terminal status connector

Param.	Name	Default value	Value range	Description
L0044	VDO1	0	0 to 1	Bit connector: Displays the final level state of VDO1.
L0045	VDO2	0	0 to 1	Bit connector: Displays the final level state of VDO2.
L0046	VDO3	0	0 to 1	Bit connector: Displays the final level state of VDO3.
L0047	VDO4	0	0 to 1	Bit connector: Displays the final level state of VDO4.
L0048	VDO5	0	0 to 1	Bit connector: Displays the final level state of VDO5.
L0049	VDO6	0	0 to 1	Bit connector: Displays the final level state of VDO6.

Application instance

When the VDO1 output source (E1-36) is set to 0000 (Output function setting), do as follows if you need VDO1 to output an active signal upon fault.

1. Assign VDO1 with function "Fault output" (E1-10 = 02).
2. Set the output source of VDO1 to "Output function setting" (E1-36 = 0000).

After preceding steps are executed, VDO1 outputs active level upon fault or inactive level when the fault is cleared.

9.11.6 Setting DI Terminal Functions

9.11.6.1 Operation Pause (Terminal Control)

Application scenarios

This function is used to pause the drive without changing the operation command.

Operating principles

Set F0-03 [Main command source of control channel 1] to 1 [Terminal control] to enable the operation pause function in terminal control mode.

As shown in the following figure, the drive responds to the operation command of the DI terminal and starts only when the operation pause function is OFF. If the operation pause function is enabled during operation of the drive, the drive stops as defined by d0-07 [Stop mode during operation]. If the operation command of the DI terminal is still valid after stop, the drive starts automatically as long as the operation pause function is set to OFF.

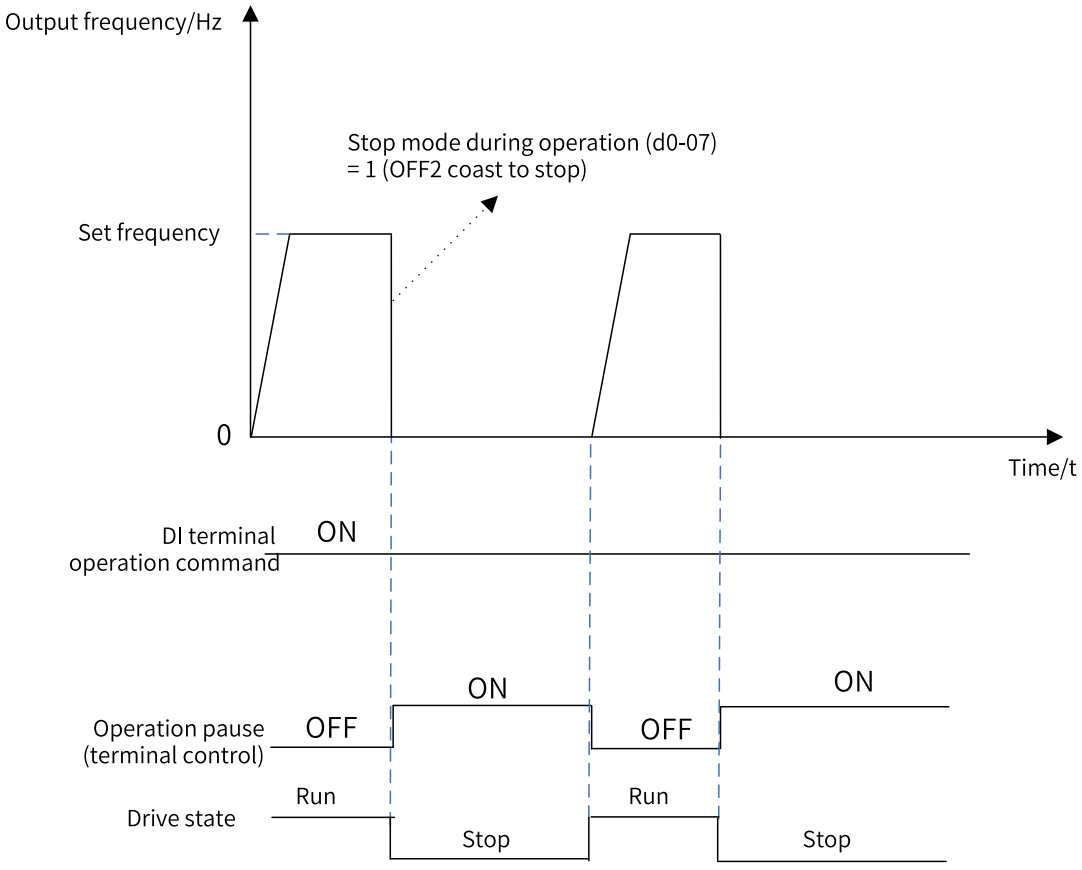


Figure 9-75 Schematic of operation pause (terminal control)

Application instance

The following examples use terminals as the source of operation commands.

1. Set F0-03 [Main command source of control channel 1] to 1 [Terminal control].
2. Set F4-03 [DI1 function selection] to 1 [Terminal start/stop module A_IN1].
3. Set F4-04 [DI2 function selection] to 10 [Operation pause (terminal control)].
4. Set E0-58 [DI active mode selection] to 0x0000 (active high).

After preceding settings are done, the operation commands of the drive can be controlled through DI1, and operation pause can be controlled through DI2. The drive can only start when DI2 opens and DI1 closes.

9.11.6.2 Operation Enable

Application scenarios

This function is used to protect the drive from inadvertent startup through the operation enable terminal.

Operating principles

The operation enable function (terminal control) is the pre-condition for startup of the drive. This function does not limit F0-03 (Main command source of control channel 1), that is, the function can

be used with any operation command source (operating panel, terminal, communication, or user-defined).

As shown in the following figure, the drive responds to the operation command of the DI terminal and starts only when the operation enable function is active and the corresponding DI terminal is valid. If this function is enabled during operation of the drive, the drive stops as defined by d0-07. If the operation command of the DI terminal is still valid after stop, the drive starts automatically as long as the operation enable function is active and the corresponding DI terminal is valid.

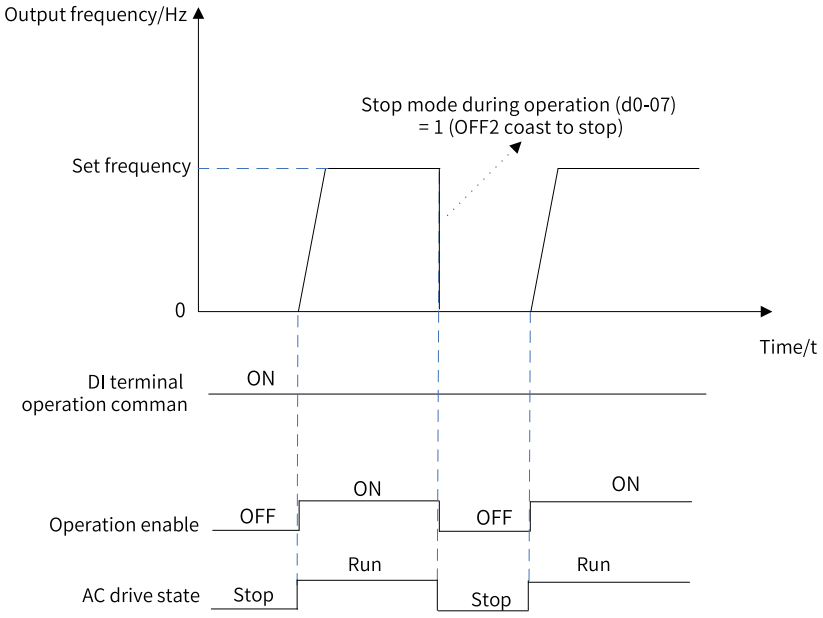


Figure 9-76 Schematic of operation enable (terminal control)

Application instance

The following examples use terminals as the source of operation commands:

1. Set F0-03 [Main command source of control channel 1] to 1 [Terminal control].
2. Set F4-03 [DI1 function selection] to 1 [Terminal A IN1].
3. Set F4-04 [DI2 function selection] to 77 [Operation enable (all modes)].
4. Set E0-58 [DI active mode selection] to 0x0000 (active high).

With the above configuration, the operation commands of the drive can be controlled through DI1, and operation enable can be controlled through DI2. The drive can only start when both DI1 and DI2 are closed.

9.11.6.3 Speed Control/Torque Control Switchover

Application scenarios

This function is used to switch the motor control mode of the drive between speed control and torque control.

Operating principles

There are two DI functions for speed control/torque control switchover, namely "29: torque control inhibition" and "46: speed control/torque control selection".

These two DI functions and F0-02 [Motor control mode] jointly determine the control mode of the drive, as shown in the following figure.

If the DI terminal function "29: Torque control inhibited" is active, the system control mode is forcibly set to speed control and input to the system.

- When this function is active, the torque control mode will be switched to speed control mode forcibly.
- When this terminal is inactive, the motor control mode is not affected.

If the DI terminal function "29: Torque control inhibited" is inactive, the DI terminal function "46: Speed control/Torque control selection" determines whether to switch the motor control mode defined by F0-02 and input the control mode to the system finally.

- When this function is active, the control mode defined by F0-02 is inverted. That is, if F0-02 is set to speed control, the system is automatically switched to torque control. If F0-02 is set to torque control, the system is automatically switched to speed control.
- When this function is inactive, F0-02 defines the current motor control mode of the system.

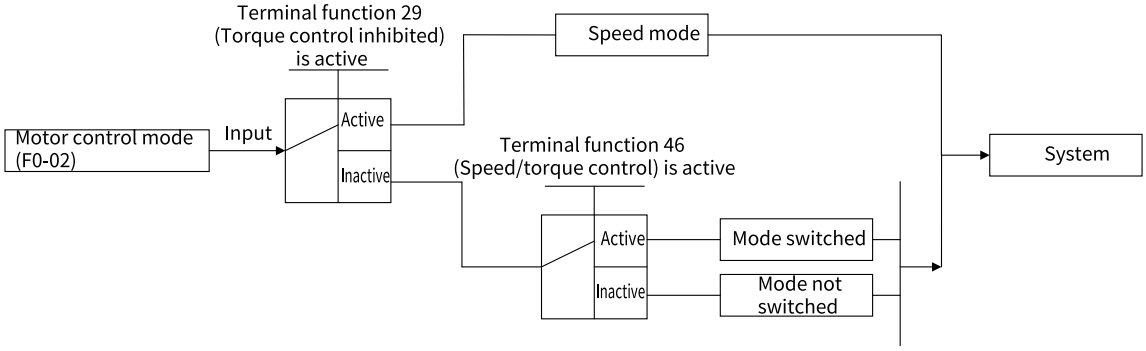


Figure 9-77 Schematic of speed control/torque control switchover

Application instance

1. Set F0-02 [Motor control mode] to 1 [Torque control].
2. Set F4-03 [DI1 function selection] to 29 [Torque control inhibited].
3. Set F4-04 [DI2 terminal selection] to 46 [Speed control/Torque control selection].
4. Set E0-58 [DI active mode selection] to 0x0000 (active high).

After preceding configurations are done, speed control applies if DI1 is closed or if DI1 is open and DI2 is closed; torque control applies when both DI1 and DI2 are open.

9.11.6.4 Immediate DC Braking

Application scenarios

This function is used to immediately brake the motor in emergencies to ensure that the rotor stops securely.

Function description

When the DI assigned with "Immediate DC braking" is active, the drive outputs the current defined by d0-30 [DC braking current at stop] and immediately brakes the motor. In this case, the motor is in a dynamic braking state. When the DI is inactive, the DC braking state is exited and the motor can operate normally.

Operating principles

When the motor operates normally, activating DI assigned with "Immediate DC braking" makes the drive output the current defined by d0-30, which immediately brakes the motor to a stop. If this DI remains active, the drive continuously outputs the current defined by d0-30 to the motor, keeping the motor braked. If the DI is deactivated during operation, the motor exits the braking state and starts normally.

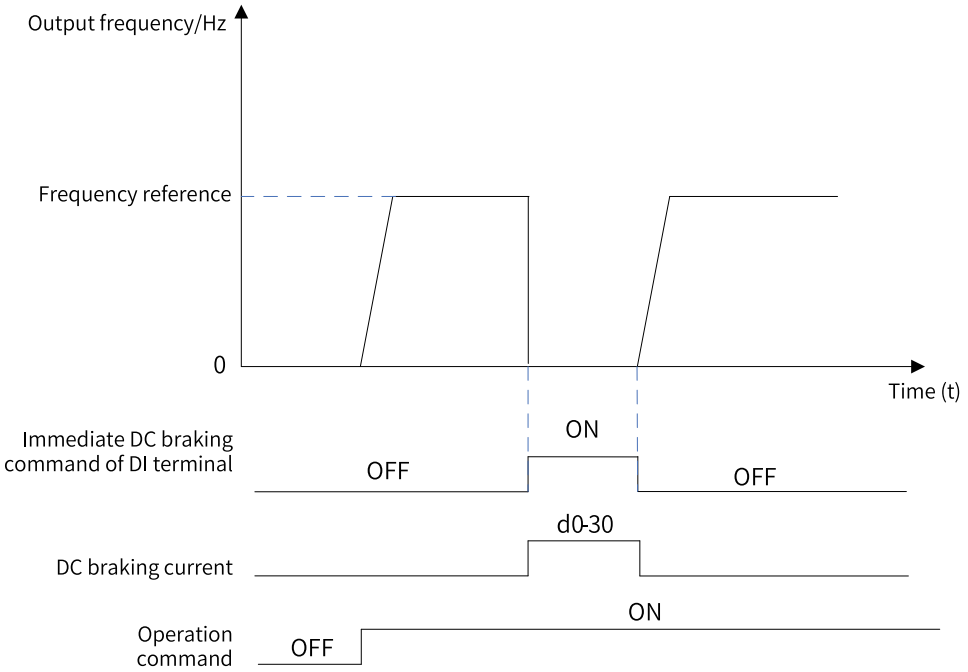


Figure 9-78 Schematic of immediate DC braking

Application instance

1. Set F4-03 [DI1 function selection] to "32: Immediate DC braking".
2. Set d0-30 [DC braking current at stop] to 50%.
3. Set E0-58 [DI active mode selection] to 0x0000 (active high).

After preceding settings are done, if DI1 closes, the drive outputs the current defined by d0-30 and immediately brakes the motor to ensure that the rotor stops securely.

9.11.6.5 Decelerate To DC Braking

Application scenarios

This function is used to decelerate the motor to a certain frequency before applying DC braking to ensure that the rotor stops securely.

Function description

When the DI assigned with "Decelerate to DC braking" is active, the drive decelerates to the frequency set by d0-27 [Starting frequency of DC braking at stop], outputs the current defined by d0-30 [DC braking current at stop], and finally brakes the motor. In this case, the motor is in dynamic braking state. When the DI is inactive, the DC braking state is exited and the motor can operate normally.

Operating principles

When the motor operates normally, activating the DI assigned with "Decelerate to DC braking" makes the drive decelerate to the frequency set by d0-27, output the current set by d0-30, and immediately brake the motor to a stop. If this DI remains active, the drive continuously outputs the current defined by d0-30 to the motor, keeping the motor braked. If the DI is deactivated during operation, the motor exits the braking state and starts normally.

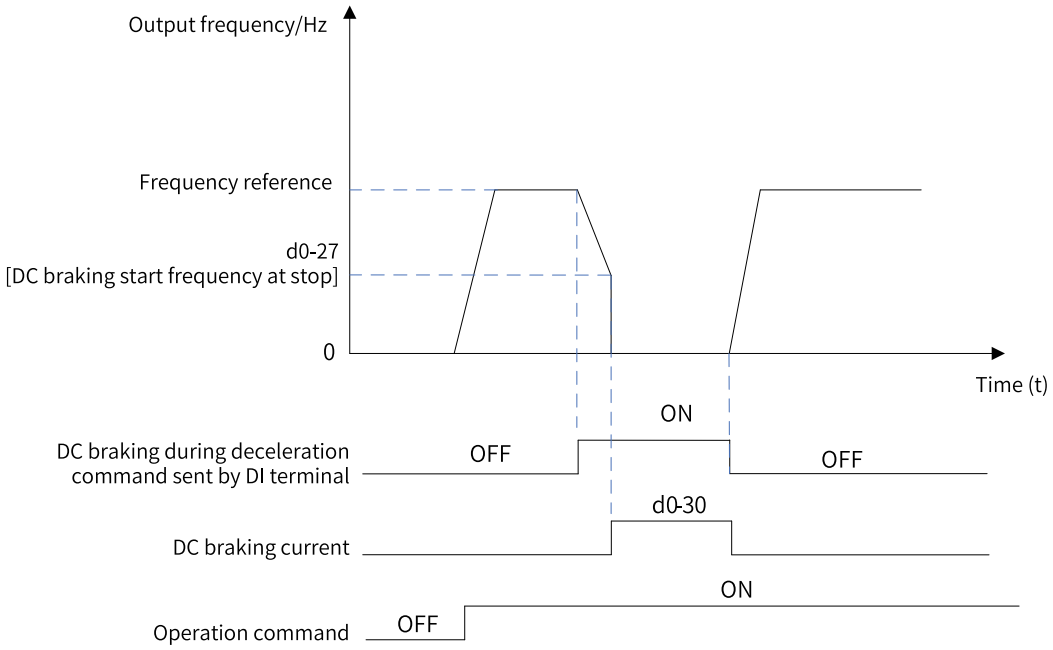


Figure 9-79 Schematic diagram of decelerating to DC braking

Application instance

1. Set F4-03 [DI1 function selection] to 49 [Decelerate to DC braking].
2. Set d0-30 [DC braking current at stop] to 50%.
3. Set d0-27 [Starting frequency of DC braking at stop] to 10 Hz.
4. Set E0-58 [DI active mode selection] to 0x0000 (active high).

After preceding settings are done, if DI1 closes, the drive decelerates to 10 Hz, outputs the current set by d0-30, and finally brakes the motor to ensure that the rotor stops securely.

9.11.7 Setting DO Terminal Functions

9.11.7.1 Motor Overload Pre-alarm

Application scenarios

This function is used to monitor the motor overload state during operation and output the state through the DO terminal.

Function description

Before motor overload protection, the drive determines whether the motor load exceeds the overload pre-alarm threshold set by d1-47. If the threshold is exceeded, the DO terminal outputs an active signal.

Operating principles

The motor overload pre-alarm function is active when d1-47 is set to a value lower than 100%. When the output current of the AC drive exceeds the motor's rated current, the motor overload cumulative value (L3210) starts to accumulate. When L3210 reaches the threshold set by d1-47, the motor pre-overload alarm (A111.1) is reported and the DO terminal outputs an active signal. The motor overload fault (E11-1) is reported when L3210 accumulates to 100%.

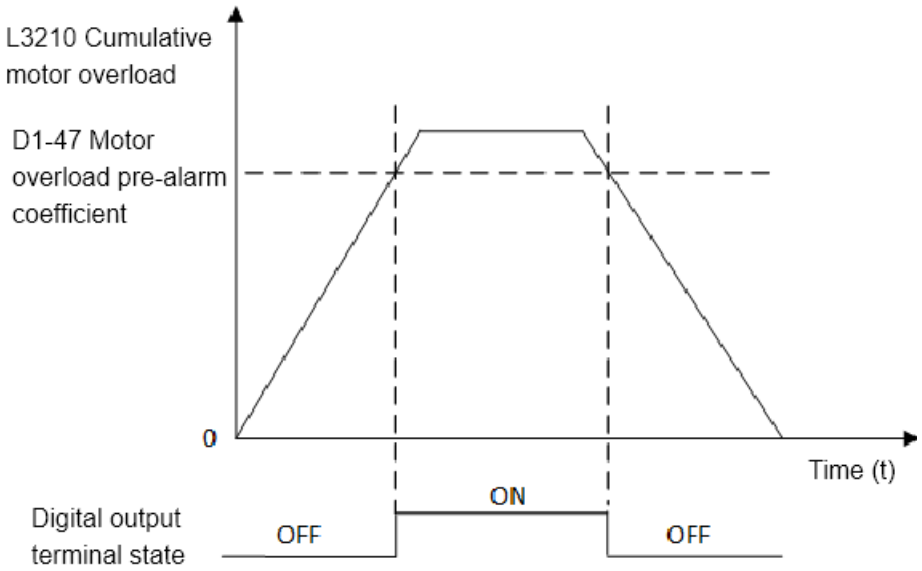


Figure 9-80 Motor overload pre-alarm

The relationship between overload current and fault indication time is shown in the following figure.

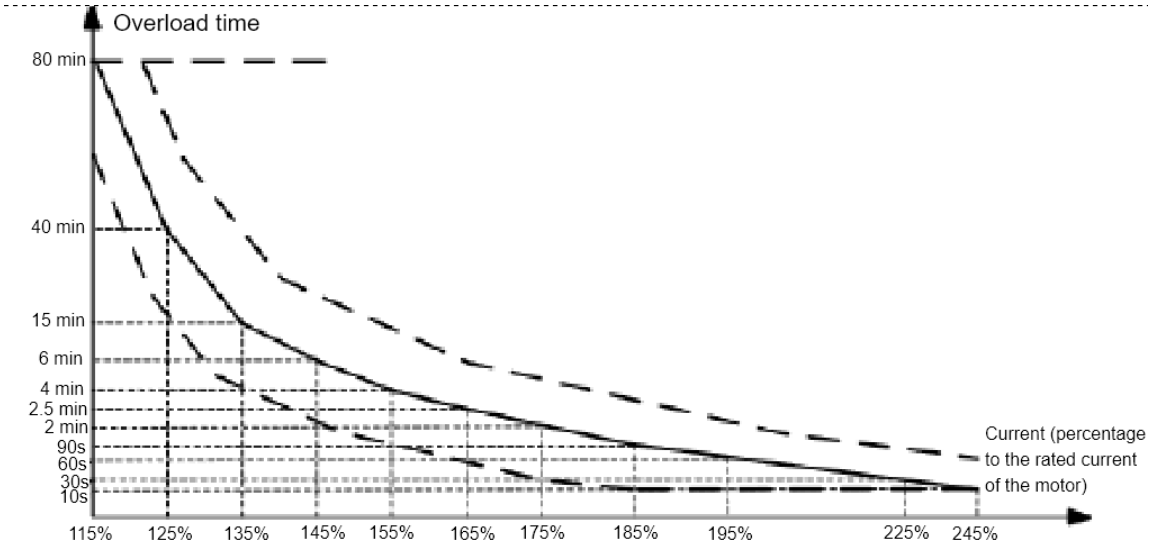


Figure 9-81 Motor overload curve

Application instance

1. Set d1-45 to 1 to enable motor overload protection and set the motor overload pre-alarm coefficient (d1-47) to less than 100%.
2. Set E1-00 (RO output function selection) to 6 (motor overload pre-alarm).

With the above configuration, the RO terminal outputs an active signal when the system detects that the motor is in the pre-overload state.

9.11.7.2 Drive Overload Pre-alarm

Application scenarios

This function is used to monitor the overload state of the drive during operation and output the state through the DO terminal.

Function description

Before drive overload protection, the system determines whether the drive load exceeds the pre-overload threshold defined by A3-53. If the threshold is exceeded, the DO terminal outputs an active signal.

Operating principles

The drive overload pre-alarm function is active when A3-53 is set to a value lower than 100%. When the output current of the drive exceeds the rated current, the overload value starts to cumulate, and when it reaches the pre-overload threshold (A3-53), a pre-overload alarm (A110.1) is reported, with the DO terminal outputs an active signal. The drive overload fault (E10-1) is reported when the cumulative drive overload value reaches 100%.

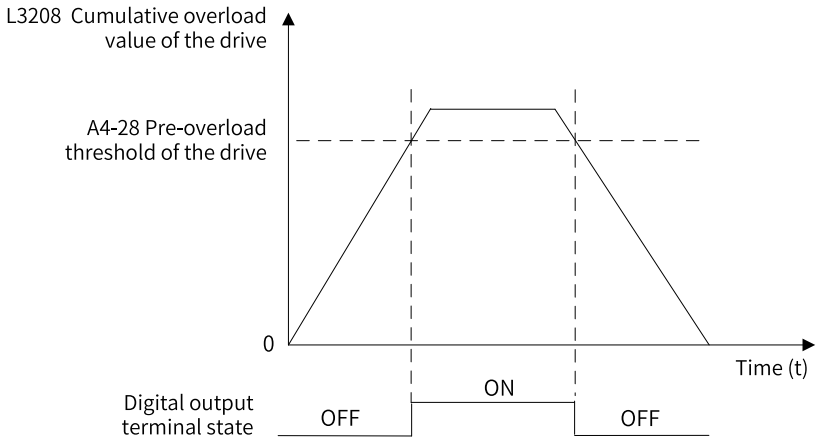


Figure 9-82 Drive overload pre-alarm

Application instance

1. Set the drive pre-overload threshold (A3-53) to a value lower than 100%.
2. Set E1-00 [RO output function selection] to 7 "Drive overload pre-alarm".

After preceding settings are done, the RO terminal outputs an active signal when the system detects that the drive is in the pre-overload state.

9.11.7.3 Torque Limited

Application scenarios

This function is used to limit the output torque in the speed control mode and output the state through the DO terminal.

Function description

The torque limit function is active in vector control (FVC or SVC) mode. To switch to SVC mode, set F0-01 [Motor control method] to 0 [SVC]. When F0-02 [Motor control mode] is set to 0 [Speed control] and the DO terminal is set to "14: Torque limited", the system is in the torque limit state and the corresponding DO terminal outputs an active signal.

Operating principles

This section takes motor forward operation as an example to demonstrate DO function 14 (torque limited).

As shown in the following figure, the DO terminal assigned with function "14: Torque limited" is active only when the following conditions are met.

1. The torque limit flag is valid.
2. The flag indicating deviation of the motor operation speed is valid.

For the first condition to be met, the motor object output torque (L3260) must exceed the limit threshold of the maximum positive torque (L3112) for a certain duration to enable system detection and assessment. If L3260 is lower than the limit threshold defined by L3112, the torque limit flag is invalid.

For the second condition to be met, a deviation must exist between the current motor speed and the target operating frequency of the system. If both conditions are met, the system determines that drive is in the torque limited state.

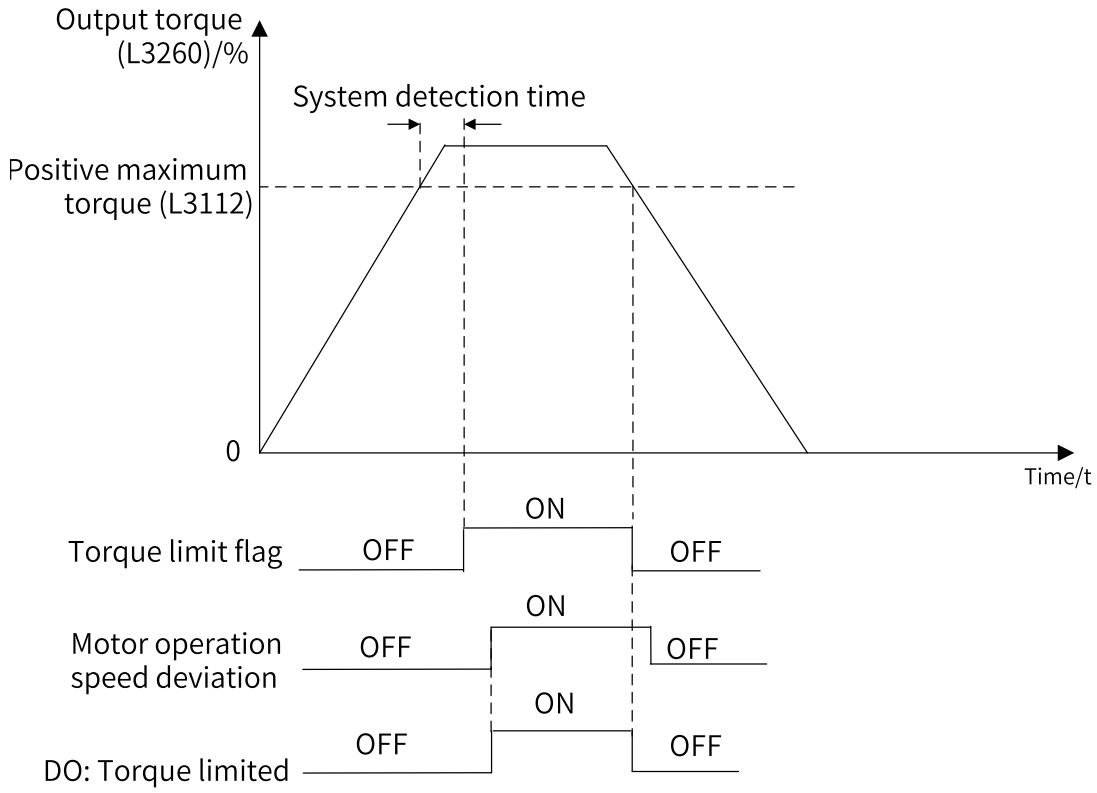


Figure 9-83 Operation principles

Application instance

1. Set d1-09 [Digital reference of torque upper limit 1], d1-11 [Torque upper limit 2], d1-10 [Digital reference of torque lower limit 1], and d1-12 [Torque lower limit 2].
2. Set E1-00 [RO output function selection] to 14 "Torque limited".

After above settings are done, the RO terminal outputs an active signal when the system detects that the drive is in the torque limited state.

9.11.7.4 Undervoltage State Output

Application scenarios

Undervoltage can easily occur under conditions such as voltage dip and low grid voltage. This function is used to monitor the motor bus voltage under such conditions and output the state through the DO terminal.

Function description

The drive determines whether the system is in an undervoltage state by monitoring the bus voltage. If undervoltage occurs, the DO terminal outputs an active signal.

Operating principles

When the bus voltage is lower than the unervoltage threshold (A3-56) due to voltage dip or low grid voltage, the unervoltage fault (E9-1) is reported and the DO terminal outputs an active signal.

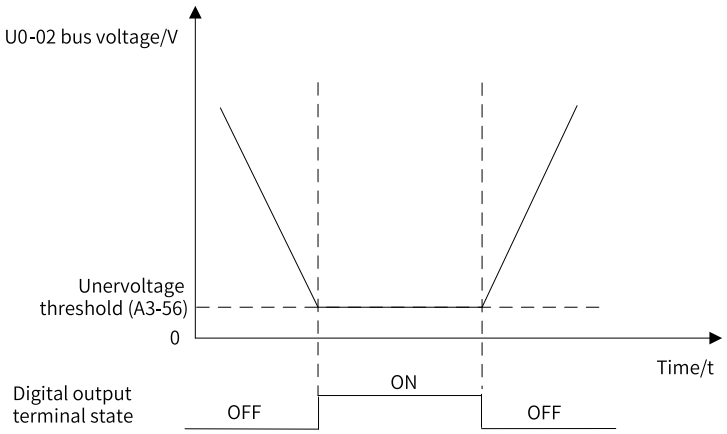


Figure 9-84 Undervoltage state output

Application instance

1. Set E1-00 (RO output function selection) to "19: Undervoltage state output".

With the above configuration, the RO terminal outputs an active signal when the system detects that the drive is in the undervoltage state.

9.11.7.5 Communication

Application scenarios

This function is used to control the DO terminal output through remote communication.

Function description

When the DO terminal function is set to 20 (communication setting), the system sends a specific value to address 0x2001 or 0x7312, and the corresponding DO terminal outputs an active signal.

Operating principles

For the digital output terminals RO, DO, and VDO1 to VDO6, if the function "20: Communication setting" is selected, the address 0x2001 or 0x7312 is used.

The address contains 16-bit data, with each terminal assigned according to the bit position. The terminal outputs an active signal when the value 1 is written to the corresponding bit of 0x2001 or 0x7312. The terminal does not output an active signal when the value 0 is written.

The data written can be viewed in U3-18.

Table 9–43 Bit positions of digital output terminals (communication setting)

Name	Bit position at address 0x2001 or 0x7312
RO status	bit0
DO1 status	bit1

Name	Bit position at address 0x2001 or 0x7312
DO2 status	bit2
DO3 status	bit3
DO4 status	bit4
DO5 status	bit5
DO6 status	bit6
Reserved	bit7
Reserved	bit8
Reserved	bit9
VDO1 state	bit10
VDO2 state	bit11
VDO3 state	bit12
VDO4 state	bit13
VDO5 state	bit14
VDO6 state	bit15

Application instance

The following shows the setting of DO output through communication.

1. Set E1-04 [DO output function selection] to 20 [communication setting].
2. According to *"Table 9-43 Bit positions of digital output terminals (communication setting)" on page 482*, the DO corresponds to bit4 at address 0x7312.
3. Confirm that the data to be sent is 0x0010 (bit4 is 1 and the remaining bits are 0).
4. Send 0x0010 to address 0x7312 to trigger the DO to output an active signal.

9.11.7.6 Three-Phase Loss

Application scenarios

This function is used to monitor the phase loss state of the drive during operation and output the state through the DO terminal.

Function description

When the three-phase output current is excessively low, the drive is in the phase loss state and the DO terminal outputs an active signal.

Operating principles

When three-phase loss protection is enabled (d1-78 = 1), if the three-phase output current keeps lower than the three-phase loss detection threshold (d1-82) for a period defined by d1-81, E30-1 (Three-phase loss fault) is reported and the DO terminal outputs an active signal.

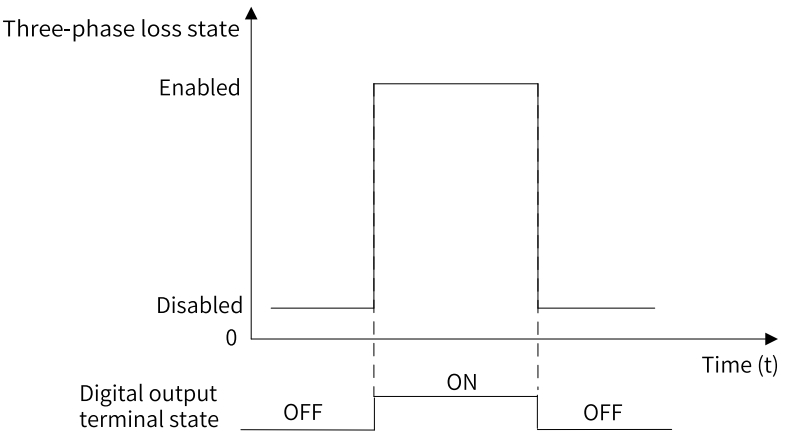


Figure 9-85 Three-phase loss

Application instance

1. Set E1-00 [RO output function selection] to "32: Three-phase loss".
2. Set d1-78 to 1 to enable three-phase loss protection.

With the preceding configuration, the RO terminal outputs an active signal when the system detects that the drive is in the three-phase loss state.

9.11.7.7 Heatsink Temperature Arrival

Application scenarios

This function is used to monitor whether the heatsink temperature of the drive reaches the threshold through the control terminal.

Function description

When the system detects that the heatsink temperature of the drive reaches the threshold, the DO assigned with function "35: Drive temperature arrival" outputs an active signal.

Operating principles

As shown in the following figure, when U0-82 [Heatsink temperature] exceeds P0-33 [Heatsink temperature arrival], the DO assigned with function "35: Drive temperature arrival" outputs an active signal.

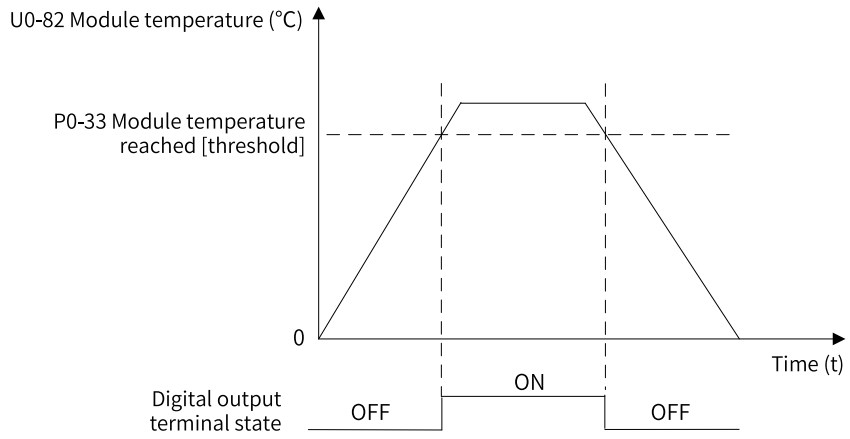


Figure 9-86 Heatsink temperature arrival

Application instance

The following takes the RO assigned with function "35: Heatsink temperature arrival" as an example.

1. Set P0-33 [Heatsink temperature arrival] to 60°C.
2. Set E1-00 [RO output function selection] to "35: Heatsink temperature arrival".
3. With above configuration, the RO outputs an active signal when U0-82 [Heatsink temperature] exceeds 60°C.

9.12 Motor Temperature Sensor

Function description

(1) The drive supports motor temperature measurement. The motor temperature sensor hardware terminals locate at the TF+/TF- of CN9 on the terminal board. Five types of motor temperature sensors are supported: PT100, PT1000, KTY84, PTC130-single core, and PTC130-three core.

(2) E2-73 defines the motor temperature sensor type, and U0-90 displays the actual motor temperature value.

(3) When the motor temperature (U0-90) exceeds the overtemperature protection threshold (E2-76), the motor overtemperature fault E045.1 is reported.

Related parameters

Param.	Name	Default value	Value range	Description
E2-73	Motor temperature sensor type	0	0: Inactive 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (single-core) 5: PTC130 (three-core)	Used to select the motor temperature sensor, which can be PT100, PT1000, KTY84-139, or PTC130.
E0-76	Motor overtemperature protection threshold	110℃	0℃ to E2-75	Defines the motor overtemperature protection threshold.
U0-90	Motor temperature	0 ℃	-50 ℃ to +300℃	Monitors the actual motor temperature.

10 Motor Control

10.1 Vector Control

10.1.1 SVC Control

Application scenarios

Vector control typically requires an encoder to acquire motor speed and position, while sensorless vector control (SVC) can achieve the excellent performance of vector control without encoder feedback. To do so, set the control mode [d0-00] to 0 [SVC control].

Both SVC and V/f control require no encoder signal feedback. The main differences are as follows.

- [d0-00] is set to 0 [SVC control]. SVC control refers to speed and torque closed-loop control, which features excellent dynamic performance and steady-state accuracy, but it is sensitive to parameters and requires motor parameter auto-tuning before operation.
- [d0-00] is set to 2 [V/f control]. V/f control is a type of open-loop control that insensitive to parameters, which is easy to use but has lower dynamic performance and speed accuracy than SVC mode. The torque cannot be controlled in v/f control of the asynchronous motor, so settings related to the torque limit are inactive.

Operating principles

The control block diagram for SVC mode is shown below, which includes sampling/pulsing, loop control, and model observation.

- Sampling/Pulsing: Signal sampling and modulation signal generation
- Loop control: Field weakening controller, flux controller, speed controller, torque controller, and current controller
- Model observation: Observer

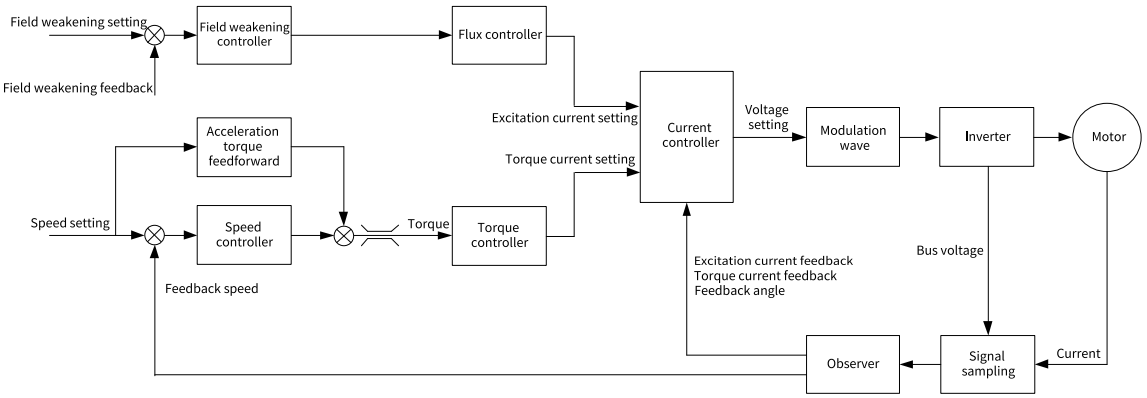


Figure 10-1 Control block diagram of SVC mode

In SVC mode, the feedback speed and angle needed in vector control are estimated through the motor model and output current by the observer module.

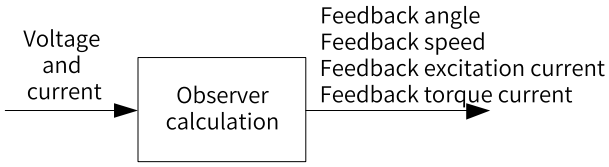


Figure 10-2 Diagram of the observer module

Related parameters

Param.	Name	Description	Default value	Range
d0-00	Motor control method	Defines the motor control mode based on the application scenario and motor type. Value description: 0: SVC - Indicates sensorless vector control. This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and requires motor parameter auto-tuning before operation. 2: V/f - Open-loop control with constant voltage-to-frequency ratio. This mode is less dependent on parameters and easy to use, but the dynamic performance of this mode is not as good as the SVC mode.	0	0 to 2

Application

In SVC mode, the speed and position are estimated based on the motor voltage, current, and motor parameters. Therefore, complete motor parameters are required for SVC mode. It is recommended to perform dynamic auto-tuning before operation. Failure to perform dynamic no-load auto-tuning may result in oscillation or overcurrent due to inaccurate motor parameters.

- Stator resistance, rotor resistance, leakage inductance, mutual inductance, and dead zone auto-tuning curve of the drive need to be auto-tuned for asynchronous motors.
- Stator resistance, d-axis inductance, q-axis inductance, rated back EMF, and dead zone auto-tuning curve of the drive need to be auto-tuned for synchronous motors.

Speed open-loop (I/F) control: (supported only by synchronous motors)

During low-speed operation, the motor speed and angle cannot be accurately calculated, affecting the control accuracy and even result in observation failure and unstable operation. You can enable low-speed open loop I/F control for long-term operation at zero speed or low speed. Low-speed I/F control, also known as current/frequency control, is a speed open-loop control with limited control accuracy and dynamic performance compared to speed closed-loop mode.

I/F control related parameters:

Param.	Name	Description	Default value	Range
d0-85	Low-speed processing method	Used to enable open loop at low speed. In SVC mode, setting the tens of d0-85 to 1 enables open loop control.	101	0 to 121
d0-86	Speed open loop current	Defines the speed open loop current. Set this parameter to a value higher than 20% of the load.	100%	0% to 800%

Param.	Name	Description	Default value	Range
d0-87	Speed open loop switchover frequency	Defines the speed open loop switchover frequency as a percentage to the rated frequency. If the percentage of the operating frequency to the rated frequency is lower than d0-87, speed open loop control applies. The default value is 10% of the rated frequency based on the low-speed operation range in speed open loop mode.	10.0%	0.0% to 100.0%
d0-88	Speed open loop switchover hysteresis frequency	Defines the speed open loop switchover hysteresis, which is a percentage to the rated frequency. When the operating frequency as a percentage to the rated frequency exceeds "d0-87 + d0-88" , SVC mode applies. Set the hysteresis range according to actual requirements. The default value is 2.5% of the rated frequency.	2.5%	0.0% to 100.0%

When the speed open loop I/F function is enabled, speed open loop control applies when the motor operates at low speed. In this case, the drive outputs the current defined by d0-86. The SVC control applies during operation at high speed. A hysteresis range exists during switchover between the speed open loop I/F control and SVC mode. The switchover process is shown in the following figure.

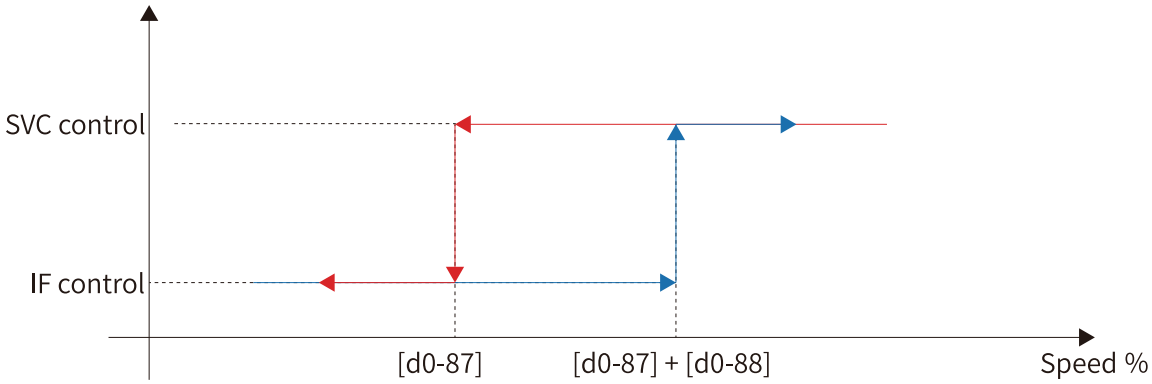


Figure 10-3 Switching between IF control and SVC mode

Application instance

A film winding/unwinding machine runs without an encoder. During tension set-up, the drive that controls unwinding must keep the unwinding device running at zero speed. When SVC mode is used, long-term stable operation at zero speed is not available. In this case, you need to set the speed open loop I/F function as follows.

1. Set [d0-86] to 1 to enable speed open loop function.
2. The torque corresponding to the tension is about 50% during normal operation. Therefore, set d0-86 to 70%.
3. During normal acceleration/deceleration, you can set the switchover frequency to a low value (d0-87 = 2%, d0-88 = 2%) to achieve quick speed response and high control accuracy.

10.1.2 Speed Control

10.1.2.1 Speed Control

Application scenarios

Most of the applications require the motor speed to be controlled. In vector control, the speed can be controlled accurately.

Operating principles

The following figure shows the typical speed control diagram. The speed reference is outputted to the motor only after being processed with the speed limit, ramp function generator (RFG), speed controller, additional torque, torque limit, and current controller (ACR).

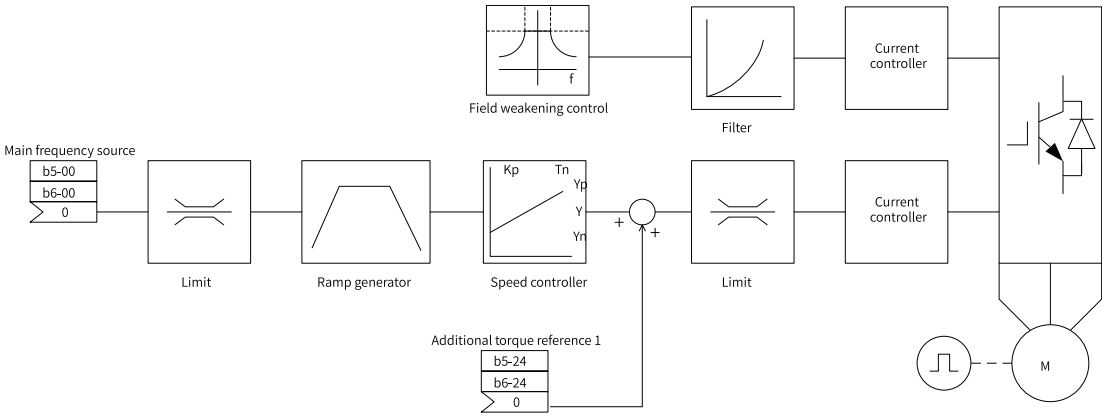


Figure 10-4 Typical block diagram of speed control

In speed control mode, the speed setpoint is generated as shown in the figure below. After the main frequency source is superimposed with the auxiliary frequency source, it is processed by the ramp function generator (RFG), then superimposed with an additional frequency, and finally generate the motor speed reference (L3002).

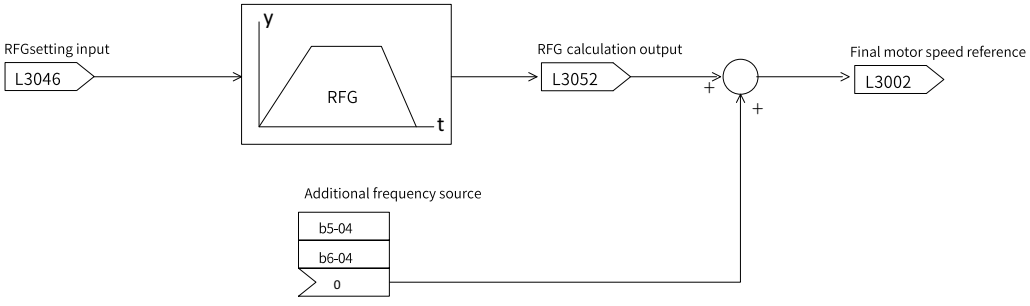


Figure 10-5 Speed reference block diagram

Related parameters

Param.	Name	Description	Default value	Range
F0-01/d0-01	Motor control mode	Defines the motor control target. Value description: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 12: DI1 to DI10 - Depends on the final state of DI (0: Speed control; 1: Torque control). Other: B connector - Depends on the status of B connector (0: Speed control; 1: Torque control). Note: The torque control mode is inactive in V/f mode.	0	0 to 7

10.1.2.2 Speed Controller (Speed Loop)

Application scenarios

In vector control, speed control can be implemented through the speed controller.

Operating principles

The speed controller obtains the speed reference (L3002) from the reference channel, receives the feedback speed value (L3000) in the feedback channel, and then generates the torque reference (L3100) from the deviation of the reference and feedback through the PI controller, and sends it to the current controller. The function diagram of the speed controller is as follows.

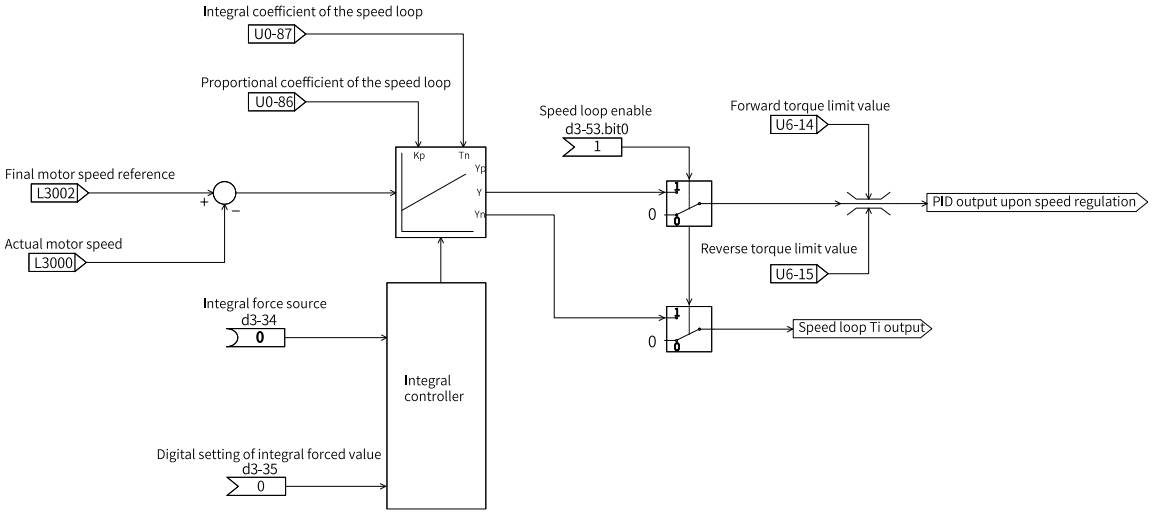


Figure 10-6 Function diagram of the speed controller

In SVC control, the speed controller can be adjusted by d3-02 [Speed loop Kp in SVC mode] and d3-03 (Speed loop Ti in SVC mode). The relationship between the speed controller output and Kp and Ti is shown in the following table.

$$Out = k_P \Delta f + \int \frac{k_P}{T_i} \Delta f dt$$

The torque reference is shown in the following figure. For speed deviation of Δf, the torque reference output of the proportional term is KpΔf. After Ti elapses, the torque reference output of the integral term is KpΔf.

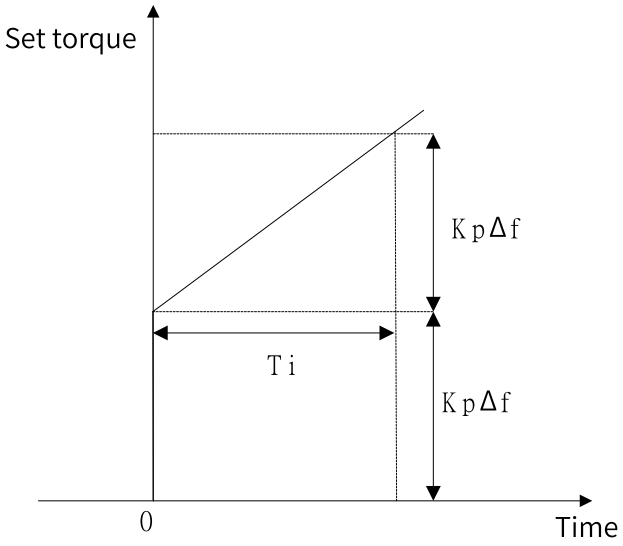


Figure 10-7 Torque reference diagram

The parameters Kp and Ti of the speed loop PI regulator can be optimized through the following auto-tuning methods.

- C2-00 = 2 (No-load dynamic auto-tuning of asynchronous motor)
- C2-00 = 12 (No-load dynamic auto-tuning of synchronous motor)

If the auto-tuned values cannot deliver expected performance, you can manually optimize the controller parameters. The effect of Kp and Ti on the controller is as follows.

- When Kp is low, the feedback speed overshoot is high. Increasing Kp can quicken the adjustment process and reduce overshoot. Note that an excessively high Kp can result in oscillation of the output torque and feedback speed.
- Decreasing Ti can quicken the adjustment process. Note that an excessively low Ti can result in oscillation of the output torque and feedback speed.

The speed loop regulator may need special processing when it is used with the PLC to set the integral parameters.

Forced integral of speed loop: Controlled by d3-33. d3-34 defines the forced integral value, and the integral output value will be set to the value defined by d3-34 forcibly after forced integral is enabled.

Related parameters

Param.	Name	Description	Default value	Range
F2-02/d3-02	Speed loop Kp in SVC mode	Defines the speed loop proportional gain in SVC mode. Note: The higher the Kp value, the higher the speed loop stiffness, and the better the speed following performance can be. Note that an excessively high Kp value can easily result in oscillation.	5.0	0.0 to 6000.0
F2-03/d3-03	Speed loop Ti in SVC mode	Defines the speed loop integral time in the SVC mode. Note: The lower the Ti value, the higher the speed loop stiffness, and the better the speed following performance can be. Note that an excessively low Ti value can easily result in oscillation.	0.127s	0.000s to 20.000s
d3-33	Forced integral enable	Defines whether to set the integral value forcibly. Value description: 0: Inactive 1: Enable - When this function is enabled, the integral term output of the speed loop is determined by d3-34 [Source of forced integral] and d3-35 [Digital reference of forced integral]. Other: B connector - Whether to enable forced integral of speed loop depends on the value of the B connector.	0	0 to 1

Param.	Name	Description	Default value	Range
d3-34	Forced integral source	Defines the source of forced integral value. Value description: 0: d3-35 6: Multi-reference - When multi-reference is used as the forward torque limit source, combinations of different DI states correspond to different forward torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The forced integral value is set through PID. PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The forced integral value is set through communication. The positive frequency upper limit can be input through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - Set a parameter number for the floating-point connector, and the value of the connector is used as the source. It is used for extension of common sources.	0	0 to 9
d3-35	Digital reference of forced integral	Defines the forced integral value of the speed loop. Note: When d3-33 [Forced integral enable] is enabled and d3-34 [Forced integral source] is set to "0: Digital reference", the output of the speed loop integral term is the setpoint of this parameter.	0.0%	-800.0 % to +800.0 %

10.1.2.3 Speed Controller Adapter

Application scenarios

The speed controller adapter automatically adjusts the speed loop parameters to suppress overshoot or oscillation of the speed controller.

Operating principles

The adapter includes speed adaption and adaptive adaption.

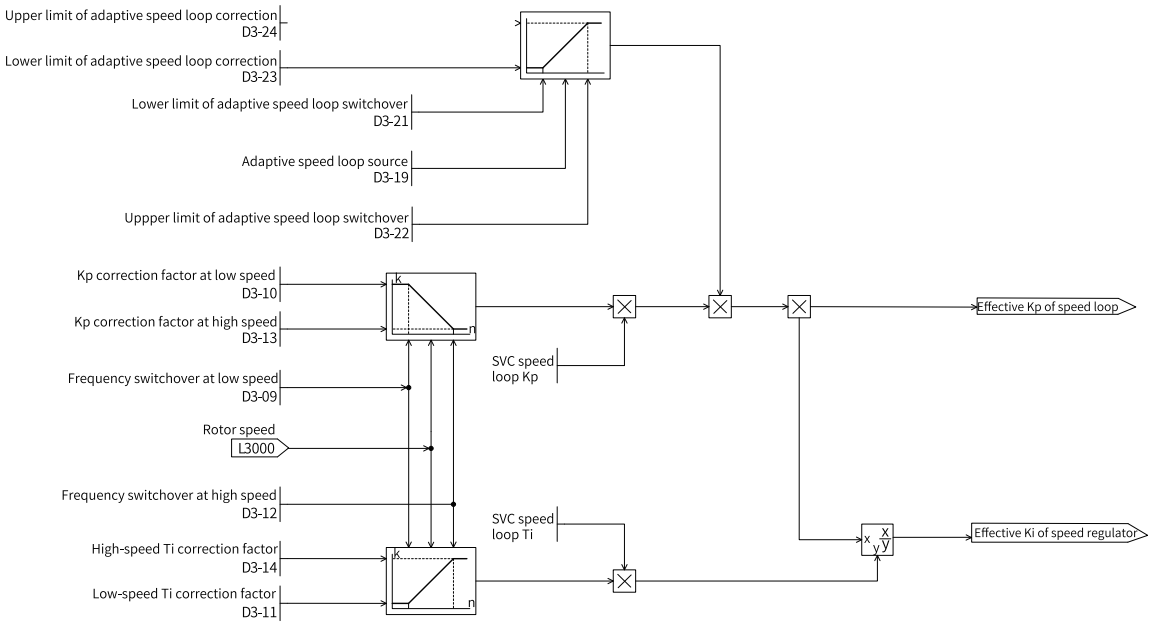


Figure 10-8 Speed controller adapter

When U0-01 [Frequency reference] is lower than d3-06 [Zero speed switchover frequency], the "zero speed adaptation" rule is applied to adjust the speed loop.

When U0-01 [Frequency reference] is higher than d3-06 [Zero speed switchover frequency], the "low speed - high speed adaptation" rule is applied to adjust the speed loop.

Zero speed adaption: The speed loop is adjusted based on the frequency reference at 0 rpm based on the following rules.

- The active speed loop parameters "U0-86 [Active proportional coefficient of speed loop] and U0-87 [Active integral coefficient of speed loop]" are adjusted based on the original speed loop parameters "d3-02 [Speed loop Kp in SVC] and d3-03 [Speed loop Ti in SVC]" using the corresponding correction coefficients "d3-07 [Zero speed Kp calibration coefficient] and d3-08 [Zero speed Ti calibration coefficient]."

Low speed - High speed adaption: The speed loop is adjusted based on the feedback speed. During operation at high speed, current control capacity is weakened, resulting in decrease of the speed loop bandwidth. In this case, adjust the active Kp and Ti parameters in real time based on the feedback speed. The adjustment rules are as follows.

- When L3000 [Actual motor speed] is lower than d3-09 [Low-speed switchover frequency], the active speed loop parameters "U0-86 [Active proportional coefficient of speed loop] and U0-87 [Active integral coefficient of speed loop]" are adjusted based on the original speed loop parameters "d3-02 [Speed loop Kp in SVC] and d3-03 [Speed loop Ti in SVC]" using the corresponding correction coefficients "d3-10 [Low speed Kp calibration coefficient] and d3-11 [Low speed Ti calibration coefficient]."
- When L3000 [Actual motor speed] is higher than d3-12 [High-speed switchover frequency], the active speed loop parameters "U0-86 [Active proportional coefficient of speed loop] and U0-87 [Active integral coefficient of speed loop]" are adjusted based on the original speed loop parameters "d3-02 [Speed loop Kp in SVC] and d3-03 [Speed loop Ti in SVC]" using the

corresponding correction coefficients "d3-13 [High speed Kp calibration coefficient] and d3-14 [High speed Ti calibration coefficient]."

- The speed loop calibration coefficient changes linearly when L3000 [Actual motor speed] is between low speed and high speed.

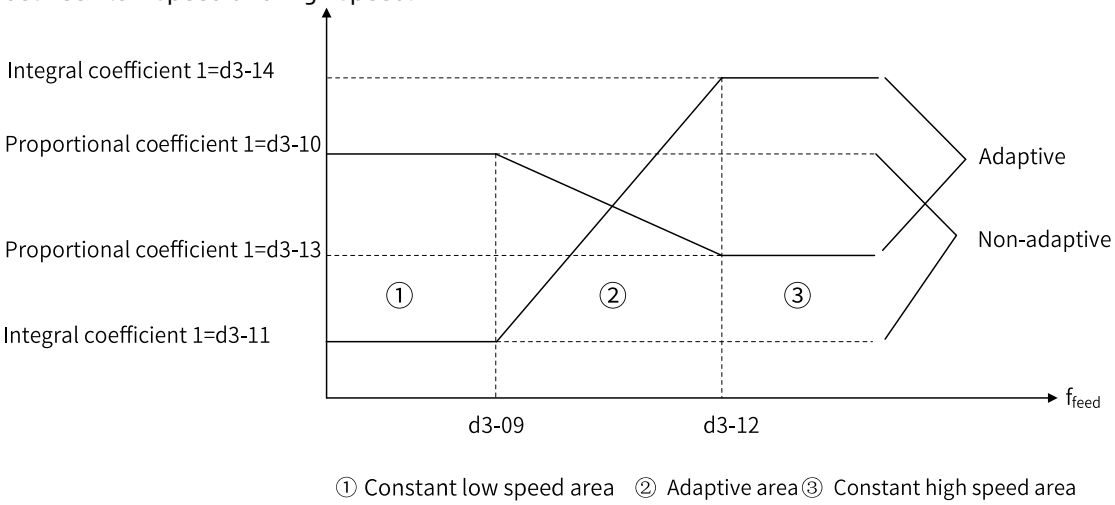


Figure 10-9 Speed adapter

Adaptive adaption: The operating principle of speed adapter is the same as that of speed adaptation, but the adjustment reference value range for adaptive adaption is wider. For example, if the speed loop controller needs to be modified when the roll diameter changes during winding and unwinding, the roll diameter can be used as the adjustment reference. The adaptive adapter outputs an adjustment coefficient, which acts on Kp of the speed adaptation output.

The adjustment rules for adaptive adaption are as follows.

- When d3-19 [Speed loop Kp adaptive source] is lower than d3-21 [Lower limit of speed loop adaptive switchover], the speed loop Kp term is calibrated using d3-23 [Lower limit of speed loop adaptive calibration].
- When it is higher than d3-22 [Upper limit of speed loop adaptive switchover], the speed loop Kp term is calibrated using d3-24 [Upper limit of speed loop adaptive calibration].
- When source value is between d3-21 and d3-22, the Kp calibration coefficient varies linearly between d3-23 and d3-24.

The adaptive calibration coefficient is calculated as follows.

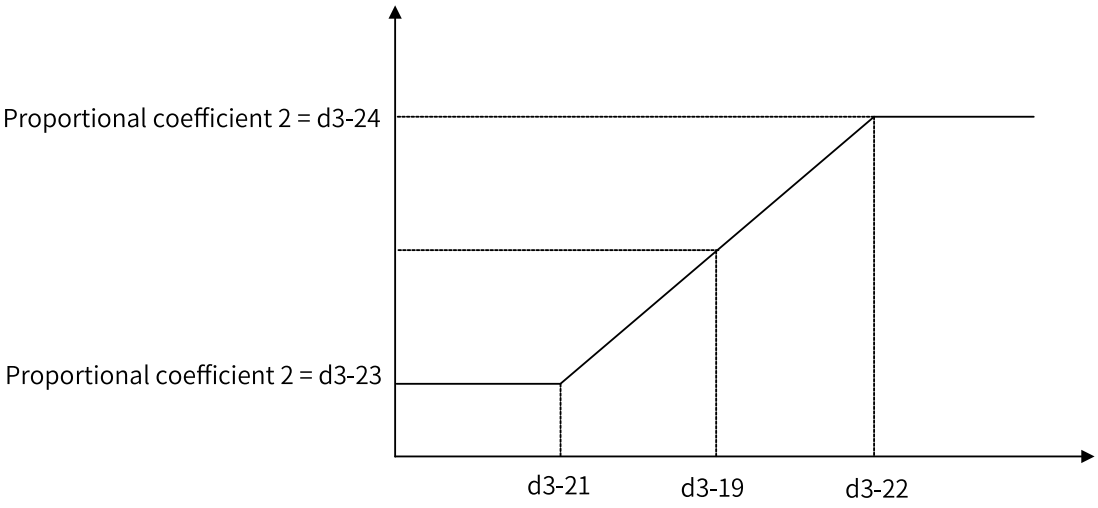


Figure 10-10 Adaptive adapter

The final active Kp and Ti are calculated as follows:

Final effective K_p value = d3-02 x Proportional coefficient 1 (speed adapter) x Proportional coefficient 2 (adaptive adapter)

Final effective T_i value = d3-03 x Integral coefficient 1 (speed adapter)

Related parameters

Param.	Name	Description	Default value	Range
F2-04/d3-06	Zero speed switchover frequency	Defines the zero speed switchover frequency of the speed loop.	1.0%	0.0% to d3-09
F2-05/d3-07	Zero speed Kp calibration coefficient	Defines the proportional calibration coefficient of the speed loop at zero speed.	100.0%	0.0% to 1000.0%
F2-06/d3-08	Zero speed Ti calibration factor	Defines the integral calibration factor of the speed loop at zero speed.	100.0%	0.0% to 1000.0%
F2-07/d3-09	Low speed switchover frequency	Defines the low speed switchover frequency of the speed loop.	10.0%	0.0% to d3-12
F2-08/d3-10	Low speed Kp calibration factor	Defines the proportional calibration factor of the speed loop at low speed.	100.0%	0.0% to 1000.0%
F2-09/d3-11	Low speed Ti calibration factor	Defines the integral calibration factor of the speed loop at low speed.	100.0%	0.0% to 1000.0%
F2-10/d3-12	High speed switchover frequency	Defines the high speed switchover frequency of the speed loop.	100.0%	d3-09 to 400.0%
F2-11/d3-13	High speed Kp calibration factor	Defines the proportional calibration coefficient of the speed loop at high speed.	100.0%	0.0% to 1000.0%
F2-12/d3-14	High speed Ti calibration factor	Defines the integral calibration factor of the speed loop at high speed.	100.0%	0.0% to 1000.0%

Param.	Name	Description	Default value	Range
d3-19	Adaptive source of speed loop Kp	Defines the adaptive source of speed loop Kp. Value description: 0: Inactive 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - The multi-speed reference is used to control the operating time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The adaptive source is set through communication. The operating frequency is set through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - Set a parameter number for the floating-point connector, and the value of the connector is used as the source. It is used for extension of common sources.	0	0 to 9
d3-21	Lower limit of speed loop adaptive switchover	Defines the adaptive switchover lower limit of the speed loop.	40.0 %	0.0% to 1000.0%
d3-22	Upper limit of speed loop adaptive switchover	Defines the adaptive switchover upper limit of the speed loop.	100.0%	0.0% to 1000.0%
d3-23	Lower limit of speed loop adaptive calibration	Defines the lower limit of speed loop adaptive calibration.	100.0%	0.0% to 1000.0%
d3-24	Upper limit of speed loop adaptive calibration	Defines the adaptive calibration upper limit of the speed loop.	100.0%	0.0% to 1000.0%

Application case

In the application of a wire drawing machine, the improper mechanical installation results in mechanical vibration of the stand. The higher the speed, The more obvious the vibration is. On-site commissioning reveals that the speed loop needed to be intensified at low speed to suppress speed fluctuation, and the speed loop needed to be reduced at high speed to reduce vibration.

Based on the actual commissioning, the speed loop parameters can be adjusted automatically by using the low-/high-speed speed loop adaptive function.

The following shows the detailed procedure.

1. Set F2-07/d3-09 (Low speed switchover frequency) to 5 Hz.
2. Set low-speed loop proportional calibration coefficient to 100%. Set F2-08/d3-10 to 100% and F2-09/d3-11 to 100%.
3. Set F2-10/d3-12 (High speed switchover frequency) = 15 Hz.
4. According to the commissioning results, the high-speed speed loop proportional term (F2-11/d3-13) is reduced to 30%, and the integral term (F2-12/d3-14) remains unchanged at 100%.

10.1.2.4 Acceleration Torque Feedforward

Application scenarios

To allow the motor to accelerate/decelerate based on the set RFG curve, set a proper acceleration torque for the motor ($T_a = T_e - T_L$) instead of using the speed regulator only, preventing overshoot at the end of acceleration and speed lag at the start of acceleration.

In this case, acceleration torque feedforward function can be used to calculate the acceleration torque needed based on the auto-tuned moment of inertia and expected acceleration, which is then superimposed to the speed regulator to reduce the output of the speed regulator and improve speed following characteristics.

Operating principles

Acceleration torque feedforward is implemented based on the motion equation of the motor, as shown below.

$$T_e - T_L = J\frac{d\omega}{dt}$$

In the preceding formula,

T_e represents the electromagnetic torque of the motor.

T_L represents the load torque and friction torque.

J represents the moment of inertia, which is displayed in C4-64 after auto-tuning. The per-unit value is equal to the electromechanical time constant (C4-63).

dω/dt represents the speed change rate of the motor, which is associated with the acceleration/deceleration time and calculated automatically by the system.

The acceleration output by RFG is used for acceleration torque feedforward to get the motor speed change rate. In this case, an accurate acceleration torque can be obtained when the speed curve is

set to be generated only by RFG. The following shows the block diagram for generating feedforward torque.

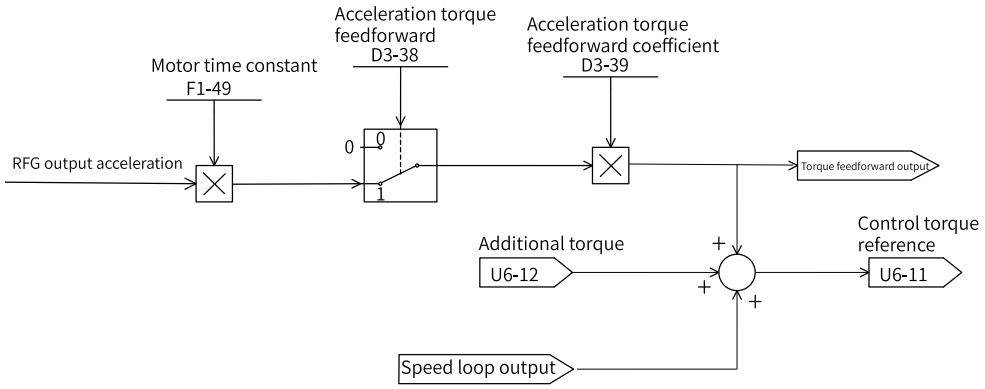


Figure 10-11 Feedforward torque

Related parameters

Param.	Name	Default value	Value range	Description
d3-38	Acceleration torque feedforward enable	0	0 to 1	Defines whether to enable feedforward torque. In the speed mode, enabling feedforward torque significantly improves the acceleration following performance. Value description: 0: Disable 1: Enable Note:To ensure the feedforward effect, complete auto-tuning or inertia auto-tuning is required.
d3-39	Acceleration torque feedforward coefficient	100.0%	0.0% to 1000.0%	Defines the magnitude of feedforward torque. Feedforward torque = Acceleration x Moment of inertia x Feedforward torque coefficient
d3-40	Acceleration source of acceleration torque feedforward	0	0 to 1	Defines the source for calculating feedforward torque. Value description: 0: Set by RFG - Setting the speed through the RFG module yields optimal performance. 1: Calculated automatically - If the speed is not set through the RFG module, select this option. Note: When the speed reference is generated by RFG, it is recommended to set this parameter to 0.

Application instance

In textile production lines, SVC speed control mode is used, where the host controller sends the speed reference through the PLC, with a communication cycle of 50 ms. After the motor accelerates to the set speed in SVC mode, excessive speed overshoot occurs.

In this case, you can enable acceleration torque feedforward to reduce overshoot. Given that the speed reference is sent through PLC, the frequency ramp transition function needs to be enabled.

Operation procedure:

1. Ensure no-load complete auto-tuning or inertia auto-tuning has been performed on the motor. If not, perform inertia auto-tuning by setting C2-00 to 4.
2. After inertia auto-tuning is done, enable frequency ramp transition function by setting b5-11 to 1.
3. As the communication cycle with PLC is 50 ms, set the frequency ramp transition interval to 50 ms (b5-12 = 50).
4. Enable the acceleration feedforward function by setting d3-38 to 1.
5. Select the source of acceleration feedforward. As the drive operates in speed control mode, and the speed reference is generated by RFG, set d3-40 to 0.

After preceding steps are done, both frequency ramp transition and acceleration torque feedforward functions are enabled simultaneously.

If in actual field applications, the speed reference is not sent through PLC, or if the speed reference is sent through PLC, but the speed reference is used as the final target speed without ramp integration by the host controller, you only need to enable RFG feedforward, with steps 2 and 3 skipped and frequency ramp transition not set.

10.1.2.5 Frequency Ramp Transition

Application scenarios

When the speed is set through PLC communication, the RFG output speed may be not smooth due to the long communication cycle between the PLC and the drive and non-continuous speeds sent by the PLC, resulting in non-continuous acceleration. When the acceleration torque feedforward function is used, the sudden change in calculated feedforward torque may cause torque oscillation in the motor output, potentially damaging rigid structures connected by gears. This issue can be resolved through frequency ramp transition.

Operating principles

After enabling b5-11 [Frequency ramp transition], the speed ramp slope is controlled during changes in the speed references, generating a continuous ramp transition rate. When the signal update interval of the external control system (PLC transmission interval) is consistent with ramp transition rate (b5-12), the output speed reference of RFG is linear.

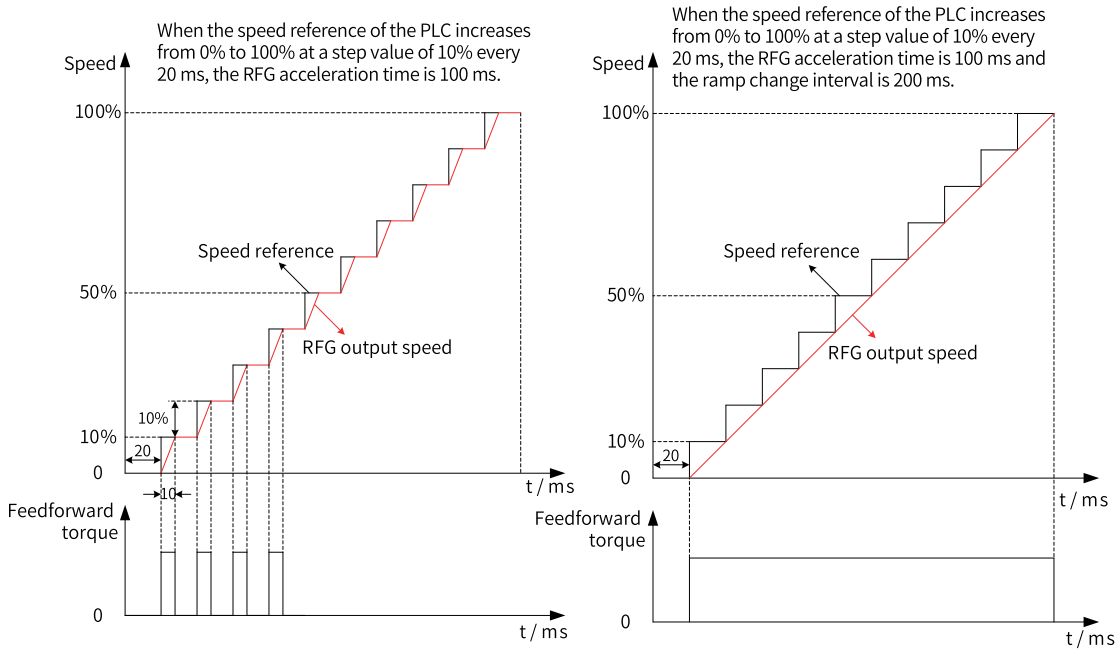


Figure 10-12 Ramp transition diagram

Related parameters

Param.	Name	Description	Default value	Range
b5-11	Frequency ramp transition enable	Defines whether to enable frequency ramp transition. When the bit signal is set to 0, this function is not enabled. When the bit signal is set to 1, this function is enabled. Value description: 0: Disable - This function is disabled. 1: Enable - This function is enabled; 3 to 12: Depends on the final terminal status of DI1 to DI9 - 0: Inhibited; 1: Enabled Other: B connector - Depends on the B connector. You can select "Other: B connector" through the pop-up window. When the connector value is 0, this function is inhibited. When it is 1, this function is enabled. Note: 1. The frequency ramp transition function controls the speed ramp slope during the change of the speed reference, generating a continuous ramp transition rate. This function can be used when the RFG output speed must be linear upon non-continuous signal update time of the external control system. When the speed is set through PLC communication, the RFG output speed may be not smooth due to the long communication cycle between the PLC and the drive and non-continuous speeds sent by the PLC. When the speed reference of the PLC increases from 0% to 100% at a step value of 10% every 20 ms, if the RFG speed output is excessively high and the acceleration from 0% to 10% is short, then an acceleration and constant-speed process applies within 20 ms. In this way, the speed output of the RFG is not a smooth line from 0% to 100%, but a step-up line. The calculated ramp-up rate is not continuous. In applications where the acceleration torque compensation function is used, the calculated feedforward torque can result in oscillation of the motor output torque, which may damage the rigid structure that connected to the gear. 2. When the speed reference is sent to the drive through communication, the frequency ramp transition function must be enabled simultaneously if the acceleration torque feedforward function needs to be enabled.	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector
b5-12	Frequency ramp transition interval	Defines the frequency ramp transition interval. Note: See b5-11 for description of the frequency ramp transition function. Expected frequency ramp transition interval = Communication cycle of the speed reference	50 ms	2 ms to 10000 ms

Application instance

Frequency ramp transition is generally used together with the acceleration torque feedforward function. See the application instance in *"10.1.2.4 Acceleration Torque Feedforward" on page 499*.

10.1.2.6 Speed Control Optimization in Vector Control

During commissioning of the drive, speed fluctuation often occur, which can be improved by increasing or decreasing the speed loop PI parameters. In high-inertia systems and applications

requiring quick acceleration and deceleration, it is difficult to improve speed following performance by adjusting PI parameters, and incorrect adjustment methods may worsen system operation.

In vector control, the speed control performance is represented by the ability to follow the speed reference and the resistance to load disturbance. During commissioning, improve the speed following performance first, and then improve the resistance to load disturbance.

1. Speed following performance

   Speed following performance indicates the ability to follow the speed reference, which is usually a challenge during acceleration/deceleration, as shown in the following figure.

   Acceleration feedforward is mainly used to improve the speed following capability. When the speed following performance is affected by acceleration/deceleration, commission the acceleration feedforward first.

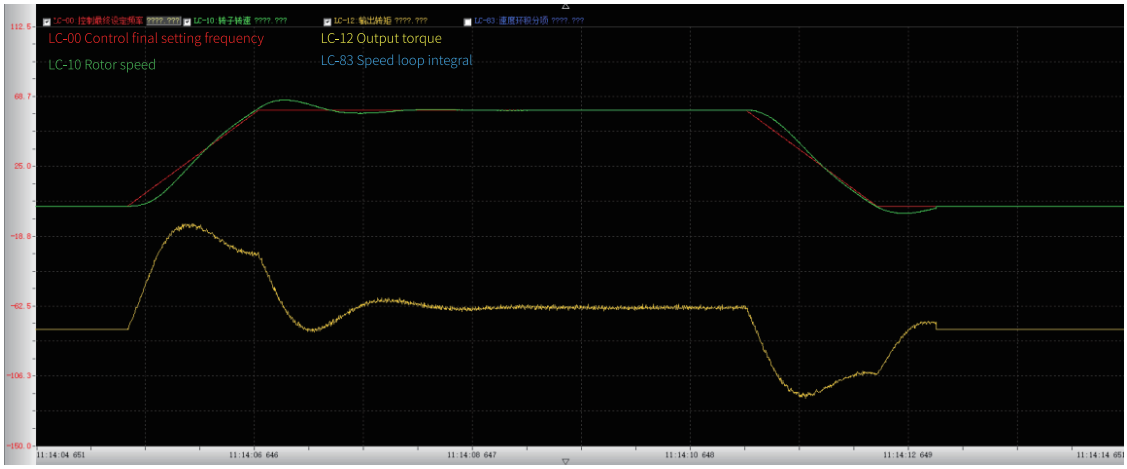


Figure 10-13 Poor speed following performance

2. Load disturbance resistance

   Load disturbance resistance indicates the ability to keep the speed stable when the load changes, which is usually a challenge when the load changes, as shown in the following figure.

   The speed loop PID is mainly used to improve the load disturbance resistance. When the speed following performance is disturbed by the load, optimize speed loop PID parameters first.

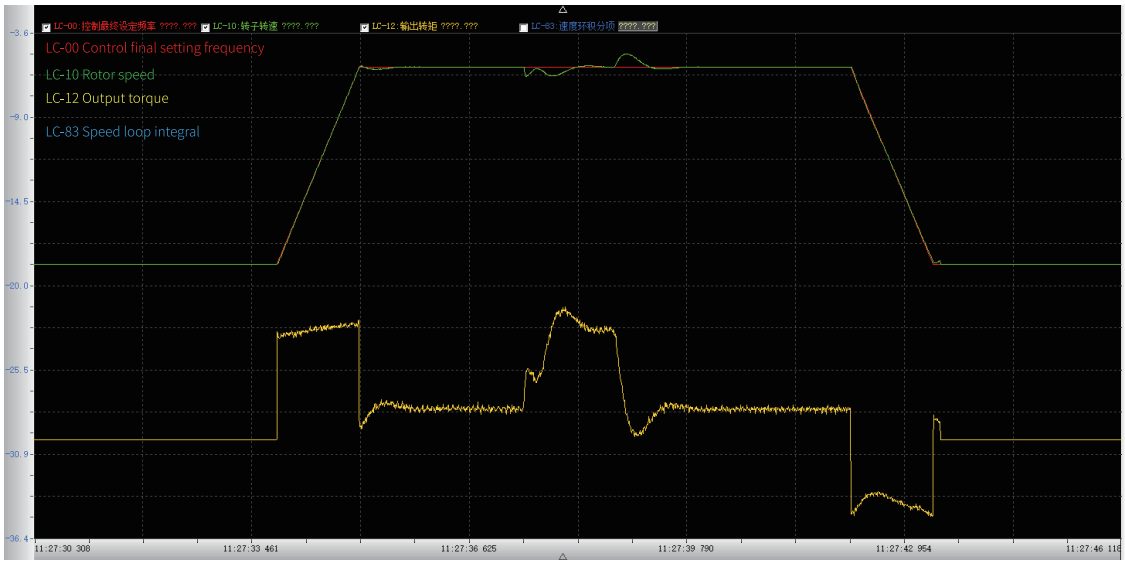


Figure 10-14 Poor load disturbance resistance

Optimizing speed following performance

Application scenario: During acceleration/deceleration, the actual speed may fail to follow the speed reference closely, resulting in excessive overshoot or repeated oscillation after the speed is reached. To optimize speed control, first adjust the speed loop to a low value. For example, set speed loop Kp to 5 (F2-02 = 5) and Ti to 2.0s (F2-03 = 2.0s). Adjusting the acceleration torque feedforward properly can greatly improve the speed following performance.

Acceleration torque feedforward calculation formula: $T_e = J \times a$.

T_e: Motor output acceleration torque

J: Moment of inertia. This is a system parameter that needs to be auto-tuned or adjusted manually.

A: Acceleration rate, indicating the acceleration/deceleration time

In the above formula, the acceleration/deceleration time "a" is known, the feedforward torque can be calculated once the system inertia "J" is known. The system inertia "J" can be auto-tuned through inertia auto-tuning. If failed, you can adjust d3-39 [Acceleration torque feedforward coefficient] manually to get the accurate inertia compensation.

If dynamic inertia auto-tuning is available, see the commissioning process for acceleration feedforward in the following diagram.

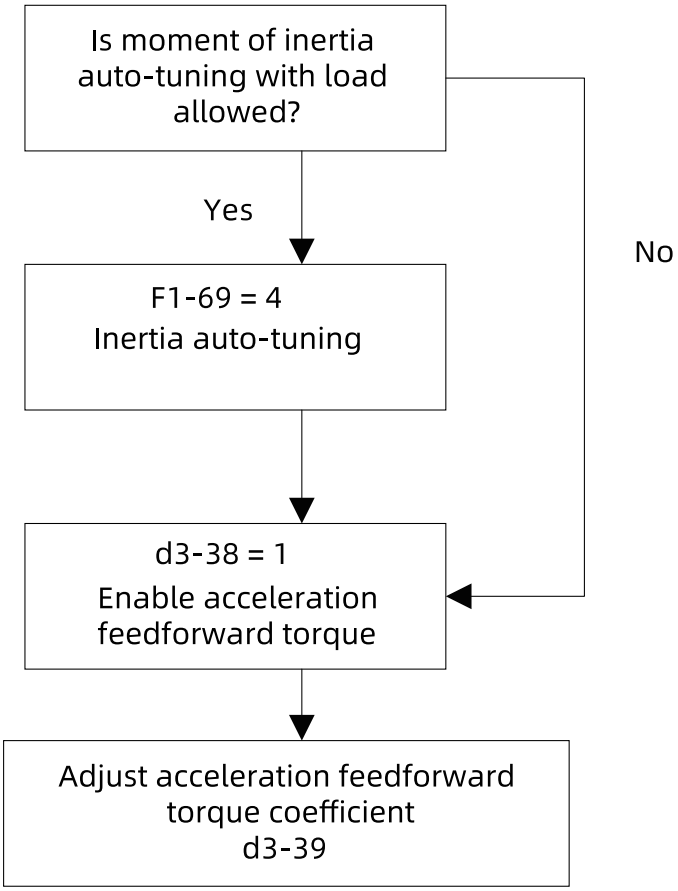


Figure 10-15 Commissioning for acceleration feedforward based on inertia auto-tuning

The moment of inertia is an important parameter for acceleration feedforward. Precautions for inertia auto-tuning are shown below.

1. Inertia auto-tuning is available for systems with fixed inertia such as inertia disks and rollers.
2. Inertia auto-tuning is not available for systems with travel limits. Partial inertia compensation (acceleration feedforward compensation) can be made for variable inertia system, with PI parameters adjusted.
3. Do not perform inertia auto-tuning on systems with variable inertia, such as winding/unwinding and reciprocating cam slider mechanisms.
4. For systems with large load variation, such as fans and pumps, you can reduce the auto-tuning speed, for example, setting C2-10 to 10% and C2-11 to 15% can reduce the adverse impact caused by load variation (the difference between C2-10 and C2-11 cannot be lower than 3%; otherwise, the auto-tuning accuracy can be affected).

If dynamic inertia auto-tuning is not available, see the commissioning process for acceleration feedforward in the following diagram.

If inertia auto-tuning is not performed, the system assigns a moment of inertia by default and adjusts d3-39 [Acceleration torque feedforward coefficient] directly during operation for commissioning on acceleration feedforward torque. First set a relatively low speed loop Kp (F2-02 = 5) and Ti (F2-03 = 2.0s), and then adjust the feedforward torque.

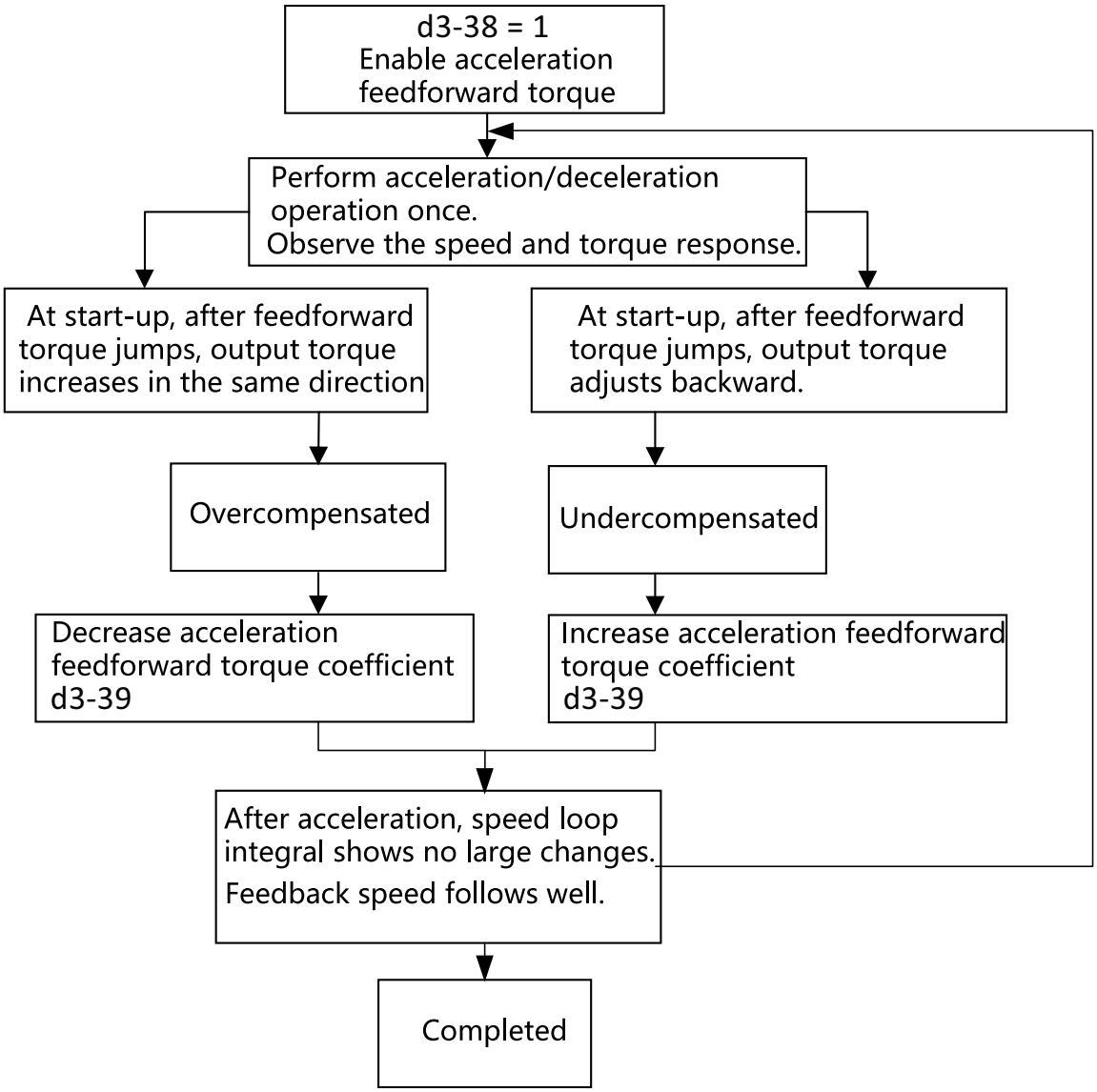


Figure 10-16 Commissioning process for acceleration feedforward without inertia auto-tuning

Feedforward undercompensation: The feedforward torque step change does not reach the required level at the start of acceleration/deceleration and speed arrival. The speed loop integral value changes significantly after the speed is reached. In undercompensation, the compensation coefficient (d3-39) needs to be increased.

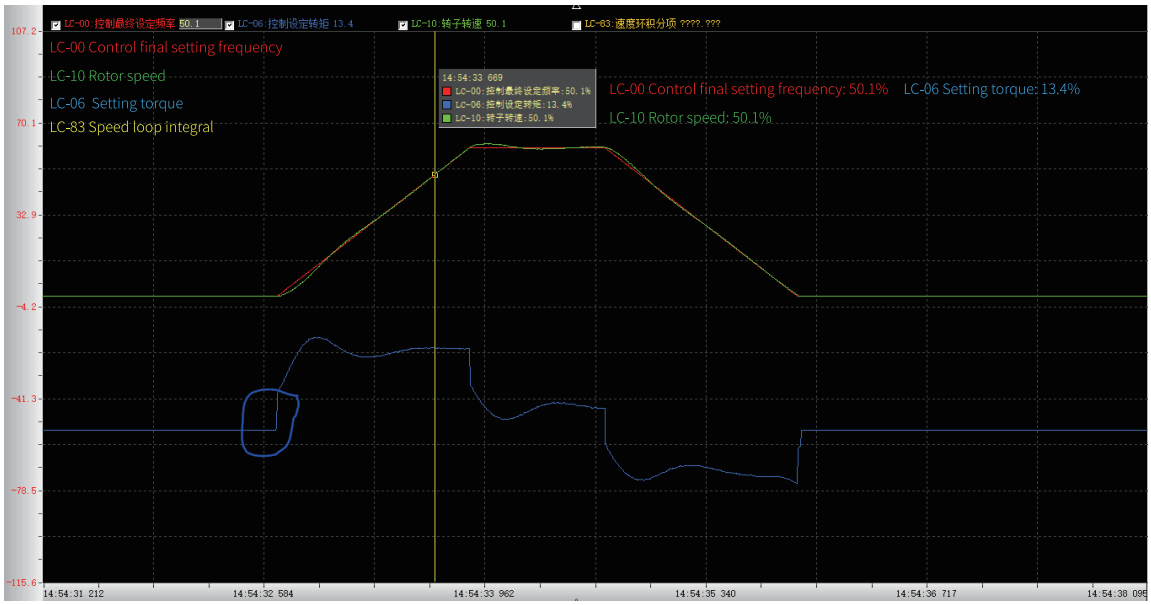


Figure 10-17 Acceleration torque feedforward undercompensation

Feedforward overcompensation: The feedforward torque step change exceeds the required level at the start of acceleration/deceleration and speed arrival. The speed loop integral value changes significantly after the speed is reached. In overcompensation, the compensation coefficient (d3-39) needs to be reduced.



Figure 10-18 Acceleration torque feedforward overcompensation

As shown in the following figure, the feedforward is close to the required torque. The actual speed follows the speed reference closely

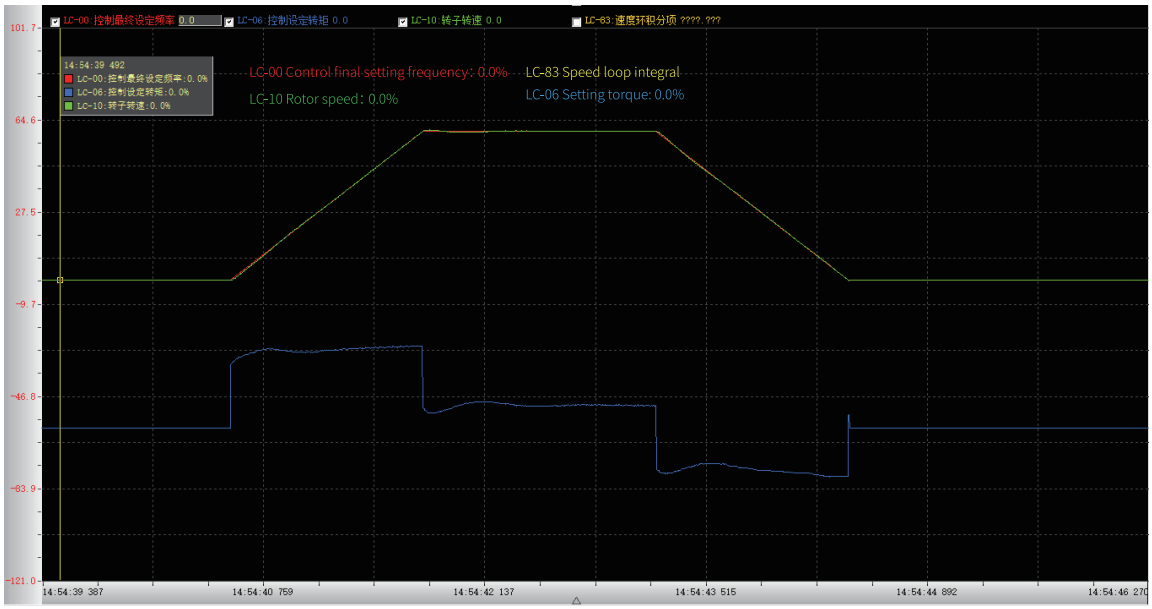


Figure 10-19 Normal effect of acceleration torque feedforward

For flexible loads, sudden changes in feedforward torque can cause acceleration shock, resulting in mechanical vibration or abnormal noise. The S-curve can be enabled by setting b7-00 to 1. b7-13/b7-14 can be set to 10% of the acceleration time (b7-04). For example, if b7-04 is set to 20s, set b7-13/b7-14 to 2s. b7-15/b7-16 can be set to 10% of the deceleration time, making the torque change linearly, which can significantly reduce torque shock and minimize mechanical vibration.

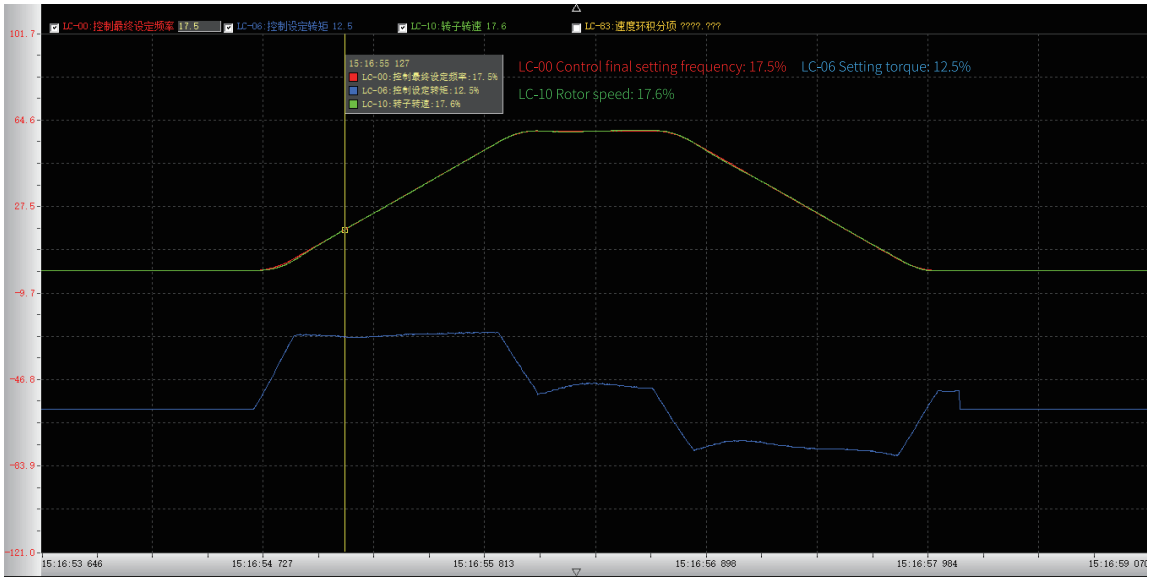


Figure 10-20 Normal effect of acceleration torque feedforward after S-curve enabled

When the PLC writes the speed reference at a slow cycle, such as once every 100 ms, step changes can occur on the feedback speed, with the output torque fluctuating significantly (see *"10.1.2.5 Frequency Ramp Transition" on page 501*). This symptom is widely present in industries such as metallurgy, papermaking, test benches, chemicals, and textiles where the PLC provides the speed references. In this case, you can enable the ramp transition function (b5-11) and define the PLC speed reference cycle through b5-12 (measure the time interval through the oscilloscope in the

software tool). The ramp transition function can effectively reduce the torque ripple during acceleration/deceleration.

Load disturbance resistance

Application scenario: Obvious speed drop occurs due to load changes, such as excessive load in the crushers and bite and throw of steel in bar/wire rod and heavy plate mills. Adjust speed loop PI parameters when the speed following performance is affected by excessive friction of the port RTG, and gantry travel and trolley, or when speed drop occurs due to sudden torque change in the assembly test bench of electric vehicles, or when torque oscillation and unusual mechanical noise occurs upon start due to excessively high speed loop parameters of low-inertia systems.

See the following procedure for PI parameter adjustment.

1. Set speed loop Kp (F2-02 = 3) and Ti (F2-03 = 2.0s) to low values first to prevent operation oscillation caused by high PI parameter values. For motors with high torque output, such as direct-drive motors, set the speed loop Kp to a value lower than 3.
2. Gradually increase F2-02, and observe U6-00 [Motor actual speed] and U6-23 [Set torque current]. The normal waveform should show speed fluctuation within 0.3% and torque current within 3%.
3. When increasing the value of Kp, note that fluctuation of U6-23 [Torque current reference] cannot exceed 3%. After changing the value of Kp, run at different speeds to check whether torque current fluctuation increases.
4. When the torque current reference fluctuates by 3%, decrease Kp by 1/3 and perform Kp value commissioning.
5. Reduce the speed loop integral time Ti (F2-03) gradually as needed by the load. Keep the integral time higher than 0.5s in general applications. In applications with high dynamic responses, keep the integral value higher than 0.1s.
6. The bandwidth of large equipment or mechanical systems with high inertia ratio is low, which may easily incur repeated speed fluctuation upon sudden unloading after loading, resulting in bus voltage pumping and overtemperature/overload of the braking transistor IGBT and braking resistor. It is recommended to set the system integral time to 2s, with the integral time set to a high value.

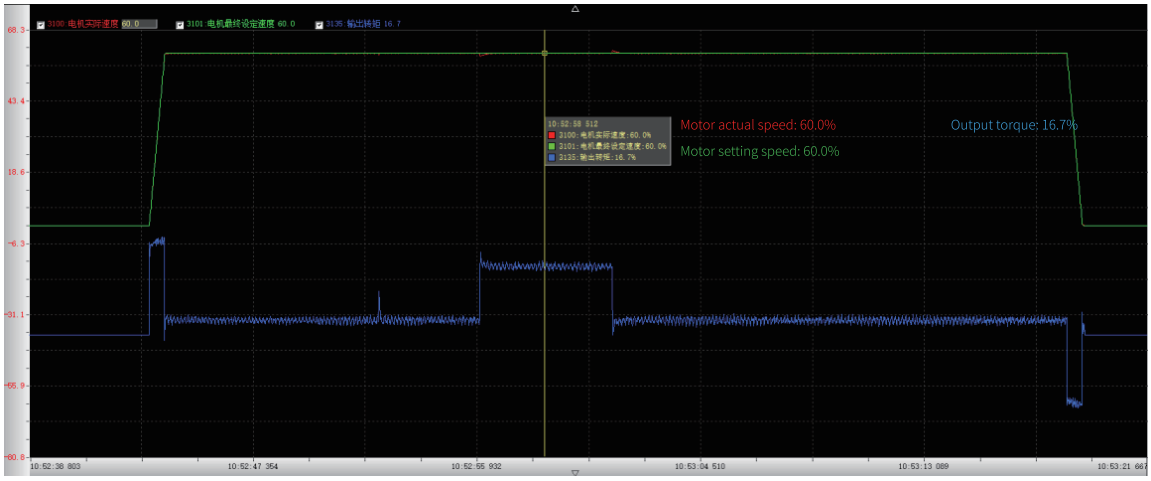


Figure 10-21 Waveform upon sudden loading/unloading after commissioning is done

10.1.3 Torque Control

10.1.3.1 Torque Control

Torque control is the control mode that ensures that the motor output torque directly follows the torque reference. Torque control includes torque reference and overspeed control. The torque reference includes torque reference setting, gain calculation, filtering, and acceleration/deceleration. Overspeed control includes setting speed limit, filtering, acceleration/deceleration, speed offset mode, and speed offset value.

Torque control must be used together with overspeed control. When the motor output torque is lower than or equal to the motor load, the motor speed is determined by the load. When the motor output torque is greater than the load torque, the motor accelerates to run. To prevent the motor from overspeed, the motor speed must be limited in torque control. When the motor speed exceeds the limit, the speed control mode applies. When the speed is restored to a value below the limit, the torque control mode applies.

10.1.3.2 Application Scenario of Torque Reference

Application scenarios

Switch the torque control mode through d0-01. In the torque control mode, set the torque reference filter and torque ramp-up/down time through b5-16, b5-17, and b5-18. In torque control, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change quickly, which can result in noise or excessive mechanical stress.

Proper torque ramp-up/down time helps smooth changes in the motor speed. The torque ramp-up/down time represents the time needed for the torque to increase from 0 to the rated motor torque.

Operating principles

In the torque control mode, the torque is set through torque control references. Torque control references can be set through digital reference of other setting methods in the parameter list.

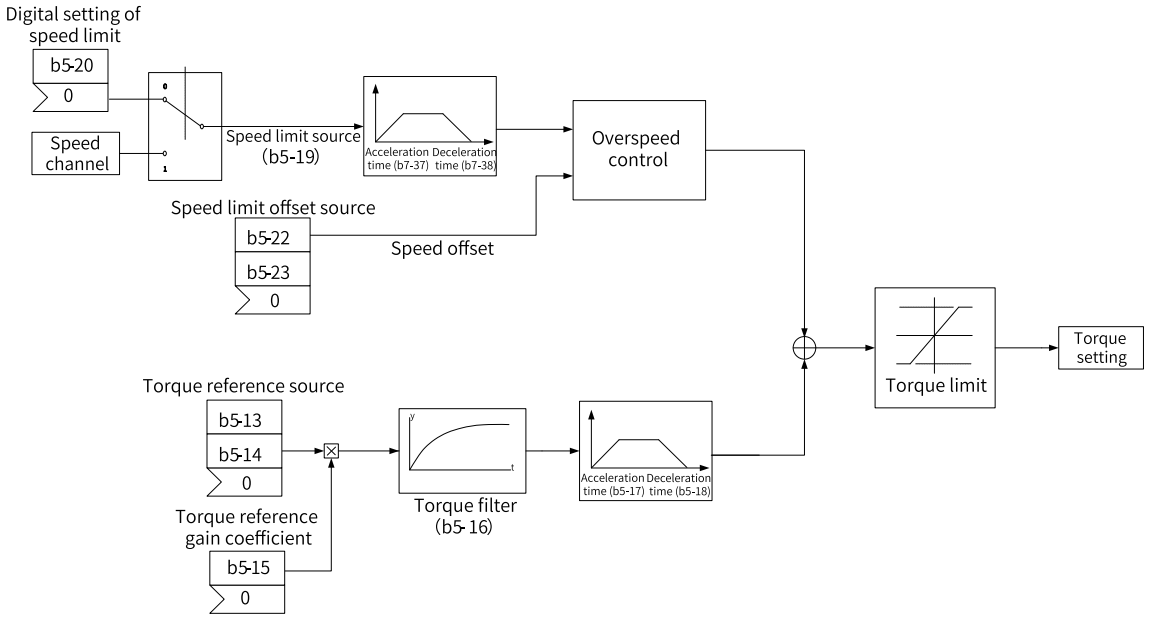


Figure 10-22 Torque control diagram

Related parameters

Param.	Name	Default value	Range	Description
F0-02/d0-01	Motor control mode	0	0: Speed control 1: Torque control 3 to 12: DI1 to DI10 Other: B connector	Defines the motor control target. Value description: 0: Speed control - The speed is controlled. 1: Torque control - The torque is controlled. 3 to 12: DI1 to DI10 - Depends on the final terminal state of the DI (0: Speed control; 1: Torque control). Other: B connector - Depends on the status of B connector (0: Speed control; 1: Torque control).
b5-13	Torque reference source	0	b5-14 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the torque reference source. Value description 0: b5-14 - The torque reference is set by b5-14. 6: Multi-reference - When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different torque references. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and torque ramp-up/down time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - The PID output is used as the torque reference source. 9: Communication - The torque reference is set through communication. When selecting the source, you can set the torque through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the source. It is used for extension of common sources.
b5-14	Digital torque reference	0.0%	-800.0 % to +800.0%	Defines the digital torque reference.

Param.	Name	Default value	Range	Description
b5-15	Torque reference gain factor	0	0: 100% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of the torque reference gain factor. Value description: 0: 100% - The torque reference gain factor is set to 100%. 6: Multi-reference - When multi-reference is used as the source of torque reference gain factor, different combinations of DI terminal states correspond to different torque reference gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and torque ramp-up/down time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - PID is selected as the source of torque reference gain factor. PID control is a common process control method, which calculates the proportion, integral, and derivative of the difference between feedback signals and target signals of the controlled variable, and adjusts the output frequency of the AC drive accordingly, thereby forming a closed-loop system to stabilize the controlled variable at the target value 9: Communication - The torque reference gain factor is set through communication. When selecting the source, you can set the torque reference gain factor through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the torque reference gain factor. It is used for extension of common sources.
b5-16	Torque filter time	0	0-10000 ms	Defines the torque filter time.
b5-17	Torque ramp-up time	0.000s	0.000s to 60.000s	Defines the torque ramp-up time.
b5-18	Torque ramp-down time	0.000s	0.000s to 60.000s	Defines the torque ramp-down time.

Application instance

In torque control, the difference between the output torque of the motor and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change rapidly, resulting in noise or excessive mechanical stress. Proper torque ramp-up/down time and filter time (b5-17 and b5-18) helps smooth changes in the motor speed. The torque ramp-up/down time represents the time needed for the torque to increase from 0 to b5-14.

In the torque control mode, the torque ramp-up/down time is not needed for start with low torque. For applications requiring quick torque response, set the torque ramp-up/down time to 0.00s.

For example, two drives are connected to drive the same load. To balance the load distribution, set one drive as the master with speed control and the other as the slave with torque control. The slave receives the output torque of the master as the torque reference and must follow the master rapidly. In this case, the torque ramp-up/down time of the slave is 0.00s.

10.1.3.3 Application Scenario of Overspeed Control

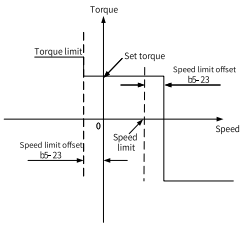
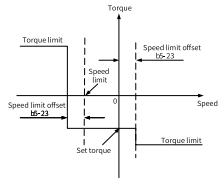
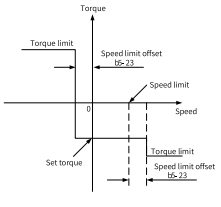
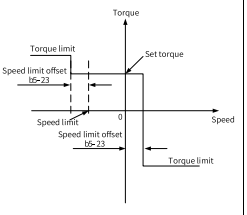
Application scenarios

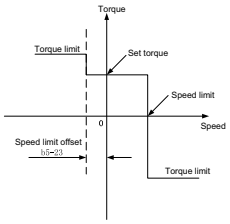
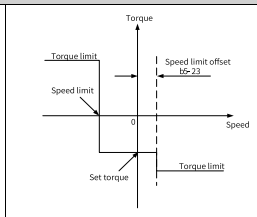
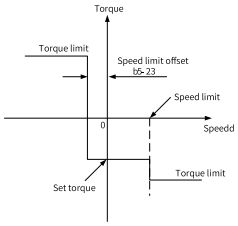
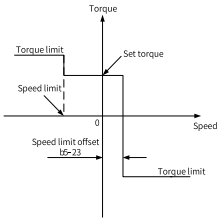
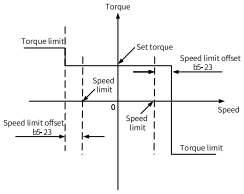
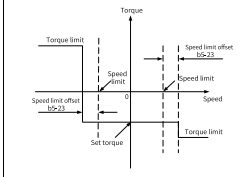
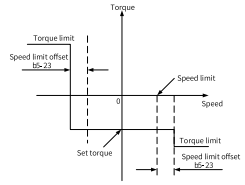
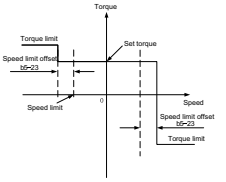
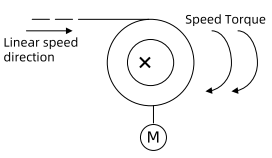
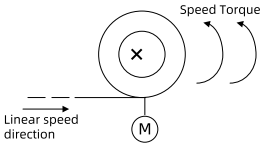
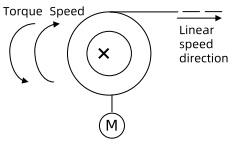
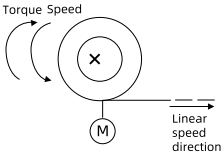
In the torque control mode, if the load torque is lower than the output torque of the motor, the motor speed keeps increasing. Therefore, the motor speed (frequency upper limit) must be limited to prevent accidents such as runaway.

Overspeed control is used in torque control mode to prevent overspeed. When the motor speed exceeds the speed limit, overspeed control is triggered. In this case, speed control applies and the motor torque cannot be outputted based on the torque reference. When the speed is restored to a value within the speed limit range, torque control resumes.

Operating principles

The speed limit parameter for overspeed control consists of two parts: speed limit and speed bias. The active status of overspeed control in the torque control mode varies with the speed limit bias setting method and the motor operating state, as shown below.

Item	Operating condition			
Operation command	Forward	Forward	Forward	Forward
Torque reference direction	+	-	-	+
Speed limit direction	+	-	+	-
Normal operating direction	Forward	Reverse	Forward	Reverse
Bi-directional speed limit bias (b5-21 = 0)				

Item	Operating condition			
Uni-directional speed limit bias (b5-21 = 1)				
Overspeed control mode (b5-21 = 2)				
Application instance	Winder  A forward  B reverse		Unwinder  C forward  D reverse	

Related parameters

Param.	Name	Description	Default value	Range
b5-19	Speed limit bias source	Defines the speed limit source. Value description: 0: Digital reference - In torque control mode, the speed limit source is digital reference, and the speed limit set by b5-20 [Digital reference of speed limit] is active. 1: Speed channel - The speed limit is set through the speed channel in torque control mode.	0	0: Digital reference 1: Speed channel
b5-20	Digital reference of speed limit	Defines the digital reference of the speed limit. This parameter is active when b5-19 [Speed limit source] is set to "0: Digital reference".	0.0%	-800.0 % to +800.0%
b5-21	Speed limit bias mode in torque mode	Defines the speed limit bias mode in the torque control mode. Value description: 0: Bidirectional bias - The bias is active in both directions (forward and reverse). 1: Unidirectional bias - The bias is active only in one direction (opposite to the limit direction). 2: Overspeed control mode - The bias is active in both directions (forward and reverse), and the absolute values of positive and negative speed limits are equal to the speed limit plus the bias.	0	0: Bidirectional bias 1: Uni-directional bias 2: Overspeed control mode

Param.	Name	Description	Default value	Range
b5-22	Speed limit bias source	Defines the speed limit bias source. Value description: 0: b5-23 - The speed limit bias is set through b5-23. 6: Multi-reference - When multi-reference is used as the source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 references. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and torque ramp-up/down time. Each reference is set through a multi-reference parameter. The simple PLC module sets the operating time and torque ramp-up/down time for each reference and supports up to 16 speeds. 8: PID - PID output is used as the speed limit bias source. 9: Communication - The speed limit bias is set through communication. When selecting the source, you can set the speed limit bias through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. Other: F connector - A parameter number is set for a floating-point connector, and the value of the connector is used as the speed limit bias source. It is used for extension of common sources.	0	0: Digital reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
b5-23	Digital reference of speed limit bias	Defines the speed limit bias as a percentage to the rated speed. This parameter is active when b5-22 [Speed limit bias source] is set to 0 [Digital reference].	5.0%	0.0% to 800.0%

Application instance

Instance 1: Tension control in torque mode for winding and unwinding is a typical application scenario of torque control.

As shown in the application example "A forward" below, this is forward winding. Overspeed control is used to prevent the motor from continuously accelerating and limit reverse rotation of the motor.

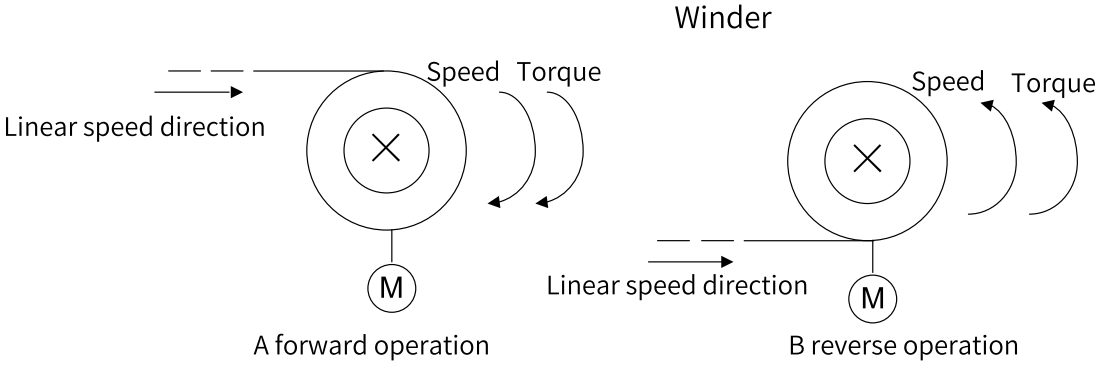


Figure 10-23 Torque control diagram 1 for winder/unwinder

If the drive controls the winder to run forwardly at a speed of 0% to 100%, and a torque of 20% is needed for winding without reverse rotation, configure parameters as shown below

Param.	Function	Value
b5-14	Digital torque reference	20.0%
b5-20	Digital reference of speed limit	100.0%
b5-21	Speed limit bias mode in torque mode	1
b5-23	Digital reference of speed limit bias	0.0%

Instance 2: As shown in the application example "C forward" below, the drive drives the unwinder to run forwardly.

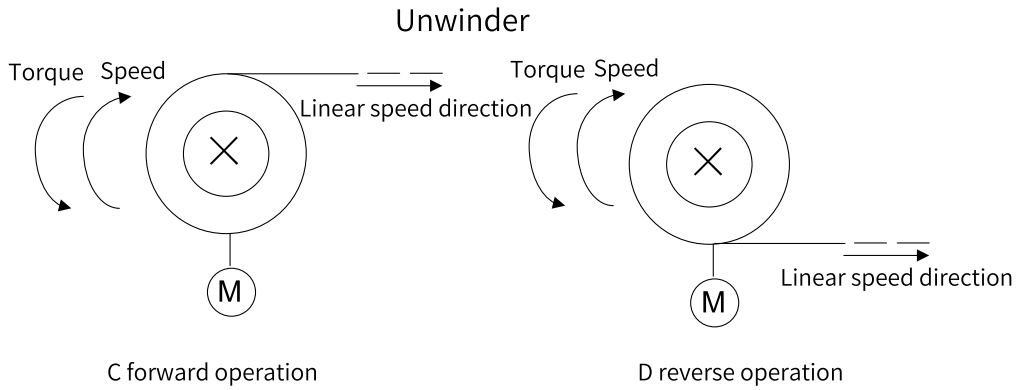


Figure 10-24 Torque control diagram 2 for winder/unwinder

If a torque of 20% is needed for unwinding and a reverse run at 5% speed is allowed, configure parameters as shown below.

Param.	Function	Value
b5-14	Digital torque reference	-20.0 %
b5-20	Digital reference of speed limit	100.0%
b5-21	Speed limit bias mode in torque mode	1
b5-23	Digital reference of speed limit bias	5.0%

Instance 3: As shown below, the motor runs forwardly, the torque reference in torque control is set by b5-14, and the speed limit for overspeed control is set by b5-20, with single-phase bias mode adopted.

Assume:

Before t1, the motor output torque equals the value of b5-14, and the motor operating speed is lower than b5-20.

At t1, the load suddenly decreases, causing the load torque to be lower than the motor output torque, resulting in motor acceleration. At t2, the speed reaches b5-20, the set speed limit is reached, and overspeed control is activated.

After t2, the speed stabilizes at b5-20. The motor torque cannot output according to the value of b5-14. The actual output torque is determined by the actual load torque, friction, and other factors at this moment.

At t3, the load continues to decrease or an external force drives the motor in the forward direction. To prevent the speed from exceeding the speed limit, the speed regulator PI decreases the positive torque rapidly. When the final torque output reaches the negative torque limit, the overspeed

control fails. After this, the speed can exceed the set speed limit. In this case, check the system configuration.

In Figure (a), the control before t3 corresponds to region I in Figure (a). Within the speed limit, the output torque equals the torque reference. At the speed limit threshold, the output torque is lower than the torque reference.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed limit.

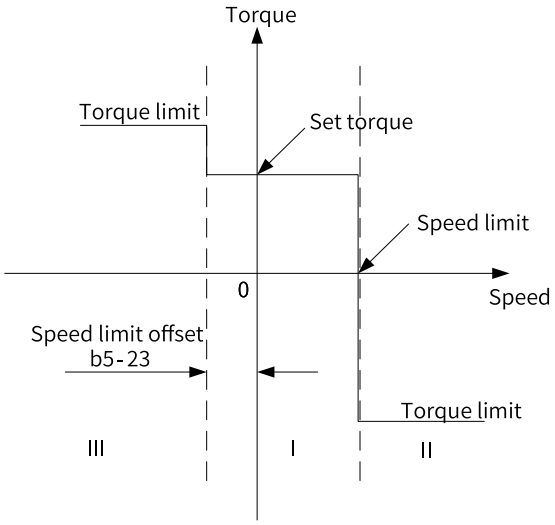


Figure 10-25 (a) Example of unidirectional limit bias in forward motoring overspeed control

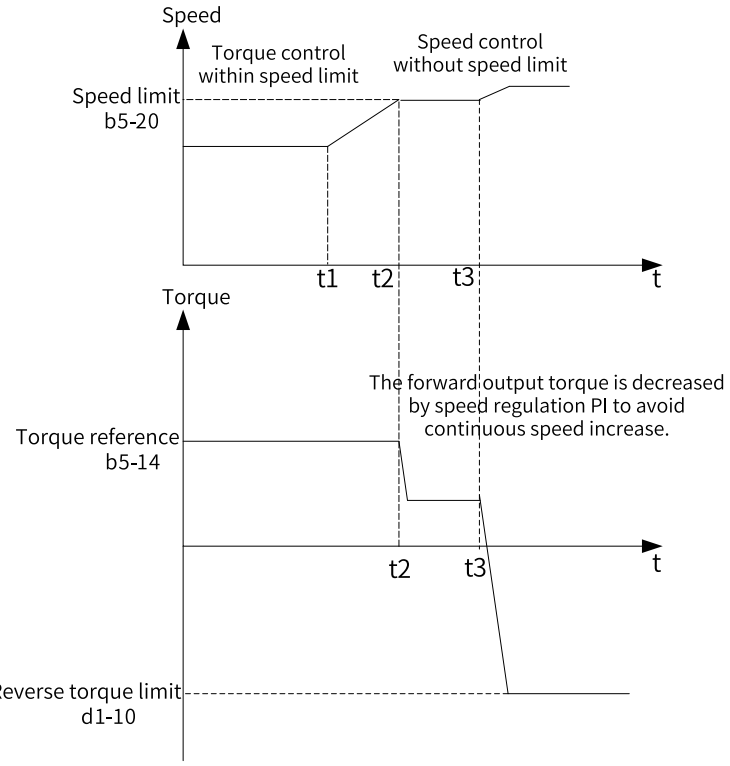


Figure 10-26 (b) Example of unidirectional limit bias in forward motoring dynamic behavior

Example 4: As shown in the figure below, the settings and operating status before t1 are the same as those in the previous example.

At t2, the load suddenly increases. Since the system does not allow significant speed reversal, a unidirectional speed bias is set. In this case, the speed regulator PI increases the motor positive torque output, and the speed reaches the speed reference of speed bias.

At t3, the load further increases or an external force drives the motor. To prevent the speed from exceeding the speed bias, the speed regulator PI increases the positive torque output. When the final torque output reaches the positive torque limit, overspeed control fails. After this, the speed can exceed the speed bias. In this case, check the system configuration.

In Figure (c), the control before t3 corresponds to region I in Figure (c). Within the speed limit and speed bias, the output torque equals the torque reference. At the speed bias threshold, the output torque is greater than the torque reference.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed bias.

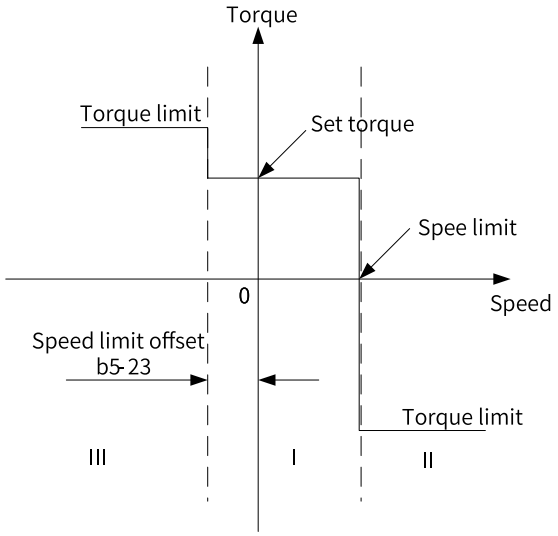


Figure 10-27 (c) Example of unidirectional limit bias in forward motoring overspeed control

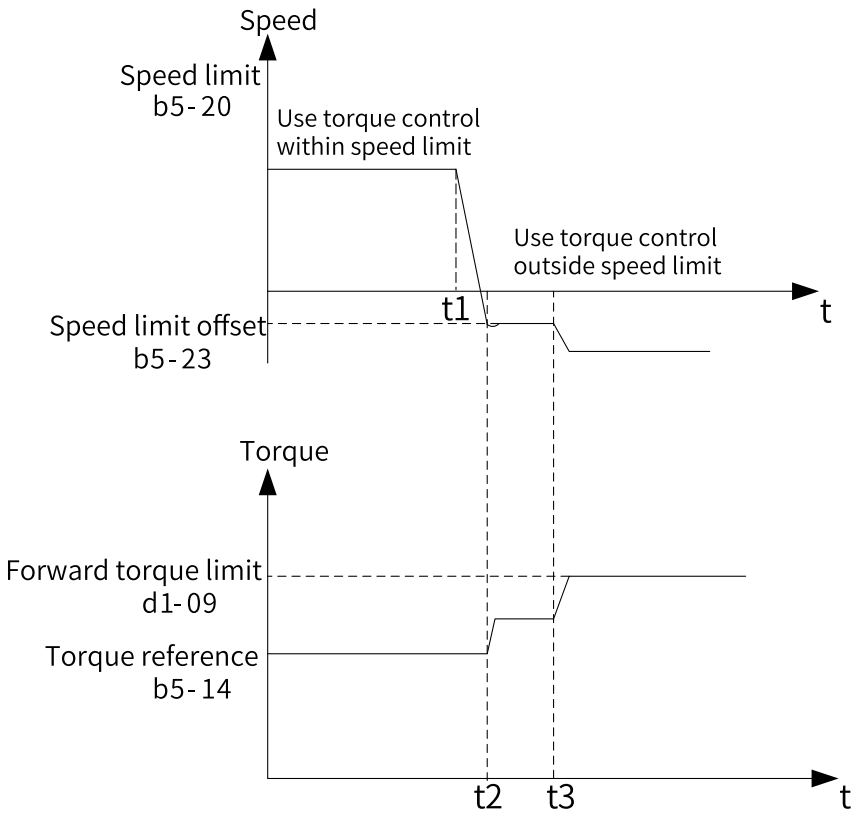


Figure 10-28 (d) Example of unidirectional limit bias in forward motoring dynamic behavior

10.1.4 Current Limit

Application scenarios

If the operating current of the motor needs to be limited in FVC or SVC mode, set the maximum motor current [F1-13] and maximum current of the drive [A3-05] to keep the current during normal operation of the motor lower than or equal to the smaller of [F1-13] and [A3-05].

Operating principles

The current regulator automatically controls the current, ensuring that the total current output does not exceed the limit value.

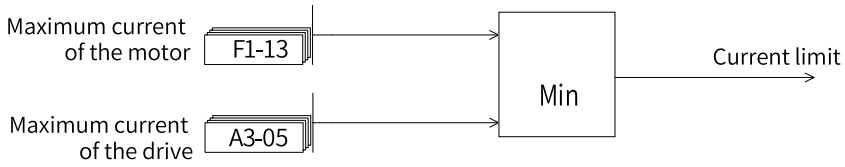


Figure 10-29 Effective current limit diagram

Related parameters

Param.	Name	Description	Default value	Range
F1-13	Maximum current of the motor	Defines the maximum current of the motor. The value 100% corresponds to the rated motor current. Note: The current limit is the smaller of F1-13 and A3-05.	1000.0 %	0.0% to 1000.0%
A3-05	Maximum current of the drive	Defines the maximum current of the drive. Output current upper limit of the drive = Maximum current of the drive x Rated current of the drive. Note: This parameter is a percentage to the rated current of the drive. The smaller of F1-13 and A3-05 is used as the effective current limit.	150 %	0% to 600 %

Precautions

- Limiting the maximum current of the motor may affect the overload capacity of the motor and reduce the motor torque output.
- The current limit of the motor is valid only in vector control. In V/f mode, the overcurrent suppression function needs to be enabled to ensure that the current is lower than the maximum current.
- When the current limit is valid, it is recommended to set [b7-46] to 1 [Ramp tracking enable] to prevent excessive deviation between the set speed and the actual speed.

10.1.5 Torque Limit

Application scenarios

In some process applications, the motor output torque needs to be limited in the FVC or SVC mode. In some cases, the motor torque limit needs to be adjusted to achieve torque control while the motor runs in the speed mode.

Operating principles

The torque limit can be achieved by limiting the output of the speed loop. The following figure shows how to set the torque limit.

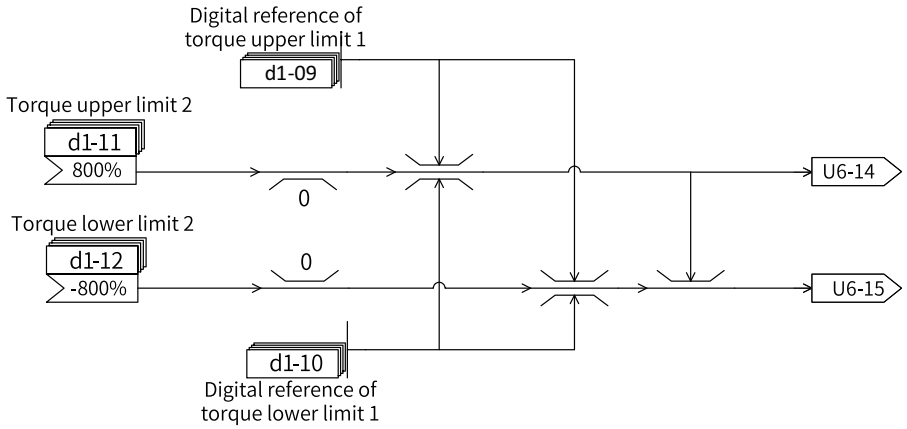


Figure 10-30 Torque limit setting

The following figure shows how the torque limit takes effect.

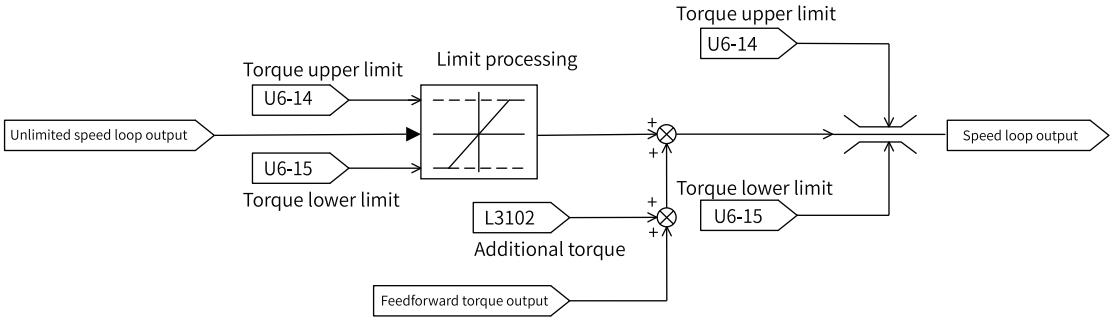


Figure 10-31 Speed loop with output torque limit

Related parameters

Param.	Name	Description	Default value	Range
d1-09	Digital reference of torque upper limit 1	Defines the maximum positive torque output. The value 100% corresponds to the rated torque of the motor. Note: The active positive torque limit is the smaller of d1-09 and d1-11.	150.0%	0.0% to 800.0%
d1-10	Digital reference of torque lower limit 1	Used to limit the maximum negative torque output. The value 100% corresponds to the rated torque of the motor. Note: The active negative torque limit is the smaller of d1-10 and d1-12.	-150.0%	-800.0% to 0.0%

Param.	Name	Description	Default value	Range
d1-11	Source of torque upper limit 2	Defines the source of torque upper limit 2, which is the per-unit value based on the rated torque of the motor. d1-11 [Source of torque upper limit 2] is mapped to F2-32 in group F. These two parameters have the same function. Value description: 0: 800% - The positive torque limit is set to 800%. 6: Multi-reference - When multi-reference is used as the positive torque limit source, combinations of different DI states correspond to different negative torque limits. More than four multi-segment instruction terminals, which can be combined into 16states, correspond to 16 set limit values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and acceleration and deceleration time. The limit is set through a multi-reference parameter. The simple PLC module sets the operating time and acceleration/deceleration time for each frequency reference. Up to 16 speeds can be set. 8: PID - The positive torque limit is set through PID. 9: Communication - The positive torque limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive torque limit depends on the value of the selected F connector. Note: The active positive torque limit is the smaller of d1-09 and d1-11.	0	0: 800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector
d1-12	Source of torque lower limit 2	Same as d1-11	1	0: -800% 1: Inverted value of the positive frequency upper limit 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector

Precautions

- The motor torque limit is active only in vector control modes. It is inactive in V/f mode.
- The actual torque limit of the motor is affected by the current limit, torque limit, and power limit. The preceding figure takes the motoring condition as an example to describe the impact of the three limits on the actual torque limit. Among all the limits, the one with the most severe restriction is active. In the figure, the active torque limit is slightly moved down for easy comparison. In actual applications, the torque reference limit coincide with the minimum torque limit.

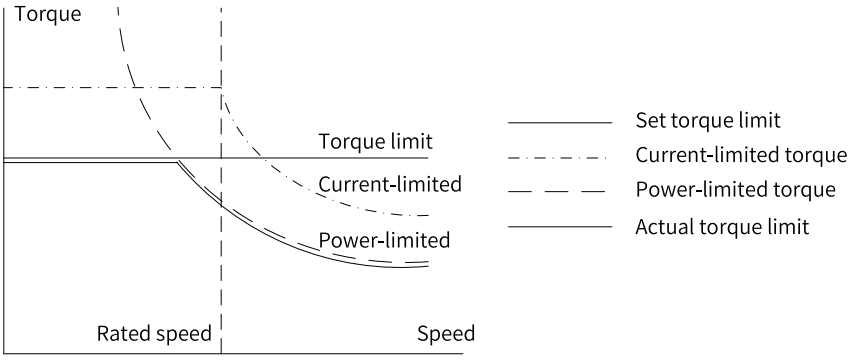


Figure 10-32 Torque limit diagram

10.1.6 Power Limit

Application scenarios

In FVC or SVC control, the power limit can limit the total power output of the motor, which is applicable to applications where the output power of the motor needs to be limited separately.

Operating principles

The power limit is converted to the torque limit internally. As the motor speed increases, the output torque limit decreases due to the power limit.

The following figure describes the difference between the generating power and the motoring power. When the motor speed direction and torque direction are both positive or negative, that is, when the speed direction and torque direction are consistent, the motor is in the motoring state and is limited by the motoring power limit. When the motor speed direction is positive and the torque direction is negative, or the speed direction is negative and the torque direction is positive, that is, the speed direction is opposite to the torque direction, the motor is in the generating state and is subject to the generating torque limit.

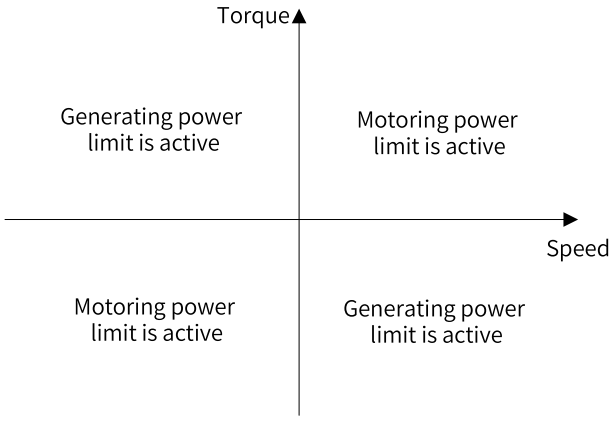


Figure 10-33 Effective range of different power limits

The generating power limit is the smaller of d1-14 [Generating power limit 1] and d1-17 [Generating power limit 2].

d1-15 [Selection of generating power limit 2] defines whether d1-17 [Generating power limit 2] is active, as well as the actual effective range.

When d1-15 [Selection of generating power limit 2] is set to 0 [Inactive], d1-17 [Generating power limit 2] is inactive.

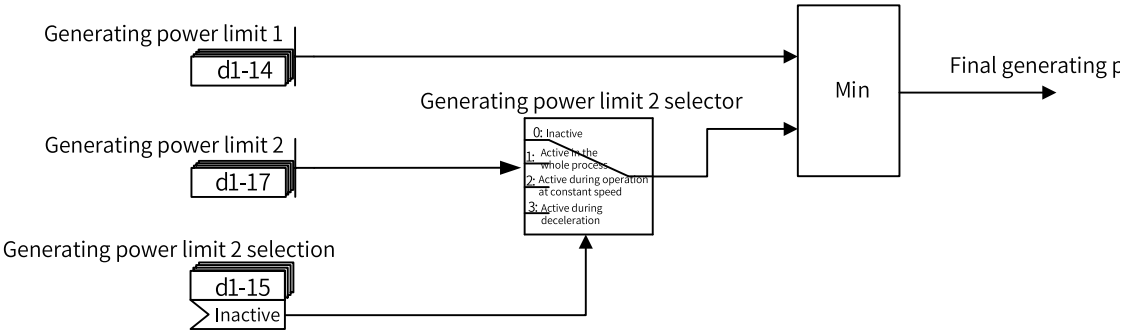


Figure 10-34 Diagram of generating power limit

Related parameters

Param.	Name	Default value	Value range	Description
d1-13	Motoring power limit	400.0%	0.0% to 1000.0%	Used to limit the output power of the motor in the motoring state. The value 100% corresponds to the rated power of the motor.
d1-14	Generating power limit 1	400.0%	0.0% to 1000.0%	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.
d1-15	Selection of generating power limit 2	0 [Inactive]	0: Inactive 1: Active in the whole process 2: Active during operation at constant speed 3: Active during deceleration	Defines whether the motoring power limit 2 is active. Value description: Inactive: Inactive during operation of the motor Active in the whole process: Active during operation of the motor Active during operation at constant speed: Active when the motor operates at constant speed Active during deceleration: Active during deceleration of the motor Note: The smaller of d1-14 [Generating power limit 1] and d1-17 [Generating power limit 2] is applied.
d1-17	Generating power limit 2	20.0%	0.0% to 800.0%	Limits the output power of the motor in the generating state. The value 100% corresponds to the rated power of the motor.

Precautions

The motor power limit is active only in vector control. It is inactive in V/f mode.

10.1.7 Overvoltage Suppression (Vector)

Application scenarios

In applications with high inertia or quick deceleration, overvoltage may occur during deceleration. In this case, the motor is in the generating state, which causes the DC bus voltage to rise. In FVC or SVC control, you can enable overvoltage suppression to suppress the rise of the DC bus voltage.

Operating principles

When overvoltage suppression is enabled, the actual deceleration speed of the motor is limited by PID control of the bus voltage after the bus voltage exceeds d1-56 [Effective voltage threshold for overvoltage suppression], preventing overvoltage caused by DC bus voltage rise. In this case, the deceleration time can be longer than the set value.

The following figure shows the overvoltage suppression process.

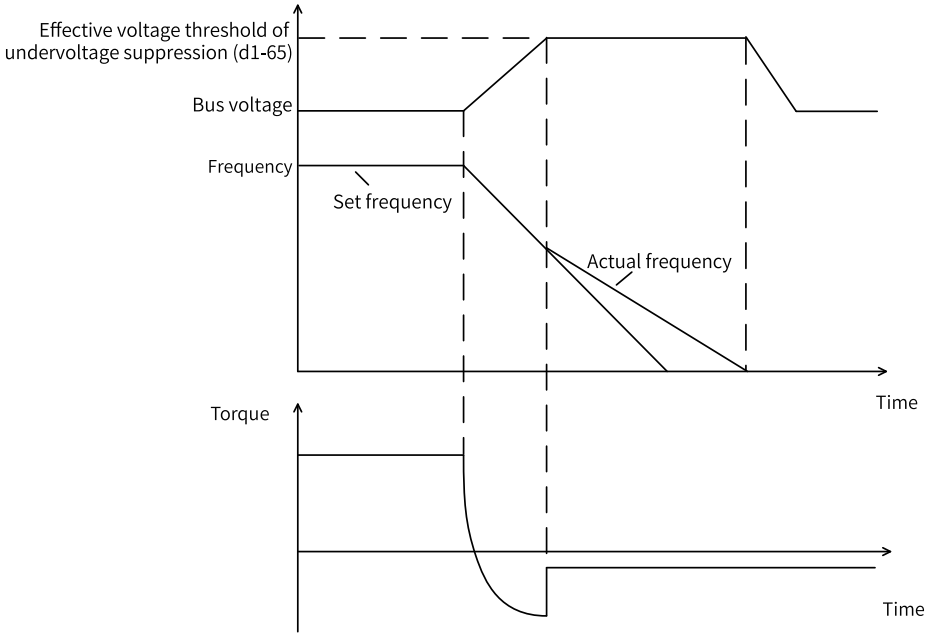


Figure 10-35 Overvoltage suppression control process

Related parameters

Param.	Name	Description	Default value	Range
d1-54 (F2-39)	Overvoltage suppression enable	Defines whether overvoltage suppression is enabled. Value description: bit0: Overvoltage suppression enable in V/f mode 0: Disable 1: Enable - After overvoltage suppression is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setpoint. bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable - After overvoltage suppression is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setpoint. Note: When a braking resistor, braking unit, or regenerative unit is used, set this parameter to 0. Otherwise, the deceleration time may be prolonged. F2-39 has the same function as d1-54. When F2-39 is changed, d1-54 is updated synchronously.	0x0	bit0: Overvoltage suppression enable in V/f mode • 0: Disable • 1: Enable bit1: Overvoltage suppression enable in vector mode • 0: Disable • 1: Enable
d1-55 (F2-40)	Voltage threshold for overvoltage suppression	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. F2-40 has the same function as d1-55. When F2-39 is changed, d1-54 is updated synchronously.	770.0 V	600.0 V to A3-57
d1-56	Effective voltage threshold for overvoltage suppression	Displays the actual effective voltage for triggering overvoltage suppression. This parameter is automatically obtained by the system and cannot be modified. When the bus voltage is greater than d1-56, overvoltage suppression function is activated.	770.0 V	600.0 V to A3-57
d1-57	Overvoltage suppression Kp adjustment	Defines the proportional coefficient of the overvoltage suppression control loop. Increasing this setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly.	100%	0% to 1000%
d1-58	Overvoltage suppression Ki adjustment	Defines the integral coefficient of the overvoltage suppression control loop. Increasing this setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly.	100%	0% to 1000%

Precautions

- Set d1-55 to a high value upon excessively high grid voltage fluctuation, preventing false triggering of overvoltage control. It is recommended to verify the trigger voltage during application.
- Use the overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value lower than the overvoltage suppression voltage threshold or disable overvoltage suppression.
- When a common bus is used, enable overvoltage suppression control of an inverter with the highest inertia, keeping the overvoltage suppression function of others disabled.
- In the torque control mode, take cautions when enabling overvoltage suppression. If the torque cannot adjust the system bus voltage, the torque may be adjusted to the limit value.
- In the case of active loads, such as lifting loads, do not enable overvoltage suppression because overvoltage suppression can limit the generating torque, which may cause motor runaway accidents and result in serious damage.

Application instance

In applications with short deceleration time and high motor inertia, overvoltage fault may occur during deceleration or speed overshoot.

Overvoltage suppression, which is disabled by default, is used to reduce the power generation by suppressing the generating torque to prevent the bus voltage from rising. During suppression, the bus voltage is kept at d1-56 [Actual effective voltage threshold of overvoltage suppression]. You can reduce this threshold through d1-55 [Voltage threshold of overvoltage suppression].

If the bus voltage cannot be suppressed effectively, increase d1-57 [Overvoltage suppression Kp adjustment] and d1-58 [Overvoltage suppression Ki adjustment] properly to accelerate the limit on the generating power and improve the dynamic response of the bus voltage.

10.1.8 Undervoltage Suppression (Vector)

Application scenarios

When the power supply or DC bus encounters instantaneous power failure in FVC or SVC mode, undervoltage can occur if the fault is not handled timely, which can cause the motor to coast to stop. After undervoltage suppression function is enabled, undervoltage can be suppressed in a short period of time, preventing stop upon instantaneous power failure. When the power supply or DC bus encounters long-term power failure, you need to enable undervoltage suppression to compensate for the bus energy loss until all motors stop reliably.

Operating principles

After the bus voltage falls below the undervoltage suppression threshold, the motor decelerates and enters the generating state to compensate for energy loss, stabilizing the voltage in the DC bus.

The following figures show the undervoltage suppression process.

- If d1-63 is set to 1 [Undervoltage suppression], normal operation applies after the voltage is recovered. If the operating frequency is higher than the sum of d1-72 [Minimum frequency of undervoltage suppression (vector)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (vector)] at the moment when undervoltage occurred, undervoltage suppression applies. If the operating frequency is higher than d1-72 upon the moment when the bus voltage is recovered, the motor accelerates to the set speed based on the set acceleration time, as shown by curve ① in the following figure.
- When d1-63 is set to 2 [Decelerate to stop], the drive decelerates to stop after the voltage is recovered. If the operating frequency is lower than the sum of d1-72 [Minimum frequency of undervoltage suppression (SVC)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (SVC)] at the moment when undervoltage occurred, the drive decelerates to stop based on d1-69 [Decelerate-to-stop time upon undervoltage] until the stop operation is done, on matter whether the bus voltage is recovered.

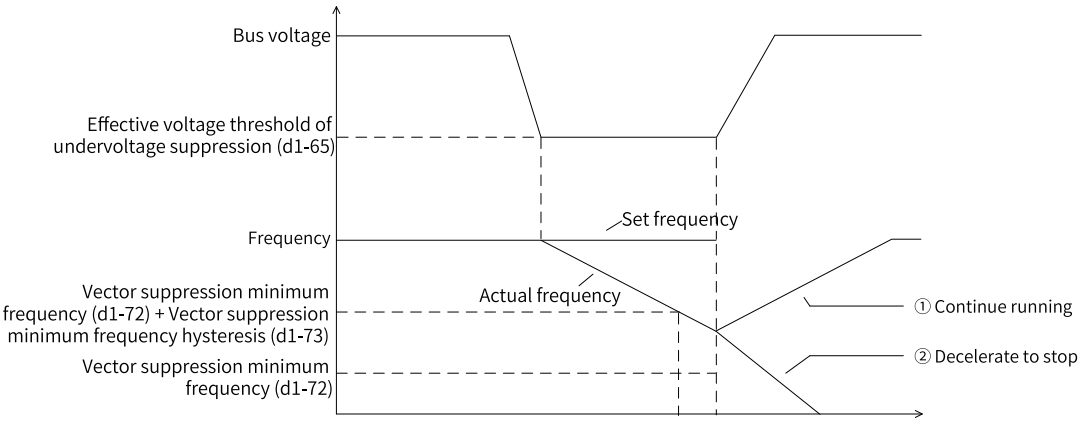


Figure 10-36 Undervoltage suppression, normal operation after voltage recovery, and decelerate-to-stop

- When d1-63 is set to 1 [Undervoltage suppression], undervoltage suppression applies when the bus voltage falls below d1-65 [Actual effective voltage threshold for undervoltage suppression] and the operating frequency exceeds the sum of d1-72 [Minimum frequency of undervoltage suppression (SVC)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (SVC)]. If the bus voltage is not recovered when the operating frequency reaches d1-72, a fault indicating the undervoltage suppression limit has been reached can be reported.

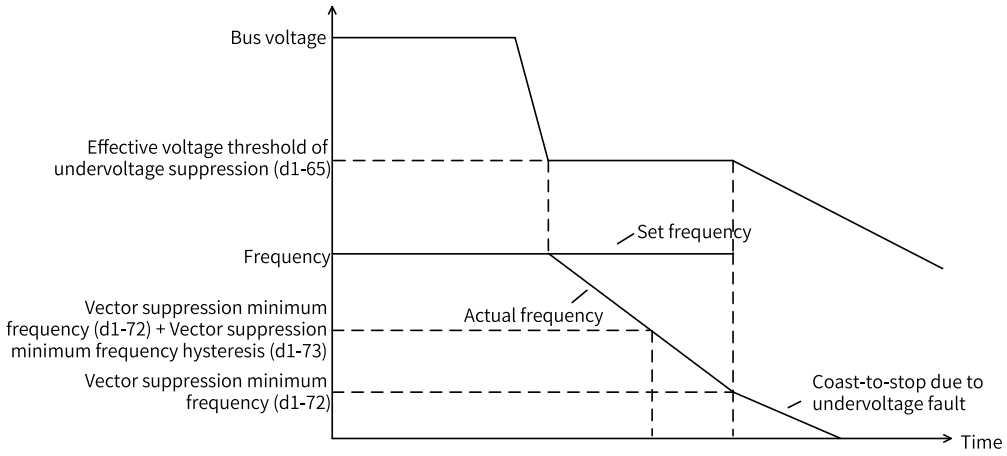


Figure 10-37 Operating frequency lower than minimum frequency for undervoltage suppression during undervoltage suppression

- When d1-63 is set to 1 [Undervoltage suppression], undervoltage suppression does not apply and the drive continues running when the bus voltage falls below d1-65 [Actual effective voltage threshold for undervoltage suppression] and the operating frequency falls below the sum of d1-72 [Minimum frequency of undervoltage suppression (SVC)] and d1-73 [Minimum frequency hysteresis of undervoltage suppression (SVC)]. The undervoltage is reported only after the bus voltage falls below A3-56 [Undervoltage threshold]. In this case, the drive stops.

Related parameters

Param.	Name	Description	Default value	Range
d1-63 (F2-43)	Response upon undervoltage	Defines the response when the bus voltage reaches the undervoltage suppression threshold due to power failure. d1-63 [Response upon undervoltage] is mapped to F2-43 in group F. These two parameters have the same function. 0: Not respond 1: Undervoltage suppression applied, normal operation resumes after voltage covery - The bus is kept at the undervoltage suppression threshold through the regenerative energy generated during deceleration of the motor, keeping the drive continue operating without stop for a short period of time. If the bus voltage is recovered during this period, the motor accelerates to the target speed based on the acceleration time. 2: Decelerate to stop - When the bus voltage fall below the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. If the bus voltage is recovered during this period, the motor still stops.	0 [Not respond]	0: Not respond 1: Undervoltage suppression applied, normal operation resumes after voltage recovery 2: Decelerate to stop after voltage recovery
d1-64 (F2-44)	Voltage threshold for undervoltage suppression	Defines the voltage threshold for triggering undervoltage suppression. d1-64 [Voltage threshold of undervoltage suppression] is mapped to F2-44 in group F. These two parameters have the same function. Note: Defines the response when the bus voltage is lower than the undervoltage suppression threshold due to power failure.	430.0 V	A3-55 to 500.0 V

Param.	Name	Description	Default value	Range
d1-65	Actual effective voltage threshold for undervoltage suppression	Displays the actual effective voltage that triggers undervoltage suppression. This is a read-only variable that cannot be modified.	430.0 V	A3-55 to 500.0 V
d1-66	Undervoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-66 [Undervoltage suppression Kp adjustment].	100%	0% to 1000%
d1-67	Undervoltage suppression Ki adjustment	Defines the proportion coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation, which is the product of Ki and d1-67 [Undervoltage suppression Ki adjustment].	100%	0% to 1000%
d1-72	Minimum frequency of undervoltage suppression (vector)	Defines the minimum frequency of undervoltage suppression in SVC mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit arrival] will be reported.	3.00 Hz	0.00 to 10.00 Hz
d1-73	Minimum frequency hysteresis for undervoltage suppression (SVC)	Defines the minimum frequency hysteresis for undervoltage suppression in SVC mode. Note: The undervoltage suppression state can be applied only when the actual speed is higher than the sum of d1-72 [Minimum frequency for undervoltage suppression] and d1-73 [Minimum frequency hysteresis for undervoltage suppression]. When the speed during undervoltage suppression is lower than d1-72 [Minimum frequency for undervoltage suppression], E193.1 [Undervoltage suppression limit arrival] will be reported.	3.00 Hz	0.00 to 10.00 Hz

Precautions

Set d1-64 to a low value upon excessively high grid voltage fluctuation. This is to prevent undervoltage control to be triggered improperly. It is recommended to verify the trigger voltage during application.

Application instance

When the grid voltage is unstable, undervoltage that causes stop may easily occur, leading to process issues. In this case, enable undervoltage suppression through d1-63 to decelerate the motor, stabilizing the bus voltage.

To restart after the bus recovers, you can set d1-63 to "1: Undervoltage suppression". The normal operation applies after the voltage is recovered.

To allow normal stop after the bus is recovered, set d1-63 to "2: Decelerate to stop". In this way, the motor decelerates to stop after the voltage is recovered.

When undervoltage suppression is active, the motor decelerates to enter the generating state, keeping the bus voltage at the value of d1-65 [Effective voltage threshold of undervoltage suppression]. To allow the bus voltage to maintain at a higher level, increase the value of d1-64 [Voltage threshold of undervoltage suppression].

If the bus voltage cannot be maintained even if the load is proper and the motor is in the generating state, increase the values of d1-66 [Undervoltage suppression Kp adjustment] and d1-67 [Undervoltage suppression Ki adjustment] properly.

10.1.9 Energy-Saving Control (Vector)

Application scenarios

In applications requiring high energy conservation, you can enable energy-saving control in FVC or SVC mode to reduce the energy consumption during no-load or low-load operation of the asynchronous motor.

Operating principles

Energy consumption during no-load and low-load operation of the asynchronous motor can be reduced through reducing the excitation current of the motor.

The following figure shows the energy-saving control function.

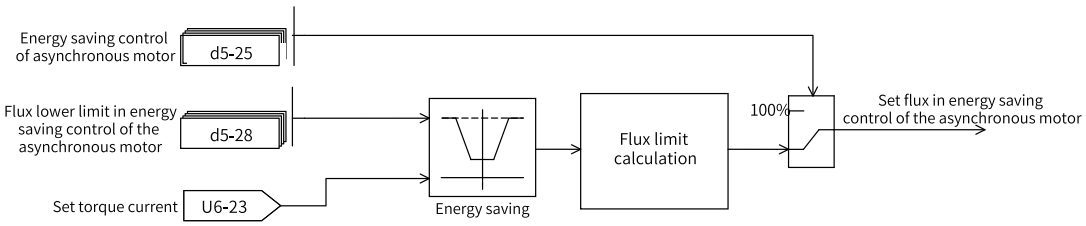


Figure 10-38 Energy-saving control

Related parameters

Param.	Name	Description	Default value	Range
d5-25	Energy-saving control selection	Defines whether to enable energy-saving control for the asynchronous motor in the vector control mode. 0: Disable - Energy-saving control is disabled. 1: Enable - Energy-saving control is enabled. After energy-saving control is enabled, the current in no-load or low-load mode can be reduced.	0 [Disable]	0: Disable 1: Enable
d5-28	Flux lower limit in energy-saving control of asynchronous motor	Defines the flux lower limit in energy-saving control of the asynchronous motor. This parameter defines the minimum flux allowed in energy-saving control. The lower the value is, the more energy will be saved during no-load operation. However, an excessively low setpoint can affect the dynamic response during with-load operation.	50.0%	5.0% to 100.0%

Precautions

The function is applicable to application with stable loads. In applications where the sudden loading/unloading occurs frequently, enable this function with caution.

10.1.10 Overexcitation

Application scenarios

For high-inertia loads, over-excitation gain in the vector control mode can speed up motor deceleration.

Operating principles

Increasing the over-excitation current helps consume the excess energy on the motor, which can accelerate deceleration. After over-excitation is enabled, over-excitation control is activated in the motor power generation state.

Related parameters

Param.	Name	Default value	Value range	Description
d0-39	Over-excitation selection (vector)	0 [Inactive]	0: Inactive 1: Active	Defines whether over-excitation is enabled in vector control.
d0-40	Over-excitation current (vector)	100%	0% to 800%	Defines the target current after over-excitation is activated in vector mode, where the value 100% corresponds to the rated current of the motor.

Precautions

The higher the over-excitation current, the quicker the motor deceleration can be. However, over-excitation in the vector control mode can increase the output current of the drive and motor loss.

10.1.11 Current Loop

Application scenarios

In the FVC or SVC control mode, the current loop acts as the regulator of the inner loop, which serves to make the output current follow the reference current closely. The reference current is the output value of the outer loop regulator. Ensure that the maximum allowable current is obtained during dynamic speed change to accelerate dynamic response.

Operating principles

General principles:

The PID output of the speed loop is the input of the current loop. The output current of the drive is the inputted as negative feedback. The difference between the input and feedback is inputted to the PI controller of the current loop to adjust the final voltage output, achieving current control to improve current stability and system performance.

Current loop parameters are auto-tuned without the need of modification.

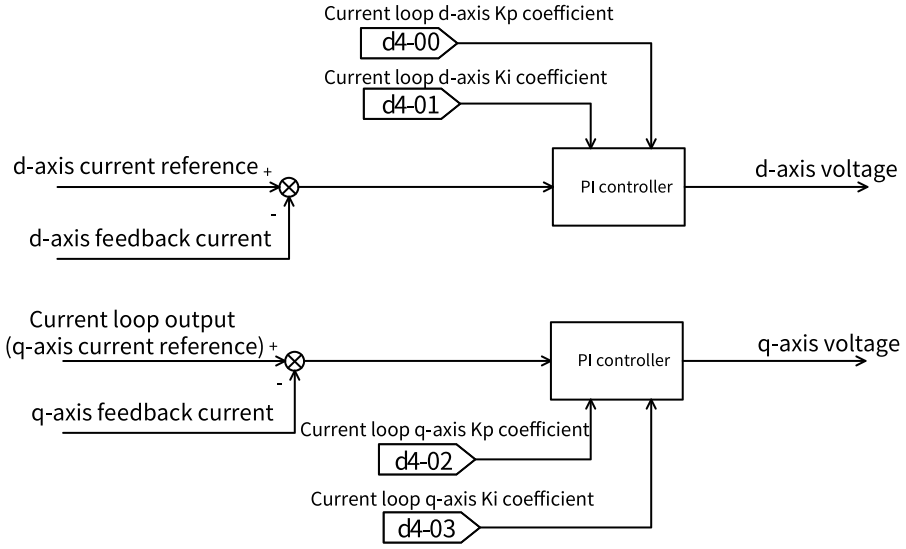


Figure 10-39 Current loop diagram

Adaptive PI parameter of current loop:

Adaptive PI parameters for current loop is suitable for adaptive adjustment of current loop parameters under heavy-duty conditions.

When the current exceeds d4-06 [Adaptive lower limit of current loop Kp] but lower than or equal to d4-05 [Adaptive upper limit of current loop Kp], the effective d-axis Kp coefficient and q-axis Kp coefficient in the current loop are obtained through calculation. Calculation method: The adaptive

coefficient is calculated linearly based on the actual current. The effective d-axis Kp coefficient and q-axis Kp coefficient is the product of the adaptive coefficient and Kp coefficient setpoint (d4-00 and d4-02).

When the current exceeds d4-05 [Adaptive upper limit of current loop Kp], the effective d-axis Kp coefficient of the current loop is the product of d4-00 [Current loop d-axis Kp coefficient] and d4-04 [Adaptive upper limit coefficient of current loop Kp], and the q-axis Kp coefficient is the product of d4-02 [Current loop q-axis Kp coefficient] and d4-04 [Adaptive upper limit coefficient of current loop Kp].

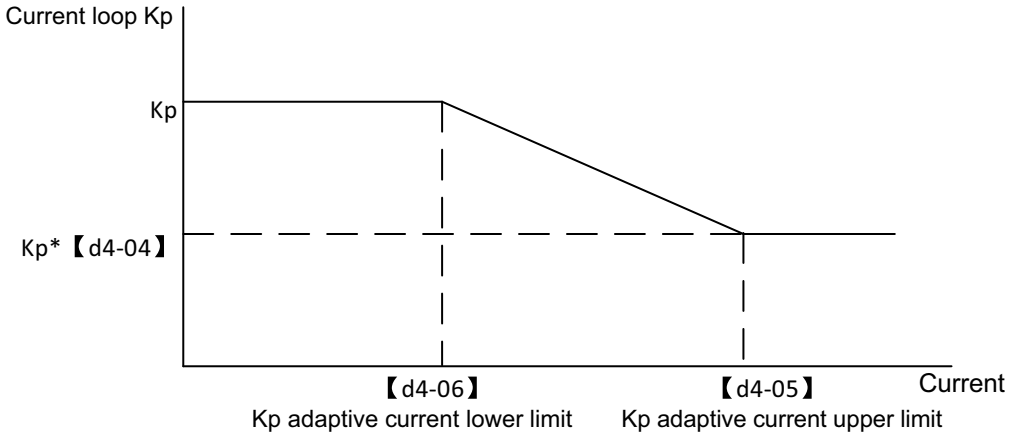


Figure 10-40 Adaptive Kp of current loop

Application instance

In heavy-duty applications, current oscillation may occur due to excessively high current loop parameters. In this case, you can limit the current loop parameters through d4-05 and d4-06 after the current exceeds d4-05, and adjust the intensity of the current loop through d4-04, helping restore the current loop to the normal operation state.

Related parameters

Param.	Name	Default value	Value range	Description
d4-00	Current loop d-axis Kp coefficient	100%	1 to 1000 %	Defines the d-axis Kp coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-01	Current loop d-axis Ki coefficient	100%	1 to 1000 %	Defines the d-axis Ki coefficient of current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-02	Current loop q-axis Kp adjustment	100%	1 to 1000 %	Defines the q-axis Kp coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.

Param.	Name	Default value	Value range	Description
d4-03	Current loop q-axis Ki adjustment	100%	1 to 1000 %	Defines q-axis Ki coefficient of the current loop. Note: The higher the value, the faster the torque response. However, an excessively high setpoint may cause current oscillation.
d4-04	Kp adaptive upper limit coefficient of current loop	50%	1 to 100 %	Defines the Kp adaptive upper limit coefficient of current loop.
d4-05	Kp adaptive current upper limit of current loop	200%	d4-06 to 300%	Defines the adaptive current upper limit of current loop.
d4-06	Kp adaptive current lower limit of current loop	100%	10% to d4-05	Defines the adaptive current lower limit of current loop.

10.1.12 Droop Control

Application scenarios

In applications such as belt conveyors, roller conveyors, or continuous casting machines, the load may be driven by multiple motors. Slight deviation can exist among motors at the same speed reference due to different mechanical characteristics, which may result in significant difference in the output torque or even inter-motor dragging.

Droop control can be applied to all motors to enable automatic even load distribution between motors, requiring no communication between motors. The motor with a high speed carries more torque. The speed reference of the motor is reduced automatically through negative feedback, achieving torque distribution to other motors.

Droop control characteristics:

- Simple application without need for communication between motor controllers
- Multiple motors can be connected rigidly or flexibly to drive the same load.
- When redundant operation is needed in the case of multiple motors, the faulty device can be stopped easily without affecting operation of other devices.
- The speed regulation range is usually not greater than the rated slip of the motor.
- The speed cannot be followed accurately. The steady-state error is present between the actual speed and speed reference. The difference value is in proportion to the load.
- Accurate load distribution is not available during dynamic process.

Operating principles

Droop control is a control method that uses the output torque of the motor to generate negative feedback, reducing the motor speed reference. See the block diagram below.

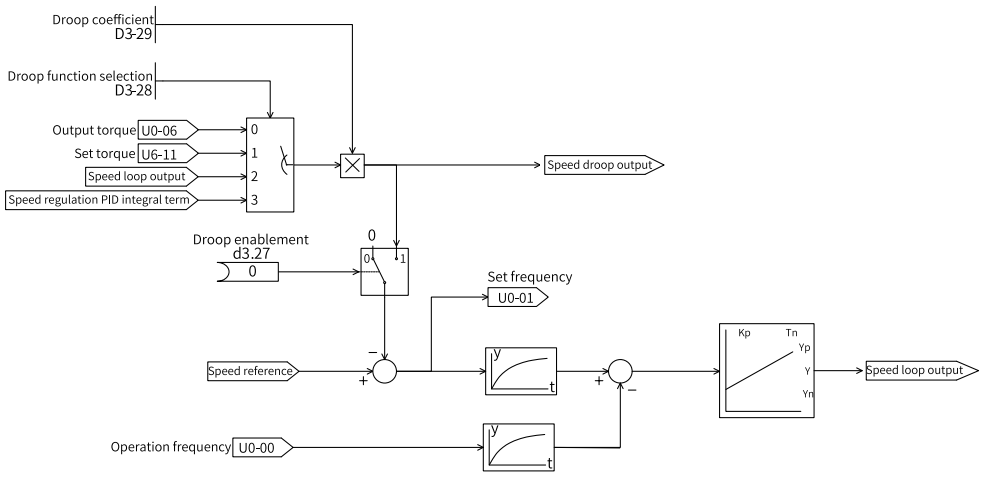


Figure 10-41 Block diagram of droop control

Four droop sources are available in droop control, which are output torque, torque reference, speed loop output, and speed loop Ti term output. The droop source can be set through d3-28. The relationship among the four droop sources is shown in the following diagram.

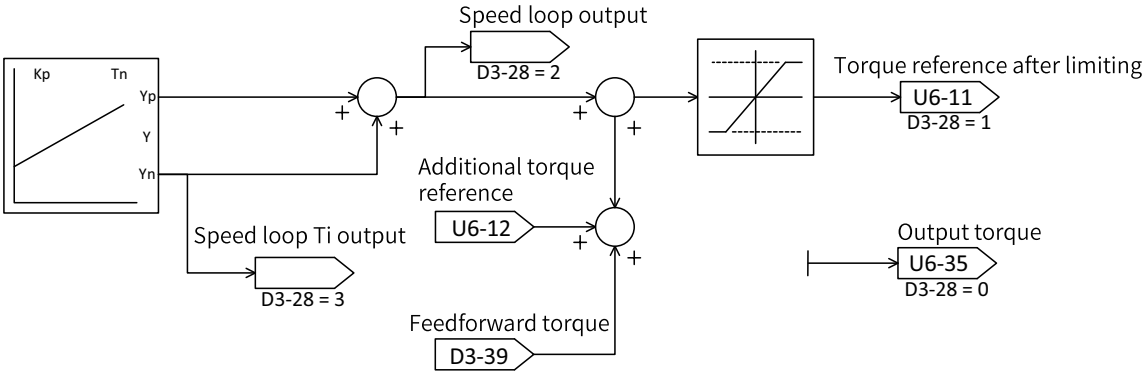


Figure 10-42 Four different droop sources

Related parameters

Param.	Name	Description	Default value	Range
d3-27	Droop function	Enables/disables the droop function in speed control. Value description: 0:Disable 1:Enable Note: In applications where multiple motors drive the same load, enabling this function can affect the speed control accuracy during load distribution of multiple motors.	0	0 to 1
d3-28	Droop source	Defines the droop source. Value description: 0: Output torque - The actual output torque of the motor is used as the droop source. 1: Torque reference - The final torque reference of the motor is used as the droop source. 2: Speed loop output - The output of the speed loop is used as the droop source. 3: Speed loop Ti term output - The integral item of the speed loop is used as the droop source.	1	0: Output torque 1: Torque reference 2: Speed loop output 3: Speed loop Ti term output
d3-29	Droop coefficient	Defines the droop coefficient. The higher the droop coefficient, the better the droop performance is, but an excessively high setpoint can affect the speed accuracy and lead to speed oscillation. Note: Droop speed change = U0-06 [Output torque] x d3-29 [Droop coefficient] x Rated frequency of the motor	0.0%	0.0% to 50.0%

Application case

In a marine elevating platform,12 motors are connected to the same rack through the gearbox (reduction ratio 80:1), and the rack is welded to the jack-up leg. The host controller uses the PLC to set different speeds to raise the jack-up leg. Difference in the manufacturing of the gearbox and rack can result in the situation where some motors are connected tightly but some motors need to run for a certain period of time to come into contact with the rack.

In general speed control mode, the motor output with good contact is in overload state, and the motor with poor contact is in no-output state or the load is being driven in the reverse direction. The motor reducer that runs under heavy duty for a long time may be easily damaged, leading to a fault.

In this case, the output speed accuracy and dynamic response requirements are not high. However, the system must be reliable if the motor or AC drive is damaged. This can be achieved by using the droop function.

Operation procedure:

1. Enable droop function for all AC drives by setting d3-27 to 1.

2. Set d3-29 to a value equal to the rated slip of the motor.

10.1.13 Flux Control

10.1.13.1 Field Weakening Control of Asynchronous Motor

Application scenarios

In FVC or SVC control, field weakening control of the asynchronous motor is triggered when the acceleration process of the motor requires a voltage output capacity higher than the maximum value or the bus voltage is insufficient to support current operating speed.

Operating principles

When the motor operating speed increases, the back EMF increases accordingly. When the back EMF exceeds the maximum output voltage, the drive cannot adjust the current, which means the motor is out of control. In this case, you can reduce the magnetic flux to reduce the back EMF and prevent motor runaway, so that the motor speed can be increased.

The maximum available voltage is calculated based on the bus voltage, and a voltage margin (d5-00) is reserved to ensure the current regulation capability. The maximum output voltage is calculated as follows.

$$V_{max} = \frac{Bus\ voltage}{\sqrt{2}}(100\% - [d5 - 00])$$

The voltage margin for field weakening (d5-00) can be adjusted manually when the output voltage capability is insufficient.

When the maximum output voltage is reached and the output frequency continues to increase, the field weakening range is entered. In this case, the back EMF is reduced based on the set magnetic flux according to the built-in curve, preventing motor runway during high-speed operation.

As shown in the following figure, the output voltage (Vout) has reached the maximum output voltage (Vmax). The frequency continues to increase and enters the field weakening range. After entering this range, the flux decreases and the output voltage (Vout) no longer increases.

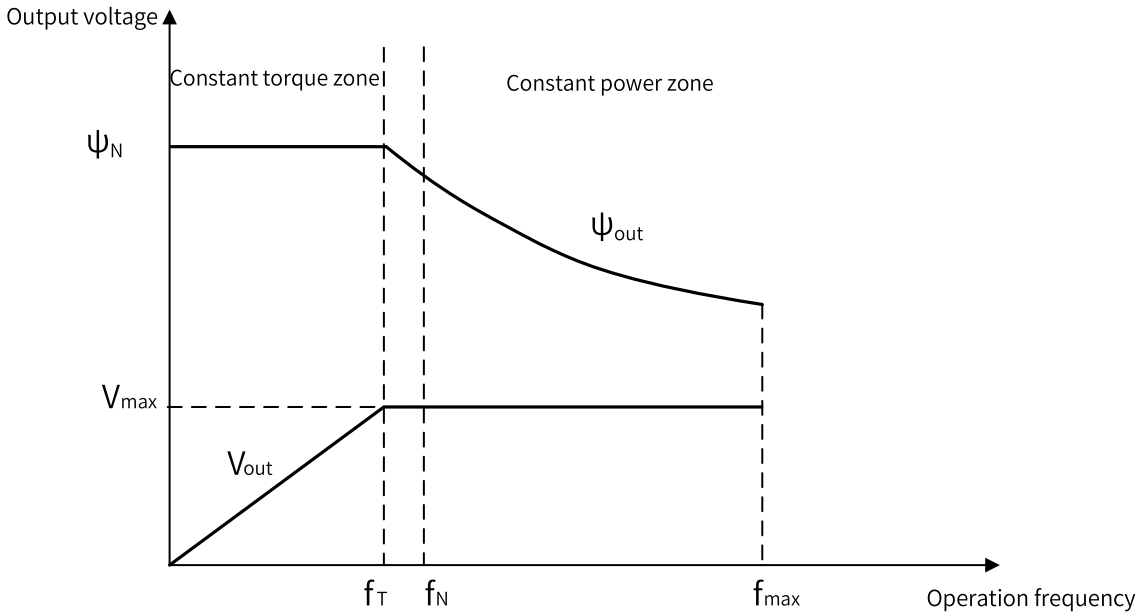


Figure 10-43 Flux frequency characteristics of the motor under voltage constraints

The following figure shows the process for obtaining the final flux reference in the field weakening phase after the maximum output voltage is obtained.

Rated flux of motor x Rated flux tuning factor = Actual applied flux of motor

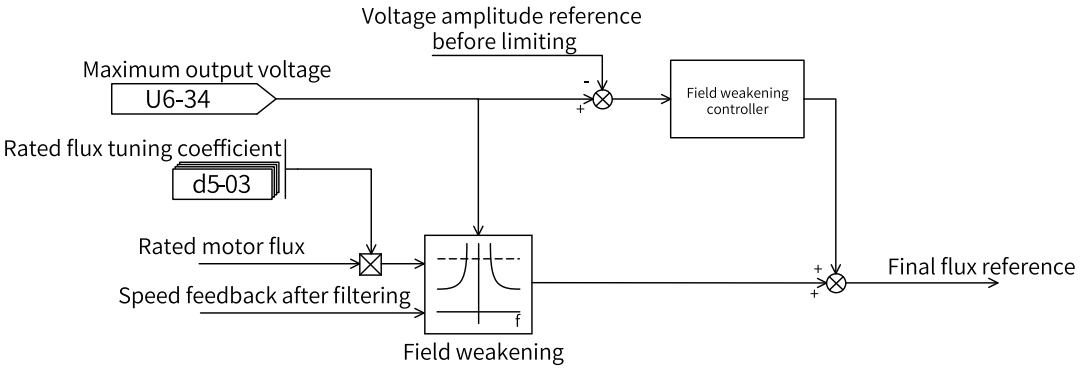


Figure 10-44 Calculation process for final flux reference

Related parameters

Param.	Name	Description	Default value	Range
d5-00	Voltage margin for field weakening	Defines the voltage margin for field weakening. Note: Decreasing this value improves voltage utilization, allowing lower current at the same load in the field weakening range. Note that an excessively low setpoint can affect dynamic performance.	3.0%	0.1% to 50.0%
d5-03	Rated flux tuning factor	Defines the flux tuning factor of the asynchronous motor. Note: This parameter is used to adjust the operation flux of the asynchronous motor. Decreasing the setpoint can cause the motor to enter the under-excitation state. Increasing the setpoint can cause the motor to enter the over-excitation state.	100.0%	50.0% to 200.0%

Precautions

Do not set the reserved voltage margin (d5-00) to an excessively high value. Otherwise, the load capacity of the motor at high speed can be affected.

10.1.13.2 Field Weakening Control of Synchronous Motor

Application scenarios

In FVC or SVC control, field weakening control of the synchronous motor is triggered when the acceleration process of the motor requires a voltage output capacity higher than the maximum value or the bus voltage is insufficient to support current operating speed.

Operating principles

The motor back EMF increases with the operating speed of the motor. When the back EMF exceeds the maximum voltage that can be output by the drive, the synchronous motor enters field weakening control. In the field weakening control mode, the synchronous motor reduces the flux linkage of the motor stator through increasing the demagnetization current, which also reduces the motor back EMF voltage. Increasing the demagnetization current of the synchronous motor can result in an increase in the motor output current. The higher the motor speed, the higher the demagnetization current can be.

Related parameters

Param.	Name	Description	Default value	Range
d5-00	Voltage margin for field weakening	Defines the voltage margin for field weakening. Note: Decreasing this value improves voltage utilization, allowing lower current at the same load in the field weakening range. Note that an excessively low setpoint can affect dynamic performance.	3.0%	0.1% to 50.0%
d5-17	Demagnetization current limit	Used to limit the demagnetization current range of synchronous motors to prevent faults such as overload. The value 100% corresponds to the rated current of the motor.	300%	0% to 500%

10.2 Asynchronous Motor V/f Control

10.2.1 Control Mode

Application scenarios

The V/f control mode is applicable to asynchronous motor control applications.

Operating principles

The frequency reference curve is regulated through droop control algorithm based on the user-defined speed reference curve. This curve, after being regulated through overcurrent suppression, overcurrent suppression, undervoltage suppression, and slip compensation, generates the final output frequency. This output frequency, after being regulated through the V/f curve, generates the output voltage reference. The final voltage magnitude is outputted after being regulated through energy-saving control and over-excitation control. The output frequency, after being regulated through oscillation suppression, is converted to the final frequency reference. The final frequency reference is then regulated through the integral action to generate the voltage phase angle to be outputted to the drive.

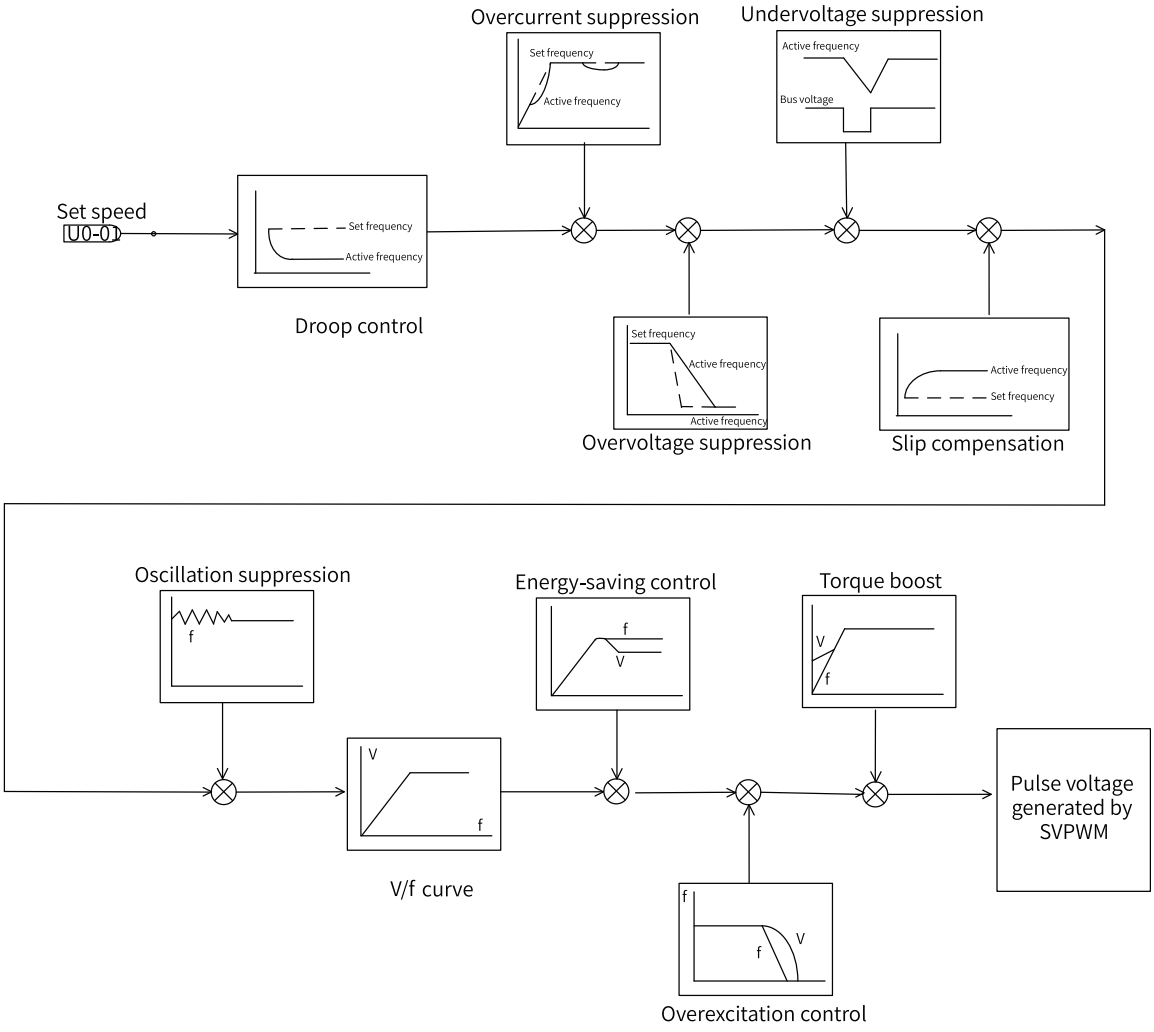


Figure 10-45 Schematic diagram of V/f control mode

10.2.2 V/f Curve Selection

Application scenarios

There are three types of V/f curves:

1. Linear V/f curve: When the motor runs at frequencies lower than the rated frequency, a linear relationship is kept between the output voltage and the frequency. It is applicable to common constant-torque load.
2. Multi-point V/f curve: It is applicable to special loads such as dehydrators and centrifuges. The relationship between the voltage and frequency points can be set based on the motor characteristics.
3. Decoupled V/f curve: It is applicable to induction heating, inverter power supply, and torque motor control. In this mode, the output voltage of the drive is independent of the frequency. You can set the output frequency and output voltage as needed.

Operating principles

1. Linear V/f curve: When the motor runs at frequencies lower than the rated frequency, a linear relationship is kept between the output voltage and the frequency.
2. Multi-point V/f curve: You can set d2-02...d2-10 to define the V/f curve frequency point and voltage point. The multi-point V/f curve needs to be set according to the motor load characteristics. The three voltage points and frequency points should meet the following conditions: V1 ≤ V2 ≤ V3 and F1 < F2 < F3. Different voltage and frequency points are connected by a polyline.
3. Decoupled V/f curve: The output frequency is determined by the frequency source. The output voltage is set by d2-48. If the set decoupled voltage changes, you can set the V/f decoupled voltage ramp-up/down time through d2-50/d2-51 to prevent sudden voltage change. You can set the frequency source through d2-52 [RFG time selection for V/f decoupled frequency] to determine whether the frequency source reaches the setpoint per a carrier frequency cycle or per the ramp-up/down curve.

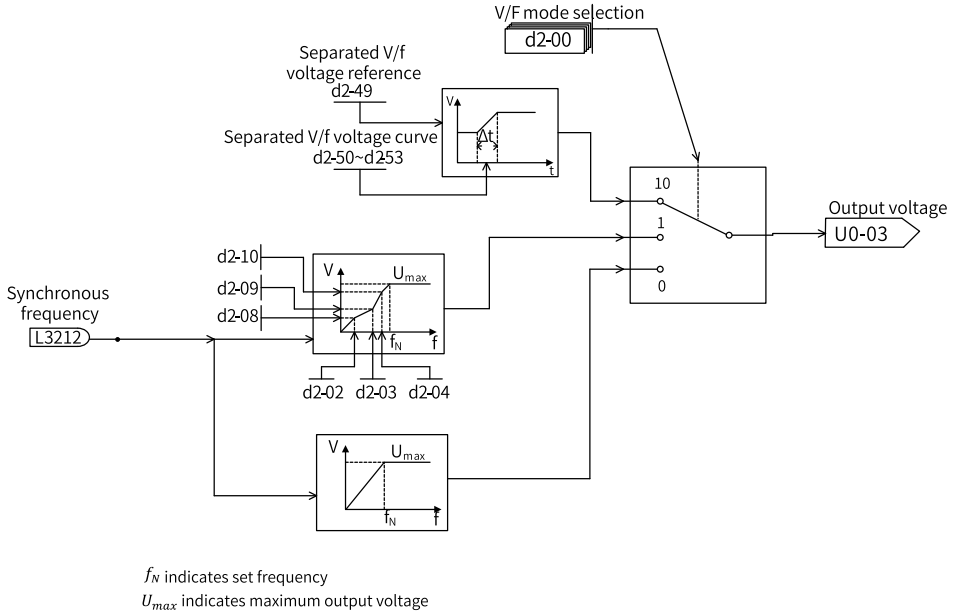


Figure 10-46 Operating principle of V/f curve

Note: F_N indicates the set frequency, and U_{max} indicates the maximum output voltage.

Related parameters

Param.	Name	Description	Default value	Range
d2-00	V/f curve type	0: Linear V/f curve 1: Multi-point V/f curve 10: Decoupled V/f	0	0: Linear 1: Multi-point 10: Decoupled V/f
d2-01	Multi-point curve source	Defines the multi-point curve source. 0: Three-point V/f curve - The V/f curve is set through d2-02...d2-04 and d2-08...d2-10.	0	0
d2-02	Frequency point 1 of multi-point V/f curve	Defines frequency point 1 of a multi-point V/f curve.	0.0 Hz	0.0 Hz to d2-03
d2-03	Frequency point 2 of multi-point V/f curve	Defines frequency point 2 of a multi-point V/f curve.	0.0 Hz	d2-02 to d2-04
d2-04	Frequency point 3 of multi-point V/f curve	Defines frequency point 3 of a multi-point V/f curve.	0.0 Hz	d2-03 to 600.0 Hz
d2-08	Voltage point 1 of multi-point V/f curve	Defines voltage point 1 of a multi-point V/f curve.	0.0	0.0 to 1000.0 V
d2-09	Voltage point 2 of multi-point V/f curve	Defines voltage point 2 of a multi-point V/f curve.	0.0	0.0 to 1000.0 V
d2-10	Voltage point 3 of multi-point V/f curve	Defines voltage point 3 of a multi-point V/f curve.	0.0	0.0 to 1000.0 V
d2-47	Voltage upper limit in decoupled V/f	Defines the voltage upper limit of decoupled V/f. The setpoint is a percentage to the rated voltage of the motor.	100.0%	50.0% to 200.0%

Param.	Name	Description	Default value	Range
d2-48	Source of V/f decoupled voltage	Defines the target voltage reference source in decoupled V/f mode. 0: d2-49 - The decoupled voltage is defined by d2-49. 6: Multi-reference - Combinations of different DI terminal states correspond to different setpoints. For details, see the multi-reference module. 7: Simple PLC - The V/f decoupled voltage is set through simple PLC. For details, see the function description of simple PLC. 8: PID - The V/f decoupled voltage is set through PID. For details, see the PID function description. 9: Communication - The V/f decoupled voltage is set through communication. The operating frequency can be input through remote communication. The drive must be equipped with a communication card to communicate with the host controller. This mode is suitable for remote control or centralized control on multiple devices. Other: F connector - Read the connector value through setting the parameter No. of a floating-point connector. The value being read is used as the V/f decoupled voltage in speed control mode. It is used for extension of common sources. Connector selection will be jumped to if you set the parameter to "Other". In this case, click on a connector and the value of this connector will be used as the source for V/f decoupled voltage.	0	0 to 9
d2-49	Digital reference of V/f decoupled voltage	Defines the digital reference of V/f decoupled voltage. This parameter is valid when d2-48 is set to 0.	0 V	0 to C4-03
d2-50	Voltage ramp-up time in decoupled V/f	Defines the time required for the output voltage to rise from 0 to the rated motor voltage.	0.0s	0.0 to 1000.0s
d2-51	Voltage ramp-down time in decoupled V/f	Defines the time required for the output voltage to fall from the rated motor voltage to 0.	0.0s	0.0 to 1000.0s
d2-52	RFG time of V/f decoupled frequency	Defines the RFG time of V/f decoupled frequency. 0: RFG time set to 0 forcibly - The frequency reference ramp-up/down time is forcibly set to zero. 1: Preset RFG time - The ramp-up/down is set based on normal operation.	0	0 to 1
d2-53	Stop mode in decoupled V/f	Defines the stop mode in decoupled V/f. 0: Frequency and voltage reduced to 0 independently - The frequency/voltage is reduced to 0 independently based on the respective ramp-down time. 1: Frequency reduced after voltage reduced to 0 - The voltage is reduced to 0 based on the ramp-down time. Then the frequency is reduced to 0 based on the ramp-down-time. 2: Coast to stop - Coast-to-stop applies directly without observing the frequency/voltage ramp-down curve.	0	0 to 2

Precautions

In decoupled V/f and multi-point V/f control, note that the ratio of V/f cannot be excessively high. Otherwise, overcurrent may occur. For example, if voltage is set without a frequency reference, overcurrent may easily occur.

10.2.3 Overvoltage Suppression in V/f

Application scenarios

When the motor is in the deceleration (generating) state, if the power supply does not have the regenerative capacity, energy will be fed to the bus, causing the DC bus voltage to rise. This is especially true for motors with high inertia and short deceleration time.

If overvoltage exists in the DC bus, enable overvoltage suppression in V/f mode.

Operating principles

After enabling the overvoltage suppression through F2-39, when the bus voltage rises to "Bus overvoltage threshold - F2-40 [Voltage threshold for overvoltage suppression]", the drive stabilizes the bus voltage and suppresses voltage rise by adjusting the output frequency.

After this function is enabled, the actual deceleration time is prolonged automatically. If the actual deceleration time cannot meet the requirements, increase the value of d0-41 [Over-excitation gain in V/f] properly.

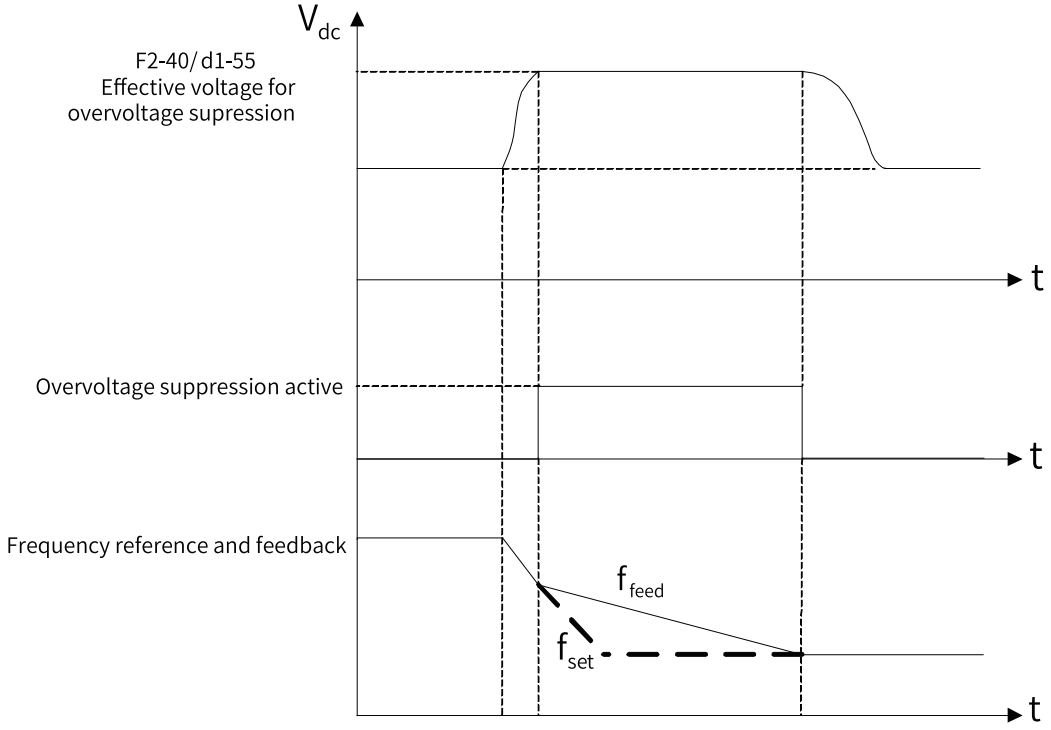


Figure 10-47 Operating principle of overvoltage suppression in V/f mode

Note: F_{feed} : Feedback frequency; f_{set} : Frequency reference

Related parameters

Param.	Name	Description	Default value	Range
F2-39/d1-54	Overvoltage suppression enable	Defines whether overvoltage suppression is enabled. Value description: bit0: Overvoltage suppression enable in V/f mode 0: Disable 1: Enable - After overvoltage suppression is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setpoint. bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable - After overvoltage suppression is enabled, the bus voltage rise is suppressed by limiting the generating torque or actual deceleration speed of the motor to prevent overvoltage. In this case, the deceleration time is longer than the setpoint. Note: When a braking resistor, braking unit, or regenerative unit is used, set this parameter to 0. Otherwise, the deceleration time may be prolonged. F2-39 has the same function as d1-54. After modifying F2-39, d1-54 is updated synchronously.	0x0	bit0: Overvoltage suppression enable in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression enable in vector mode 0: Disable 1: Enable
F2-40/d1-55	Voltage threshold for overvoltage suppression	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. If the grid voltage is excessively high and the overvoltage suppression voltage threshold is set to a value lower than the rectified bus voltage, the motor may accelerate or overcurrent may occur at startup. F2-40 has the same function as d1-55. When F2-40 is modified, d1-55 is updated synchronously.	770.0 V	600.0 V to A3-57
d1-56	Effective voltage threshold for overvoltage suppression	Displays the actual effective voltage for triggering overvoltage suppression. When the bus voltage is greater than this value, overvoltage suppression is activated.	770.0 V	600.0 V to A3-57

Param.	Name	Description	Default value	Range
d1-57	Overvoltage suppression Kp adjustment	Defines the proportional coefficient of the overvoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-57 [Overvoltage suppression Kp adjustment].	100%	0% to 1000%
d1-58	Overvoltage suppression Ki adjustment	Defines the proportion coefficient of the overvoltage suppression control loop, which is a percentage to Ki. Ki is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage, but may result in output frequency fluctuation. When the output frequency fluctuates greatly, reduce this value properly. The actual Ki gain is calculated through loop calculation, which is the product of Ki and d1-58 [Overvoltage suppression Ki adjustment coefficient].	100%	0% to 1000%

Precautions

- Use the overvoltage control function only when the power supply is lack of the regenerative capability.
- When using a braking resistor, set the braking voltage to a value lower than the voltage threshold of overvoltage suppression or disable overvoltage suppression.
- When a common bus is used, enable overvoltage suppression control of an inverter with the highest inertia, keeping the overvoltage suppression function of others disabled.
- Overvoltage suppression cannot be enabled for lifting-type active loads. When the load drops, the motor is in the generating state. Overvoltage suppression limits the power generation, which can prevent the motor from carrying the load effectively, leading to continuous acceleration and the risk of motor stall.
- If massive parallel motors are connected, increase the overvoltage suppression Kp. If the motor inertia is large, decrease the overvoltage suppression Kp.

Application case

When the braking resistor is not installed, set F2-39/d1-54 to "Enable", and set F2-40 (d1-55) according to the actual bus voltage. The remaining parameters can be set with the default values. When decelerate-to-stop is needed, you can enable overvoltage suppression to prevent the bus voltage from rising to an excessively high value.

10.2.4 Undervoltage Suppression in V/f Mode

Application scenarios

This function is mainly applicable to unstable power grid, preventing system stop due to undervoltage caused by transient voltage dip. It can also be used to prevent coast-to-stop of the

mechanism due to power failure, avoiding machining materials from be damaged, such as yarn breakage in the textile industry.

During undervoltage suppression, when the bus voltage detected is lower than the value of d1-65 [Actual effective voltage threshold for undervoltage suppression], the motor will be set to the generating state to compensate for the energy loss, stabilizing the DC bus voltage. When instantaneous power failure occurs on the power supply or DC bus, undervoltage can occur if the fault is not handled in time, resulting in coast-to-stop.

Operating principles

When undervoltage suppression is enabled (d1-63 ≠ 0), the undervoltage fault can be suppressed for a short period of time to allow power dip ride-through. When the power supply or DC bus is powered off for a long time, the drive keeps the bus voltage stable and suppresses voltage drop by adjusting the output frequency. Enabling the undervoltage suppression function can compensate for the energy loss of the bus until each motor stops reliably.

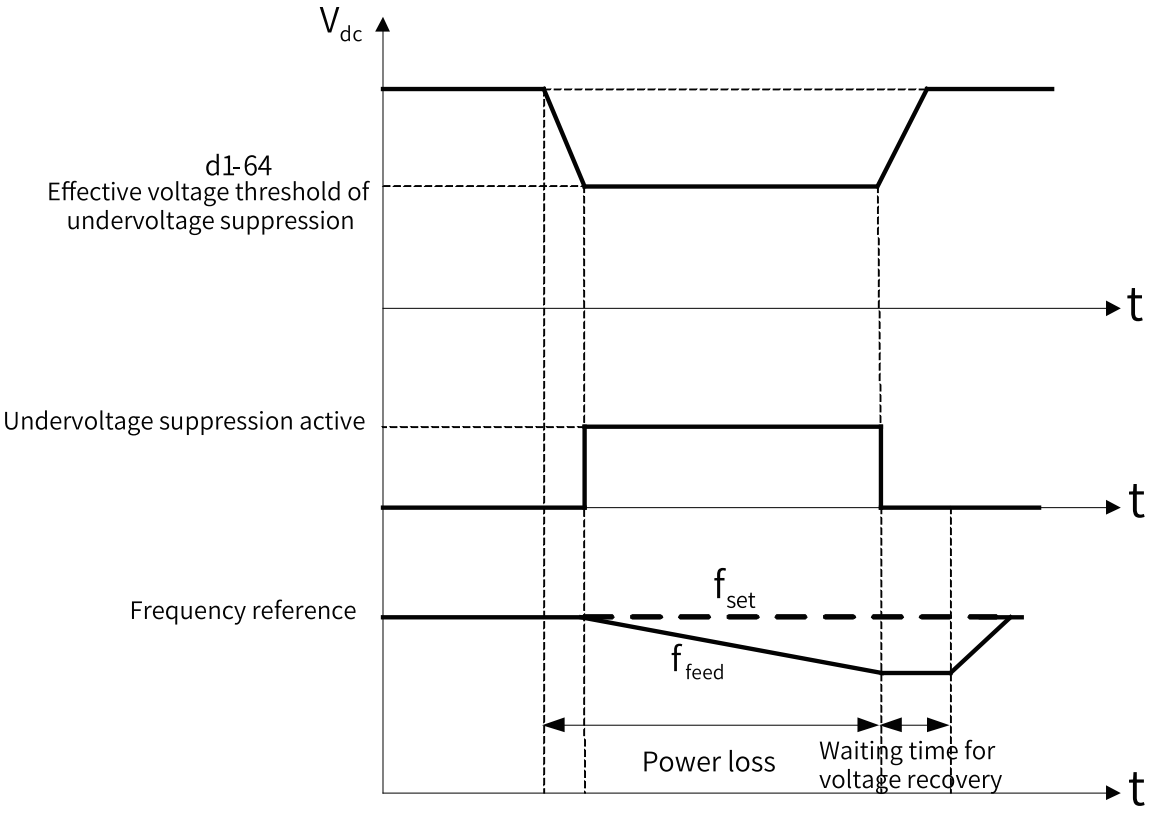


Figure 10-48 Schematic diagram of undervoltage suppression in V/f mode

Note

F_{feed} : feedback frequency, f_{set} : set frequency

Related parameters

Param.	Name	Description	Default value	Range
d1-63	Response upon undervoltage	Defines the response when the bus voltage reaches the undervoltage suppression threshold due to power failure. 0: Not respond 1: Undervoltage suppression applied, normal operation resumes after voltage recovery - The motor decelerates to feed energy back to the bus, keeping the bus voltage at the undervoltage suppression threshold, enabling short-term operation without shutdown. During this period, if the bus voltage recovers, the motor will accelerate to the target speed according to the acceleration time. 2: Decelerate to stop after voltage recovery - When the bus voltage drops to the undervoltage suppression threshold, the motor decelerates to stop based on the deceleration time defined by d1-69. During this period, even if the bus voltage recovers, the motor remains in the stop state until the stop process is done.	0	0 to 2
d1-64	Voltage threshold for undervoltage suppression	Defines the voltage threshold for triggering undervoltage suppression. When the bus voltage falls below the undervoltage suppression threshold due to power failure of the system, the drive responds accordingly based on the setting of d1-63.	430.0 V	A3-55 to 500.0 V
d1-65	Actual effective voltage threshold for undervoltage suppression	Displays the actual effective voltage that triggers undervoltage suppression. The actual voltage threshold is internally limited when the set undervoltage suppression threshold does not match the model.	430.0 V	A3-55 to 500.0 V

Param.	Name	Description	Default value	Range
d1-66	Undervoltage suppression Kp adjustment	Defines the proportional coefficient of the undervoltage suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. Increasing this setpoint improves the dynamic characteristics of the bus voltage. Note that an excessively high setpoint can result in fluctuation, oscillation, or even unusual noise. A low Kp value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Kp gain is calculated through loop calculation, which is the product of Kp and d1-66 [Undervoltage suppression Kp adjustment].	100%	0% to 1000%
d1-67	Undervoltage suppression Ki adjustment	Defines the integral coefficient of the undervoltage suppression control loop, which is a percentage to Ki. Ki is calculated through the loop calculation. Increasing this setpoint improves the dynamic characteristics of bus voltage. A high Ki value can result in output frequency fluctuation. When the output frequency fluctuates greatly during undervoltage suppression, reduce this setpoint properly. A low Ki value can result in unstable bus voltage during power failure, leading to undervoltage or overcurrent fault when the motor still rotates. The actual Ki gain is calculated through the loop calculation, which is the product of Ki and d1-67 [Undervoltage suppression Ki adjustment].	100%	0% to 1000%

Application case

The textile industry requires high yarn continuity. If the power grid is disconnected, the entire machine coasts to stop. In this case, all yarns are broken, making it difficult to restart production. Undervoltage suppression can effectively prevent the machine from rotating freely and breaking the yarn after power failure. When power failure occurs for a short period of time, the machine enters undervoltage suppression state and resumes normal production.

Configuration for this application case is as follows.

1. Connect the buses of the drives together and use a drive of a high power rating to power up other drives.
2. Select a motor with larger inertia and enable undervoltage suppression by setting d1-63 to 1.
3. During power failure, the motor with undervoltage suppression enabled is used as the master. The PLC calculates the matching speed of other motors, and the master motor decelerates to stop.
4. Bit4 of L1021 is the undervoltage suppression activation flag. This flag is set to 1 after undervoltage suppression is activated.

10.2.5 Overcurrent Suppression in V/f Mode

Application scenarios

In the case of rapid acceleration, deceleration, or overload, the current can easily exceed the limit, resulting in overcurrent. The overcurrent suppression function can prevent the current from exceeding the overcurrent threshold.

Operating principles

After overcurrent suppression is enabled, if the output current of the drive reaches the motor overcurrent suppression threshold during motor current rise, the output frequency of the drive changes to reduce the motor output current until the current falls below the overcurrent threshold where the frequency changes to the target frequency again. During common rapid acceleration, the actual acceleration time may automatically extend. During rapid deceleration, the deceleration time may also extend. The motor output frequency drops when a sudden heavy load is connected during steady-state operation.

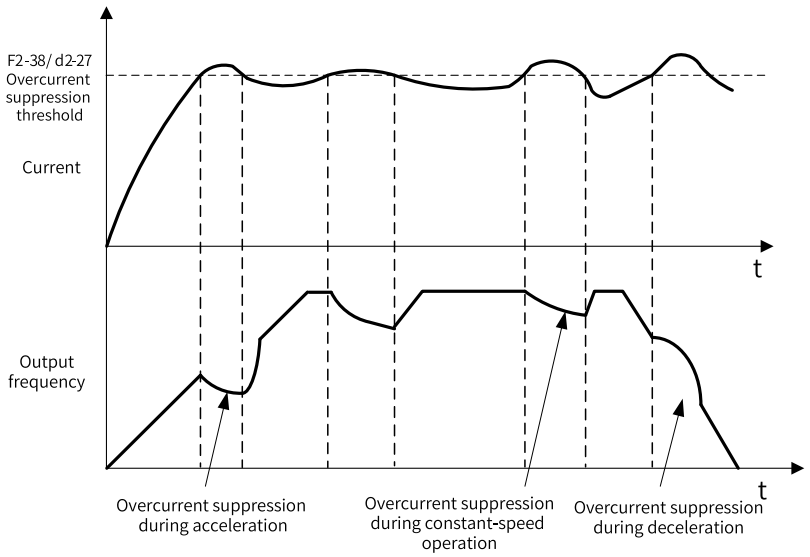


Figure 10-49 Schematic diagram of the overcurrent suppression control function

Related parameters

Param.	Name	Description	Default value	Range
F2-37/d2-26	Overcurrent suppression enable	Defines whether overcurrent suppression is enabled. d2-26 [Overcurrent suppression] is mapped to F2-37 in group F. These two parameters have the same function. Value description: 0: Disable 1: Enable Note: When the drive output current reaches the threshold set by d2-27, the drive slows down the acceleration or reduces the operation frequency to prevent continuous current rising, suppressing the overcurrent faults.	1	0: Disable 1: Enable
F2-38/d2-27	Overcurrent suppression threshold	Defines the current threshold for triggering overcurrent suppression. The setpoint is a percentage to the rated current of the motor. The actual effective overcurrent suppression threshold is also limited by A3-05 [Maximum current of the drive], whichever the smaller. F2-38 has the same function as d2-27. After F2-38 is modified, d2-27 is updated synchronously.	200%	80% to 300%
d2-28	Overcurrent suppression Kp adjustment	Defines the proportional coefficient of the overcurrent suppression control loop, which is a percentage to Kp. Kp is calculated through loop calculation. The higher the setpoint, the faster the frequency adjustment, and the better the acceleration following performance can be. However, an excessively high setpoint can increase the risk of oscillation. The actual Kp gain is calculated based on the loop. Actual Kp gain = Kp x d2-28 [Overcurrent suppression Kp adjustment].	100%	1% to 500%
d2-29	Overcurrent suppression Ki adjustment	Defines the integral coefficient of the overcurrent suppression control loop, which is a percentage to Ki. Ki is calculated through loop calculation. The higher the setpoint, the faster the frequency adjustment, and the better the acceleration following performance can be. However, an excessively high setpoint can increase the risk of oscillation. The actual Ki gain is calculated based on the loop. Actual Ki gain =Ki x d2-29 [Overcurrent suppression Ki adjustment].	100%	10% to 1000%

Precautions

The current in V/f overcurrent suppression is high, so the motor decelerates upon high loads. When the output frequency is lower than 5 Hz, the drive may derate at low frequencies, triggering the overload fault easily. If overload may easily occur at low speed during overcurrent suppression, check whether the load is proper. Otherwise, select a drive with a higher rated power.

Application case

Set F2-37/d2-26 [Overcurrent suppression] to 1 [Enable] and set F2-38/d2-27 [Overcurrent suppression threshold] according to the current magnitude in the application site. Ensure that the current suppression threshold is higher than the current under normal operating conditions. The remaining parameters can be set with default values.

10.2.6 Oscillation Suppression in V/f Mode

Application scenarios

During motor operation, system oscillation may occur due to mechanical resonance. In this case, you can enable oscillation suppression.

Operating principles

You can enable oscillation suppression by setting d2-22 to 1 to improve the control effect. d2-23 represents the V/f oscillation suppression gain, which must be as low as possible to minimize the impact on operation, provided that the oscillation can be effectively suppressed. Increase this gain only upon obvious oscillation. The higher the gain, the better the suppression effect can be.

Related parameters

Param.	Name	Description	Default value	Range
d2-22	Oscillation suppression in V/f mode	Enables/disables oscillation suppression in V/f mode. 0: Disable 1: Enable	1	0 to 1
d2-23	Oscillation suppression gain in V/f mode	Defines the oscillation suppression gain in V/f mode. This parameter is used to adjust the intensity of V/f oscillation suppression. The higher the setpoint, the stronger the compensation performance is, but an excessively high setpoint can result in over-compensation and oscillation.	100%	0% to 400%

Precautions

When oscillation suppression is enabled, the rated current and no-load current of the motor must be as accurate as possible to ensure the V/f oscillation suppression effect.

Application case

Motor oscillation caused by mechanical structure on site can be reduced through d2-22 [V/f oscillation suppression enable]. Observe the actual motor oscillation during normal operation.

10.2.7 Torque Boost in V/f Mode

Application scenarios

When the motor operates in V/f control mode, the voltage drop on the stator resistor can lead to low motor output torque, and even low load-carrying capacity of the motor during low-speed operation. In this case, you can compensate the voltage loss on the stator resistor through the torque boost function to improve the load-carrying capacity of the motor during low-speed operation. If the torque boost is not enabled upon heavy-duty startup in V/f mode, overload faults may occur.

Operating principles

Enable this function through d2-16 and select the torque boost mode.

During manual torque boost, the voltage can be compensated by the torque boost defined by d2-14. When the load is excessive and the starting torque of the motor is insufficient, the value of d2-14 can be increased. Note that an excessively high setpoint can easily result in motor overtemperature and drive overcurrent. d2-15 defines the cutoff frequency of torque boost. If the frequency is lower than this value, the boost is enabled; otherwise, it is disabled.

When automatic torque boost is applied, the drive automatically calculates the voltage compensation value according to the motor parameters, so there is no need to set d2-14 and d2-15. Before using this function, ensure that the motor parameter auto-tuning function is enabled to guarantee the motor parameter accuracy.

When the automatic and manual torque boost is selected, you can adjust the manual boost value through d2-14 and d2-15. If the manual boost value is excessively low, the automatic torque boost calculates the voltage needed and makes voltage compensation accordingly.

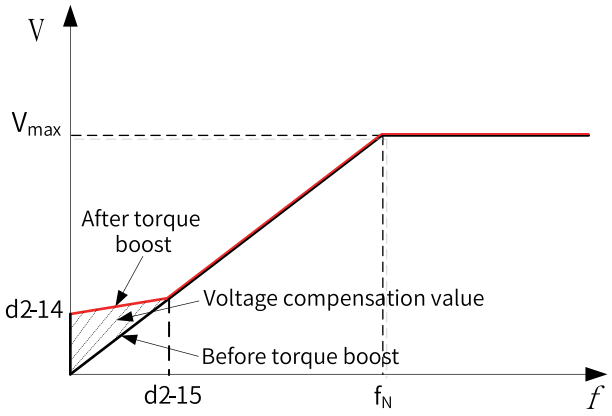


Figure 10-50 Schematic diagram of torque boost in V/f mode

Note: F_N indicates the frequency reference, and V_{max} indicates the maximum output voltage.

Related parameters

Param.	Name	Description	Default value	Range
d2-14	Manual torque boost	Defines the manual torque boost value. This parameter defines the voltage boost value at zero speed in V/f mode. Increasing this voltage can improve the load-carrying capacity at low speed, but an excessively high setpoint may easily result in overcurrent and overload. After the output frequency is increased to the value of d2-15 [Cutoff frequency of torque boost], the boost voltage is linearly reduced to 0.	3.0%	0.0% to 100.0%
d2-15	Cutoff frequency of torque boost	Defines the cutoff frequency of torque boost. When the operating frequency exceeds this cutoff frequency, manual torque boost is disabled.	100.0%	0.0% to 400.0%
d2-16	Torque boost mode	Defines the torque boost mode. 0: Manual boost - The boost value at zero speed is defined by d2-14. After the speed increases, the manual boost amount is reduced linearly until the cutoff frequency decreases to 0. 1: Automatic boost - The boost voltage is calculated automatically based on motor parameters. In this mode, it is recommended to perform auto-tuning. 2: Manual boost + Automatic boost - The final effective boost value is the sum of the manual boost and the automatic boost. This boost mode is recommended.	2	0 to 2

Application case

After startup, operation errors occur to high load. The value of d2-14 [Manual torque boost] needs to be increased in the stop state. Increase this value continuously until the motor can be started properly.

10.2.8 Slip Compensation in V/f Mode

Application scenarios

Slip compensation is used to compensate speed drop of an asynchronous motor when the load increases, so that the motor speed can remain unchanged when the load changes. Slip compensation can improve the speed accuracy in V/f mode.

Operating principles

Enable d2-41 [Slip compensation mode] to activate slip compensation, and adjust the compensation frequency through d2-42. When the coefficient is set to 100%, the compensation slip is the rated slip of the motor when the rated load is applied to the motor. When the compensation coefficient is set to 0, the slip compensation function is disabled. When adjusting the V/f slip compensation gain, check that the motor speed under the rated load is the same as the target motor speed. If they are different, adjust this parameter.

d2-43 defines the slip compensation filter time in V/f mode. The lower the setpoint, the faster the response speed of slip compensation, but an excessively low setpoint can also result in oscillation or instability in the dynamic process of the motor.

Related parameters

Param.	Name	Description	Default value	Range
d2-41	Slip compensation mode	Defines the slip compensation mode. Value description: 0: Disable - Slip compensation disabled 1: Enable - Slip compensation enabled Note: Due to slip of the asynchronous motor, speed errors can be generated in V/f mode during with-load operation. After slip compensation is enabled, the frequency can be compensated based on the magnitude of the load to improve the speed accuracy.	0	0: Disable 1: Enable
d2-42	Slip compensation gain	Adjust the slip compensation frequency based on the rated slip setting.	100.0%	0.0% to 200.0%
d2-43	Slip compensation filter time	Defines the slip compensation filter time. A longer filter time means a slower and smoother dynamic process of slip compensation.	0.5s	0.1s to 10.0s

Precautions

Slip compensation in V/f mode can improve dynamic accuracy, but slows down the dynamic response. For applications requiring high dynamic response, use vector control.

Application case

In textile applications, the asynchronous motor operates stably in V/f mode. The heavier the load, the lower the output speed on the motor shaft end can be compared with the speed reference. In the actual process, the speed must be as accurate as possible to match motors of different mechanisms.

If d2-41 (Slip compensation mode) is set to 1, the slip compensation mode is enabled to improve the speed accuracy. The speed accuracy during operation can meet the process requirements. If compensation is too fast during slip compensation, increase d2-43 [Slip compensation filter time].

10.2.9 Energy-Saving Control in V/f Mode

Application scenarios

Energy-saving control is applicable to applications where the motor load does not change. It can be also used in low-load applications to reduce output current automatically for energy conservation. It can be used in applications where the load changes slowly, such as fans, water pumps, and air compressors.

Operating principles

After this function is enabled through d2-35, when the motor runs with low load, the drive reduces the output voltage continuously to lower the excitation current for less energy consumption.

Related parameters

Param.	Name	Description	Default value	Range
d2-35	Energy-saving control in V/f mode	Used to enable/disable energy-saving control in V/f mode. 0: Disable 1: Enable - Energy-saving control can reduce the output current and energy consumption of an asynchronous motor when it runs without load or with low load.	0	0 to 1
d2-36	Cutoff frequency of energy-saving control in V/f mode	Defines the cutoff frequency of energy-saving control in V/f mode. Energy-saving control can be enabled only when the frequency is greater than this cutoff frequency.	30 %	20% to 100%

Application case

In low-load applications, to reduce the output power, you can enable d2-35 [Energy-saving control in V/f mode] and set the cutoff frequency (d2-36) to the value lower than the normal operating frequency.

10.2.10 Droop Control in V/f Mode

Application scenarios

The droop control function applies to applications where the load is driven by multiple motors. Slight deviation exists among motors at the same speed reference due to different mechanical characteristics, which may result in significant difference in the output torque or even mutual dragging between motors.

The droop control function is widely used in applications with belt conveyors, roller conveyors, or continuous casting machines. The function is easy to use, without the need for communication between motor controllers. Multiple motors can be used to drive the same load through rigid or flexible connection. When multiple motors run in redundant mode, you can stop the faulty devices while keeping others running normally.

Operating principles

The droop (softening) control is a control method that uses the output torque of the motor to generate negative feedback, reducing the motor speed. Droop control features good stability and simple application though low control accuracy. It can be applied to all motors to enable even load distribution between motors without communication. The motor with a high speed carries more torque. The speed reference of the motor is reduced automatically through negative feedback, achieving torque distribution to other motors.

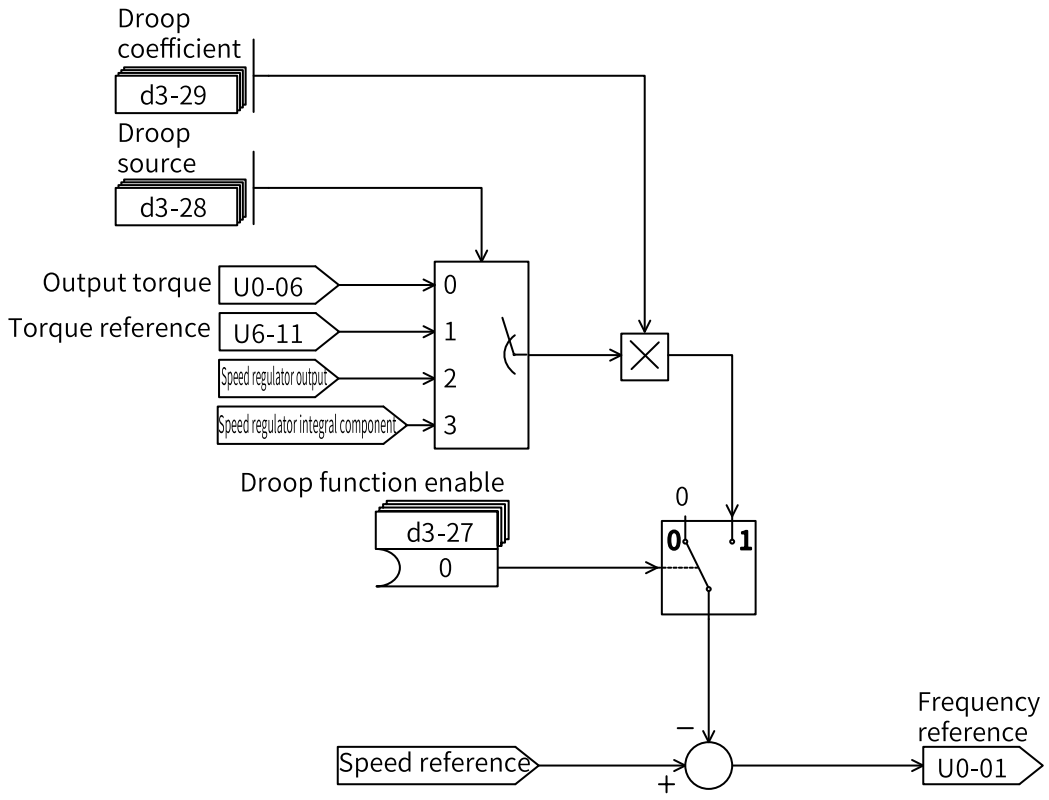


Figure 10-51 Schematic diagram of droop control in V/f mode

Related parameters

Param.	Name	Description	Default value	Range
d3-27	Droop function	Enables/disables the droop function in speed control. Value description: 0: Disable 1: Enable When multiple motors are used to drive the same load, the load distribution between multiple motors can be achieved after this function is enabled. Note that the speed accuracy can be affected.	0	0 to 1
d3-28	Droop source	Defines the droop source. 0: Output torque - The actual output torque of the motor is used as the droop source. 1: Torque reference - The final torque reference of the motor is used as the droop source. 2: Speed loop output - The output of the speed loop is used as the droop source. 3: Integral component of speed regulator - The integral item of the speed loop is used as the droop source. For droop control in V/f mode, the droop source can only be set to 0.	1	0 to 3
d3-29	Droop coefficient	Defines the droop coefficient. The higher the droop coefficient, the better the droop performance is, but an excessively high setpoint can affect the speed accuracy and lead to speed oscillation. Speed change value in droop control = U0-06 [Output torque] x d3-29 [Droop coefficient] x Rated frequency of the motor	0.0%	0.0% to 50.0%

Precautions

- The speed regulation range is usually not greater than the rated slip of the motor.
- The actual speed may not follow the speed reference accurately, where a steady difference exists between the actual speed and reference speed. The difference is proportional to the load.
- Accurate load distribution is not available during dynamic process.

Application case

When multiple motors are connected with a belt, a droop coefficient needs to be set to prevent any of the motor from generating due to uneven load distribution. The droop coefficient must allow the speed change value in droop control to be adjusted to the rated slip.

In this application case, it is recommended to enable the droop (softening) function (d3-27 = 1) because the system must be able to operate properly when the motor or drive is damaged, without high requirements on the speed output accuracy or output dynamic response. d3-29 = {(Rated frequency x 60/Pole pairs) - Rated speed}/Rated speed.

10.2.11 Overexcitation

Application scenarios

During quick deceleration, the bus voltage increases. When the bus voltage is close to the overvoltage threshold, increase the motor excitation current to increase the loss and reduce the deceleration time.

Operating principles

Set over-excitation gain through d0-41 when the asynchronous motor is decelerating and the bus voltage is approaching the overvoltage threshold in V/f mode. When entering the overexcitation state, the drive increases the output voltage to increase the motor exciting current, increasing the loss and reducing the motor deceleration time. The higher the overexcitation gain, the better the suppression effect will be.

Related parameters

Param.	Name	Description	Default value	Range
F2-36 (d0-41)	Overexcitation gain (V/f)	Defines the overexcitation gain (V/f). Note: This parameter is active when the asynchronous motor is decelerating and the bus voltage is approaching the overvoltage threshold in V/f mode. When entering the overexcitation state, the drive increases the output voltage to increase the motor exciting current, intensifying the loss and reducing the motor deceleration time. The higher the setpoint, the better the overexcitation gain performance is.	90%	0 to 200 %

Application case

In the ceramic industry, massive mechanisms on the ceramic tile production line need to be started and stopped quickly. The bus voltage rises during deceleration, triggering overvoltage suppression and prolonging the deceleration time. For devices that require quick start and stop, increase d0-41 [Overexcitation gain in V/f] properly to allow faster consumption of the bus voltage, reducing the deceleration time significantly.

10.3 Basic Control

10.3.1 Random PWM

Application scenarios

When a motor is being driven, a sharp noise may be caused by the switching frequency. In noise-sensitive applications, you can enable the random PWM function to improve the user experience.

Operating principles

After random PWM is enabled, the active carrier frequency changes randomly near the set carrier frequency, changing the sharp noise to a soft rustling sound.

Related parameters

Param.	Name	Default value	Value range	Description
A5-11	Random PWM depth	0	0 to 10	Used to turn the sharp electromagnetic noise of the motor caused by the carrier frequency into a soft rustling sound. Setting this parameter to 0 disables this function. The higher the setpoint, the better the noise reduction performance can be.

Precautions

- The higher the random PWM depth, the better the noise reduction performance can be. Note that an excessively high setpoint may increase current harmonics. Therefore, it is recommended to increase the default value gradually during actual commissioning.
- When the carrier ratio (ratio of carrier frequency to output frequency) is lower than 10, it is recommended that random PWM cannot be turned on. When the carrier ratio is low, enabling the random PWM can result in insufficient control frequency and excessive motor speed fluctuation.
- This parameter is active only for asynchronous motors in the V/f mode.

10.3.2 Overmodulation

Application scenarios

In applications with high requirements on the output current and energy efficiency, increasing the voltage overmodulation coefficient can enhance the output capacity of the voltage and effectively improve the load capacity of the motor in the field weakening range.

Related parameters

Param.	Name	Description	Default value	Range
A5-06	Overmodulation coefficient	Defines the overmodulation coefficient. Increasing the voltage overmodulation coefficient can enhance the voltage output capacity and effectively improve the load capacity of the motor in the field weakening range. However, this can also increase the output current distortion.	103.0 %	0.0% to 110.0%

Precautions

- The higher the overmodulation coefficient, the greater the output voltage distortion and current fluctuation can be. Excessive fluctuation can easily result in pulse-by-pulse current limit or overcurrent. Therefore, take the fluctuation rise into account when increasing the overmodulation coefficient.
- The output voltage reserves a voltage margin of 3% to meet the dynamic current response. Therefore, a overmodulation coefficient of 103% is equal to 100% of the maximum output voltage, which means there is no overmodulation effect. It is recommended that the overmodulation coefficient not exceed 108%. A value within 105% is recommended. Otherwise, large harmonic current can be generated, resulting in a decrease in system efficiency.
- The conversion relationship between the effective value of the maximum output line voltage of the drive and the bus voltage is as follows: Umax = U_DC/1.414 x (A5-06) x {1 - (D5-00)}.

10.3.3 Braking Resistor Control

Application scenarios

In applications with energy regeneration, such as quick deceleration of high-inertia loads or potential energy loads like hoists, a braking unit must be connected to dissipate the energy that fed back to the bus, preventing overvoltage faults.

In quick deceleration applications, if high speed tracking accuracy is required, it is recommended to install a braking resistor. If speed tracking accuracy upon deceleration is not required, you can enable over-excitation and overvoltage suppression to prevent excessive bus voltage rise during deceleration.

Operating principles

During operation of the drive, if the bus voltage is higher than the actual effective voltage threshold for activating the braking unit, the braking unit acts to discharge the energy through braking resistor. When the bus voltage falls below the braking unit activation voltage, the braking unit stops.

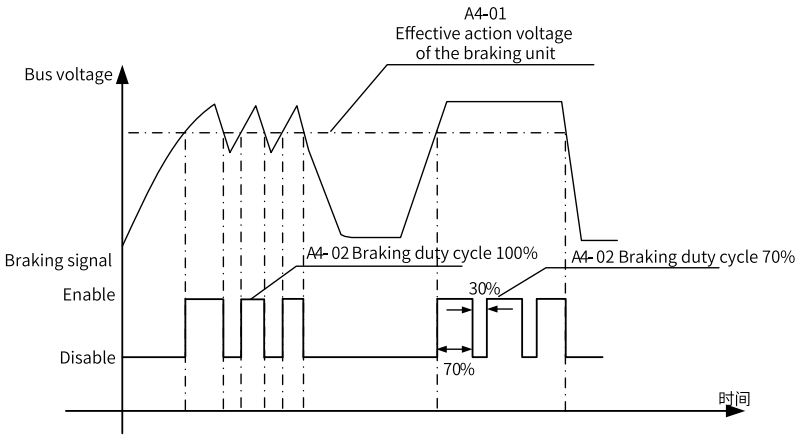


Figure 10-52 Braking resistor control schematic

Related parameters

The activation voltage of the braking unit is set through A4-00 [Braking unit activation voltage], and the actual effective value is displayed in A4-01. A4-02 [Braking duty cycle] can be used to adjust the power of the braking unit.

Param.	Name	Description	Default value	Range
A4-00	Braking unit activation voltage	Defines the bus voltage threshold for activating the braking transistor. The actual effective value is displayed in A4-01. When the bus voltage exceeds this threshold, the braking transistor turns on to prevent overvoltage through discharging bus energy through the external braking resistor. Note: The braking transistor does not operate in the stop state. Models equipped with the braking unit include the 380 V - 2.2 kW, 380 V - 4.0 kW, 380 V - 5.5 kW, 220 V - 1.5 kW, and 220 V - 2.2 kW.	760.0 V	600.0 V to 820.0 V
A4-01	Effective activation voltage of the braking unit	Displays the actual effective activation voltage of the braking unit, which is set through A4-00.	760.0 V	600.0 V to 820.0 V
A4-02	Braking duty cycle	Defines the braking duty cycle. The setpoint 0 indicates that the brake is not applied. The setpoint 100% indicates that the brake is normally open. This parameter is used to control the braking power. Formula for calculating braking power: Braking power = Square of bus voltage/Braking resistance x Braking duty cycle	100%	0.0% to 100.0%

Precautions

- Connect one end of the braking resistor to BR terminal and the other end to the bus (+) terminal. Then measure whether the resistance between the bus (+) and BR terminals is normal with a multimeter.
- Select a braking resistor of proper power and connect the braking resistor terminals properly. Improper contact can result in temperature rise of wiring terminals, which can lead to a fire in extreme conditions.

- If a braking resistor is connected but overvoltage still occurs on the bus during regeneration, the power of the braking unit may be insufficient. In this case, replace with a braking unit of higher power. You can also reduce the activation voltage of the braking unit to apply brake in advance in abrupt deceleration. For details on the braking resistor, see *"18.7.1 Braking Resistor" on page 1299*.
- When setting the braking voltage, pay attention to the power supply voltage range. When the grid voltage is high, the corresponding bus voltage will also be high. If the braking voltage is set below the normal bus voltage, the braking unit may continuously operate during operation of the drive, which may damage the braking unit. Therefore, the braking voltage must be kept at least 20 V higher than the normal bus voltage to prevent preceding risks.
- When the braking unit is connected and overvoltage suppression is enabled, set the braking voltage A4-00 to a value below d1-56 [Actual effective voltage threshold for overvoltage suppression].
- For loads with high inertia, if the speed loop integral time is excessively low in vector control, bus voltage fluctuation may repeatedly occur during load fluctuation, causing overtemperature of the braking resistor. In this case, increase F2-03 [Speed loop integral time] (2s for example) to effectively reduce bus voltage fluctuation.

10.3.4 Parameter Auto-tuning

Application scenarios

Auto-tuning is used to get the drive and motor parameter values. Auto-tuning is a must in the SVC mode. Otherwise, the motor cannot operate properly. It is also recommended to perform parameter auto-tuning in the V/f mode. If parameters are accurate, better control performance can be achieved.

Operating principles

After the auto-tuning type is set, the drive enters parameter auto-tuning state upon start, and sends auto-tuning voltage/current signals based on the set motor type and nameplate parameters to update auto-tuned parameters to the motor parameter set. After auto-tuning is done, the drive changes from the auto-tuning state to the stop state.

Related parameters

Param.	Name	Description	Default value	Range
C2-00	Motor parameter auto-tuning mode	0: Not applied 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning Note: Dynamic auto-tuning and inertia auto-tuning are suitable for occasions where the motor can rotate without load. After rotation, any condition without significant load torque can be considered no-load, which means a complete disconnection from the load mechanism is not strictly required. Static auto-tuning is suitable in situations where the motor cannot rotate. In dynamic auto-tuning, all parameters are auto-tuned to ensure optimal operating performance. Differences between different kinds of static auto-tuning modes are as follows: Asynchronous motor: Compared with dynamic auto-tuning, in the complete static auto-tuning mode, inertia and friction torque parameters are not auto-tuned, and the mutual induction and no-load current are less accurate. Compared with the static complete auto-tuning, mutual induction and no-load current are not auto-tuned in static partial auto-tuning. Synchronous motor: Compared with dynamic auto-tuning, back EMF, inertia, and friction torque are not auto-tuned in static auto-tuning.	0	0: Not applied 1: Static partial auto-tuning of asynchronous motor 2: Dynamic auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static partial auto-tuning of permanent magnet motor 14: UV gain deviation auto-tuning

Parameter description:

Set C2-00 to 1, 2, or 3 for auto-tuning of asynchronous motors. Set C2-00 to 11, 12, or 13 for auto-tuning of synchronous motors. The following scenarios apply to each auto-tuning mode:

C2-00 = 1: Static partial auto-tuning of asynchronous motors

The motor is at a standstill during auto-tuning. This mode applies to motors with load or travel limits or motors that cannot rotate. In this auto-tuning mode, only some motor parameters are auto-tuned. The mutual inductance and no-load current are estimated values that may deviate from actual values. See details in *"Table 10-1 Parameters related to auto-tuning" on page 569*.

C2-00 = 2: Dynamic auto-tuning of asynchronous motor

The motor rotates during auto-tuning. This mode features the highest accuracy and applies to motors disconnected from the load.

C2-00 = 3: Static complete auto-tuning of asynchronous motors

The motor is at a standstill during auto-tuning. Compared with static partial auto-tuning, the parameters auto-tuned are more complete though with less accurate than dynamic auto-tuning.

C2-00 = 4: Inertia auto-tuning

This mode applies to applications requiring high-speed operation. Auto-tuning can be performed without load or with low load (below 80% of the rated load) or with pure inertia load. Inertia ratio and other parameters are auto-tuned.

C2-00 = 5: Dead zone auto-tuning

The non-linear characteristics of the drive are auto-tuned to improve the voltage output precision and operation efficiency of the drive.

C2-00 = 12 No-load dynamic auto-tuning of permanent magnet motors

The motor rotates during auto-tuning. This mode features the highest accuracy and applies to motors disconnected from the load.

C2-00 = 13 Static partial auto-tuning of permanent magnet motors

The motor is at a standstill during auto-tuning, with only some motor parameters auto-tuned. The auto-tuning accuracy is slightly lower than dynamic auto-tuning.

C2-00 = 14 UV gain deviation auto-tuning

The sampling deviation between phase current is auto-tuned.

Table 10–1 Parameters related to auto-tuning

Param.	Name	C2-00 = 1	C2-00 = 2	C2-00 = 3	C2-00 = 12	C2-00 = 13
C4-12	Back EMF of synchronous motor	-	-	-	Yes	-
C4-20	Stator resistance	Yes	Yes	Yes	Yes	Yes
C4-22	Rotor resistance of asynchronous motor	Yes	Yes	Yes	-	-
C4-24	Leakage inductance of asynchronous motor stator	Yes	Yes	Yes	-	-
C4-26	Leakage inductance of asynchronous motor rotor	Yes	Yes	Yes	-	-
C4-28	Mutual inductance of asynchronous motor	√[1]	Yes	Yes	-	-

Param.	Name	C2-00 = 1	C2-00 = 2	C2-00 = 3	C2-00 = 12	C2-00 = 13
C4-30	No-load current of asynchronous motor	√[1]	Yes	Yes	-	-
C4-32	d-axis inductance of synchronous motor	-	-	-	Yes	Yes
C4-34	q-axis inductance of synchronous motor	-	-	-	Yes	Yes
C4-62	Inertia ratio	-	Yes	-	Yes	-
C4-63	Electromechanical time constant	-	Yes	-	Yes	-
C4-64	System moment of inertia	-	Yes	-	Yes	-
C5-02 to C5-05	Current coefficient of mutual inductance curve	-	Yes	Yes	-	-
C5-06 to C5-09	Flux coefficient of mutual inductance curve	-	Yes	Yes	-	-
C5-32 to C5-55	d/q-axis inductance curve	-	-	-	Yes	Yes
d3-02	Speed loop Kp in SVC mode	-	Yes	-	Yes	-
d3-03	Speed loop Ti in SVC mode	-	Yes	-	Yes	-
d3-07	Zero speed proportional calibration coefficient	-	Yes	-	Yes	-
d3-08	Zero speed integral calibration coefficient	-	Yes	-	Yes	-
d3-10	Low-speed proportional calibration coefficient	-	Yes	-	Yes	-
d3-11	Low-speed integral calibration coefficient	-	Yes	-	Yes	-
d3-13	High-speed proportional calibration coefficient	-	Yes	-	Yes	-

Param.	Name	C2-00 = 1	C2-00 = 2	C2-00 = 3	C2-00 = 12	C2-00 = 13
d3-14	High-speed integral calibration coefficient	-	Yes	-	Yes	-
A3-13	U/V current sampling coefficient	Yes	Yes	Yes	Yes	Yes
A3-30	Drive transistor voltage drop	Yes	Yes	Yes	Yes	Yes
A3-31 to A3-38	Dead zone curve current	Yes	Yes	Yes	Yes	Yes
A3-39 to A3-46	Dead zone curve time	Yes	Yes	Yes	Yes	Yes

Precautions

The parameters marked [1] are estimated values instead of auto-tuned values, which may not accurate. Running in SVC mode may affect low-speed performance.

During dynamic parameter auto-tuning of asynchronous motors, the motor rotates at a high speed. Therefore, ensure that it is set under conditions allowed by mechanical safety.

If the friction or load torque is excessively low after the motor runs, the motor is in the no-load state. In this case, you can select dynamic parameter auto-tuning to get the optimal control performance. For example, in cases where the motor drives an empty roller or inertia disk, it is not necessary to mechanically disconnect the motor from the load.

The auto-tuning parameters set by the motor manufacturer may deviate from the actual auto-tuning parameters.The actual auto-tuning parameters shall prevail.

10.3.5 Parameter Calculation

Application scenarios

The parameter calculation function can be used when auto-tuning is not available or high parameter accuracy is not required (such as V/f control). This function calculates and updates some auto-tuning parameters based on the motor nameplate parameters and built-in algorithms.

Operating procedure

When using parameter calculation, first set the motor nameplate parameters including C4-00 to C4-09 properly, then set C2-19 [Parameter calculation enable] to 1 and C2-20 [Parameter calculation acknowledgement] to 1 to complete parameter calculation.

Related parameters

Param.	Name	Default value	Value range	Description
C2-19	Parameter calculation enable	0	0 to 1	Used to enable the parameter calculation function. Value description: 0: Inactive 1: Motor nameplate parameter calculation
C2-20	Parameter calculation acknowledgement	0	0 to 1	Used acknowledge whether the parameter calculation function is active. Parameter calculation can be executed only when C2-19 and C2-20 are both set to 1. Value description: 0: Inactive 1: Active

Precautions

Parameter calculation is based on algorithms, which can provide a reference value only.

In parameter calculation, only active motor parameter sets are updated. You can set and view active motor parameter sets through b0-00 and b0-01.

The parameters updated through parameter calculation are as follows.

Param.	Name	Parameters updated through parameter calculation
C4-12	Back EMF of synchronous motor	Yes
C4-20	Stator resistance	Yes
C4-22	Rotor resistance of asynchronous motor	Yes
C4-24	Leakage inductance of asynchronous motor stator	Yes
C4-26	Leakage inductance of asynchronous motor rotor	Yes
C4-28	Mutual inductance of asynchronous motor	Yes
C4-30	No-load current of asynchronous motor	Yes
C4-32	d-axis inductance of synchronous motor	Yes
C4-34	q-axis inductance of synchronous motor	Yes

10.3.6 Self-Test

Application scenarios

Self-test is a function that automatically checks the errors of the drive.

The self-test covers IGBT shoot-through, ground short circuit, and output phase loss. It is recommended to perform manual static self-test during initial use of the drive and motor to check

whether the drive/motor and external wiring are normal. Self-test can be used to detect ground short circuit, phase-to-phase short circuit, phase loss or other hardware faults of the system, with instructions generated to guide users in terms of maintenance.

Self-test can be started in three ways: manual self-test, self-test before operation, and self-test upon power-on.

- Manual self-test: Self-test is triggered through C2-04 manually.
- Self-test before operation: Self-test is performed before operation every time when a startup command is set.
- Self-test upon power-on: Self-test is performed every time the drive is powered on.

Related parameters

Table 10–2 Parameter configuration for self-test before startup

Param.	Name	Description	Default value	Range
C2-03	Self-test configuration before startup	Defines the self-test configuration before startup. Value description: bit0: Whether IGBT shoot-through self-test is enabled before start of the drive bit1: Whether ground short circuit self-test is enabled before start of the drive bit2: Whether output phase loss self-test is enabled before start of the drive	0x0000	0x0000 to 0xFFFF

Table 10–3 Parameter configuration for self-test upon power-on

Param.	Name	Description	Default value	Range
C2-06	Self-test configuration upon power-on	Defines the self-test configuration upon power-on. Value description: bit0: Whether IGBT shoot-through self-test is enabled upon power-on of the drive bit1: Whether ground short circuit self-test is enabled upon power-on of the drive bit2: Whether output phase loss self-test is enabled upon power-on of the drive	0x0002	0x0000 to 0xFFFF

Table 10–4 Parameter configuration for manual self-test

Param.	Name	Description	Default value	Range
C2-04	Manual self-test	Defines manual self-test command. Value description: 0: No command 1: Static self-test	0	0 to 1
C2-05	Manual self-test configuration	Defines the self-test configuration. Value description: bit0: Whether IGBT shoot-through self-test is enabled upon manual self-test of the drive bit1: Whether ground short circuit self-test is enabled upon manual self-test of the drive bit2: Whether output phase loss self-test is enabled upon manual self-test of the drive	0x0007	0x0000 to 0xFFFF

Similar to parameter auto-tuning, when self-test is selected, the operating panel flashes CHEC. Self-test will be done 100 ms after startup and the drive then enters the startup lockout state. If no fault is reported, the self-test is normal.

Precautions

During self-test, the drive can generate pulses. Therefore, perform self-test, especially self-test upon power-on without the risk of electric shock.

Self-test takes about 100 ms. In applications with strict startup time requirements, enable self-self with caution, otherwise startup may be delayed.

Do not start self-test when the motor is rotating. If the motor has back EMF, false triggering of self-test faults may occur, such as ground short circuit fault (E023.1).

When using the self-test function, ensure that the rated current of the motor is greater than 0.2 x rated current of the drive. If the power of the motor is much lower than the power of the drive, self-test may fail. In this case, self-test is not recommended.

For drives with power lower than 30 kW, when motor cables reach hundreds of meters, the ground capacitance is significant. During self-test, the ground leakage current may be much higher than the rated current of the drive, which may incur false triggering of self-test faults. In this case, self-test is not recommended.

When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system. The following figure shows connection for different power grid types.

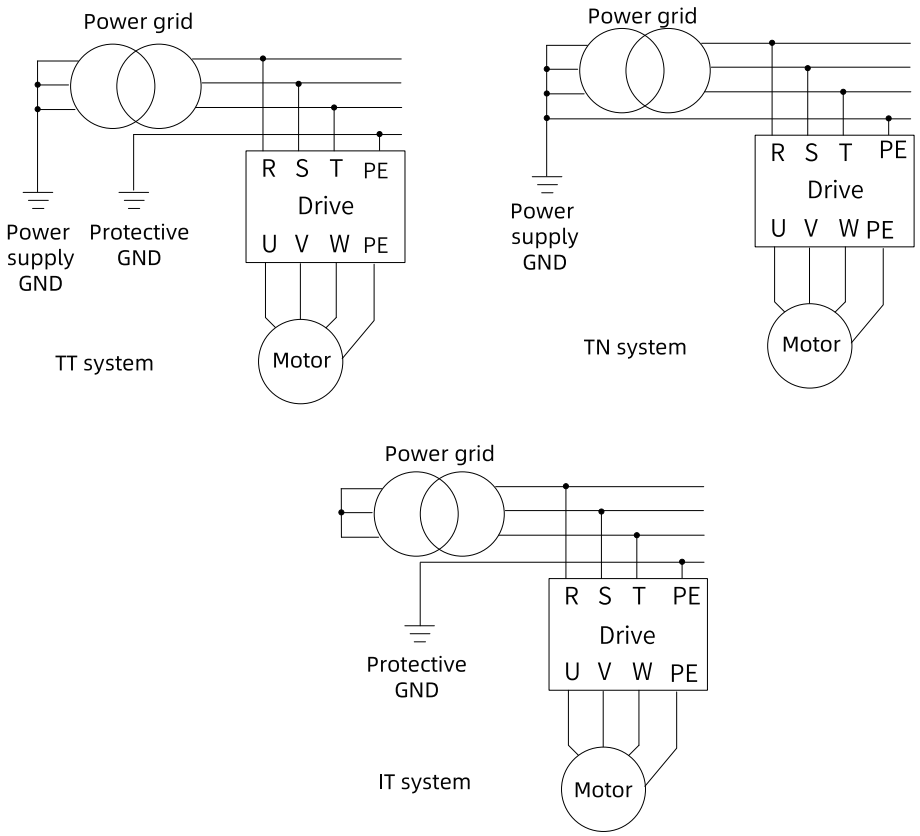


Figure 10-53 Connection for self-test under different power grid types

10.3.7 Active Short Circuit Control

Application scenarios

Active short circuit control is applicable for braking control of synchronous motors. For instance, in potential energy load applications such as hoists, when the load moves unexpectedly, a defined braking torque is generated through active short circuit control to prevent load overspeed. In applications with fans and water pumps, active short circuit control can also be used to prevent the motor from rotating due to inertia.

Operating principles

When the motor is rotating, the drive short-circuits the three winding phases in the synchronous motor in the active short circuit control state, inducing current within the windings to generate a braking torque. Therefore, the higher the motor speed, the greater the braking torque can be generated in active short circuit control.

The diagram for active short circuit control is shown in the following figure.

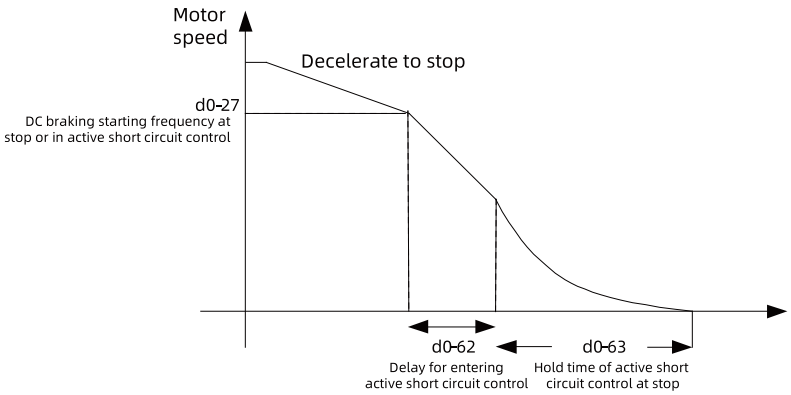


Figure 10-54 Schematic of active short circuit control

Precautions

When the motor speed is high, the kinetic energy generated during rotation of the motor is fed back to the bus in the active short circuit control state, causing the bus voltage to rise. When the bus voltage reaches a high level, to prevent overvoltage, the drive stops active short circuit control, causing the motor to lose the braking torque generated in active short circuit control. Therefore, it is recommended to use this function together with a braking resistor.

Related parameters

Param.	Name	Default value	Value range	Description
d0-27	Starting frequency of DC braking at stop or active short circuit control	0.0 Hz	0.0 Hz to 600.0 Hz	Defines the starting frequency of DC braking at stop. Note: When both the active short circuit control and DC braking are enabled, active short circuit control is responded to first, without executing DC braking. When active short circuit control is enabled: During decelerating to stop, when the operating frequency drops to d0-27, the drive blocks the output until the time defined by d0-62 elapses where the drive enters the active short circuit control state. After the hold time defined by d0-63 elapses, the drive enters the stop state. When only DC braking is enabled: 1. During decelerating to stop, when the operating frequency drops to d0-27, the drive blocks the output until the time defined by d0-28 elapses where the drive outputs the DC braking current defined by d0-30. After the time defined by d0-29 elapses, the drive enters the stop state. 2. Do not set this parameter to an excessively high value. Failure to comply can result in overcurrent of the drive.
d0-61	Active short circuit control	0	0 to 1	0: Disable 1: Enable Other: B connector This function is active in the decelerate-to-stop, stop-with-maximum-capacity, and quick stop modes, but not in the coast-to-stop mode.
d0-62	Delay for entering active short circuit control	0.0 ms	0.0 ms to 5000.0 ms	Defines the delay for entering active short circuit control.
d0-63	Hold time of active short circuit control at stop	10.0s	0.1s to 3600.0s	The active short circuit state is exited after the hold time elapses. When this parameter is set to the maximum value (3600.0s), active short circuit control persists.

10.3.8 Carrier Frequency and Pulse Generation

Application scenarios

The carrier frequency of the drive is set by A5-01. The effective carrier frequency is limited by A5-01 [Frequency reference], A5-00 [Maximum carrier frequency of the drive], and the functions of "Carrier

frequency adjusted with synchronous frequency" and "Random PWM". For details, see descriptions of A5-09 to A5-13.

Operating principles

After the carrier frequency is set to be adjusted with the synchronous frequency (bit1 of A5-08), if the output frequency is lower than the value of A5-10, the carrier frequency is limited by A5-12 or A5-13. If the output frequency is higher than "A5-10 + A5-09", the effective carrier frequency will reach the set carrier frequency. The operating principles for carrier frequency to be adjusted with the synchronous frequency is shown in the following figure.

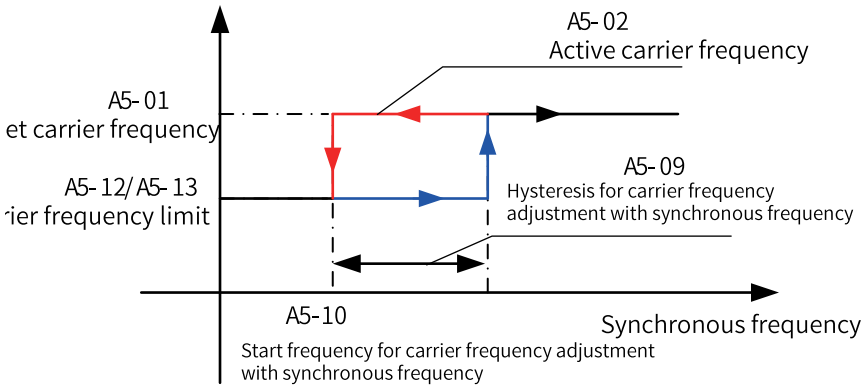


Figure 10-55 Schematic for carrier frequency to be adjusted with the synchronous frequency

Related parameters

Param.	Name	Description	Default value	Range
A5-00	Maximum carrier frequency	Defines the maximum carrier frequency that can be set. This parameter is unchangeable and related to the motor type, control mode (d0-00), and the model hardware.	16.0 kHz	0.0 kHz to 24.0 kHz
A5-01	Carrier frequency reference	Defines the carrier frequency of the drive. This function is used to adjust the carrier frequency of the drive. You can reduce the motor noise, avoid the resonance point of the mechanical system, and reduce the ground leakage current and interference generated by the drive through adjusting the carrier frequency. Note: The higher the setpoint, the lower the motor noise and the lower the current ripple can be. However, an excessively high carrier frequency can derate the drive, resulting in frequent overload faults. An excessively low carrier frequency can lead to increase of high-order harmonics in the output current, motor loss and temperature rise.	4.0 kHz	0.8 kHz to 20.0 kHz
A5-02	Effective carrier frequency	Displays the effective carrier frequency of the drive. Note: The actual effective carrier frequency of the drive is also affected by the synchronous frequency and random PWM.	4.0 kHz	0.8 kHz to 20.0 kHz

Param.	Name	Description	Default value	Range
A5-09	Hysteresis for adjusting carrier frequency with synchronous frequency	Defines the hysteresis for adjusting carrier frequency with synchronous frequency. Note: After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08), when the output frequency is lower than the value of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the sum of A5-10 + A5-09, the effective carrier frequency will reach the set carrier frequency.	3.0 Hz	0.0 Hz to 100.0 Hz
A5-10	Starting frequency for adjusting carrier frequency with synchronous frequency	Defines the starting frequency for adjusting carrier frequency with synchronous frequency. Note: After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08), when the output frequency is lower than the value of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the sum of A5-10 + A5-09, the effective carrier frequency will reach the set carrier frequency.	5.0 Hz	0.0 to 600.0 Hz
A5-12	Low-speed carrier frequency limit (V/f)	Defines the low-speed carrier frequency limit in V/f mode. Note: 1. This parameter is active in the V/f mode. 2. After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08 PWM command word), when the output frequency is lower than A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the sum of A5-10 + A5-09, the effective carrier frequency will reach the set carrier frequency.	20.0 kHz	0.8 kHz to 20.0 kHz
A5-13	Low speed carrier frequency limit (SVC)	Defines the low-speed carrier frequency limit in the SVC mode. Note: 1. This parameter is active only in the SVC mode. 2. After carrier frequency adjustment with synchronous frequency is enabled (bit1 of A5-08 PWM command word), when the output frequency is lower than A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than the sum of A5-10 + A5-09, the effective carrier frequency will reach the set carrier frequency.	2.0 kHz	0.8 kHz to 20.0 kHz

Precautions

In SVC mode, an excessively high setpoint may easily cause low motor torque and result in failure to drive the load or start. It is recommended to set A5-13 to a value not exceeding 6.0 kHz.

Increasing the carrier frequency generally improves the control performance and reduces the current harmonics and noise of the motor, but may also incur temperature rise of the drive, as described below.

Item	Problem
Carrier frequency	Low → High
Motor noise	High → Low
Current harmonics	Bad → Good
Motor temperature rise	High → Low
AC drive temperature rise	Low → High
Leakage current	Low → High
External radiation interference	Low → High

The default carrier frequency varies with the power rating of the drive. You can change the carrier frequency as needed.

Note: If the set carrier frequency is higher than the default value, temperature rise can occur on the heasink of the drive. In this case, you need to derate the drive. Otherwise, the overtemperature alarm can be triggered.

11 Advanced Functions

11.1 Frequency Detection

11.1.1 Frequency Detection (FDT)

Function description

This function is used to set the detection value for the output frequency and the hysteresis value for output action deactivation. The hysteresis value is active only during deceleration. Hysteresis does not occur in detection during acceleration.

Operating principles

When the operating frequency is higher than the frequency detection value, the DO, which is assigned by E1-04 [DO function selection] with the function of "3: Frequency level detection FDT1" or "25: Frequency level detection FDT2" outputs an active signal. When the frequency is lower than the frequency detection hysteresis, the active signal outputted by DO is deactivated. The frequency detection function is shown in the following figure, in which the frequency detection level (FDT1) is used as an example.

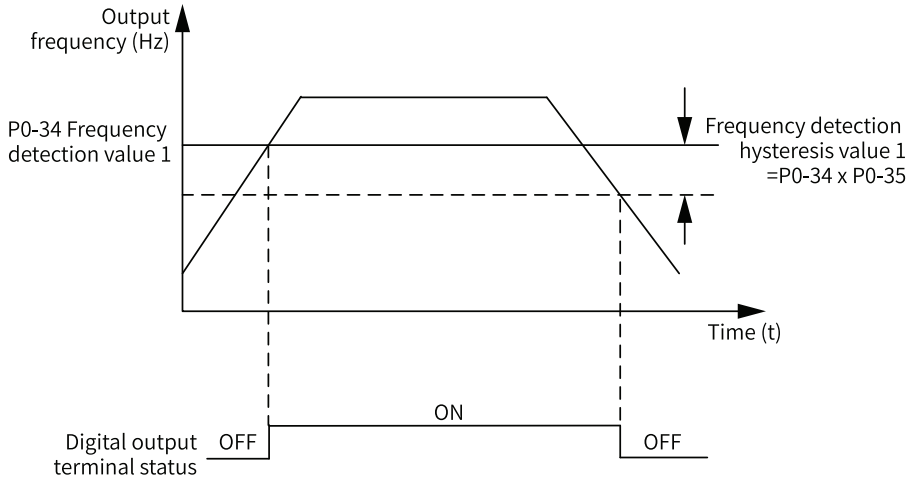


Figure 11-1 Parameters related to frequency detection

Related parameters

Table 11–1 Parameters to frequency detection

Param.	Name	Default value	Value range	Description
P0-34	Frequency detection value (FDT1)	50.00 Hz	0.00 Hz to A2-17	Defines the operating frequency detection value 1 of the drive. Note: 1 .Set DO output function to "3: Frequency level detection FDT1 output". 2 .When the operating frequency of the drive is higher than or equal to the frequency detection value (FDT1), the DO outputs an active signal. 3 .When the operating frequency is lower than the result of "P0-34 - P0-34 x P0-35", the DO terminal outputs an inactive signal.
P0-35	Frequency detection hysteresis value (FDT1)	5.0%	0.0% to 100.0%	Defines the operating frequency detection hysteresis coefficient of the drive, which is a percentage to the frequency detection value (FDT1). Note: Same as P0-34.
P0-36	Frequency detection value (FDT2)	50.00 Hz	0.00 Hz to A2-17	Defines the operating frequency detection value 2 of the drive. Note: 1 .Set DO function to "25: Frequency level detection FDT2 output". 2 .When the operating frequency of the drive is higher than or equal to the frequency detection value (FDT2), the DO can be configured to output an active signal 3 .When the operating frequency is lower than the result of "P0-36 - P0-36 x P0-37", the DO terminal outputs an inactive signal.
P0-37	Frequency detection hysteresis value (FDT2)	5.0%	0.0% to 100.0%	Defines the operating frequency detection hysteresis coefficient of the drive, which is a percentage to the frequency detection value (FDT2). Note: Same as P0-36.

Application instance

The following takes frequency detection (FDT) as an example.

1. Set E1-00 [RO output function selection] to "3: Frequency level detection FDT1 output".
2. Set P0-34 [Frequency detection value (FDT1)] and P0-35 [Frequency detection hysteresis value (FDT1)].
3. Set the target frequency of the drive to a value higher than frequency detection value (FDT1).
4. During operation of the drive, if the operating frequency during acceleration reaches P0-34 [Frequency detection value (FDT1)], the RO outputs an active signal.

5. If the operating frequency during deceleration is lower than the result of "P0-34 [Frequency detection value (FDT1)] - P0-34 [Frequency detection value (FDT1)] x P0-35 [Frequency detection hysteresis (FDT1)]", the RO stops outputting the active signal.

11.1.2 Frequency Arrival Detection Window

Function description

This function is used to detect the operating frequency of the drive, which is within the target frequency range.

Operating principles

Set the frequency arrival detection range through P0-38 [Frequency arrival detection window]. When the operating frequency of the drive is within "Frequency reference±A2-04 x P0-38", and E1-04 [DO output function selection] is set to "4: Frequency arrival", the detection amplitude sequence diagram is shown below.

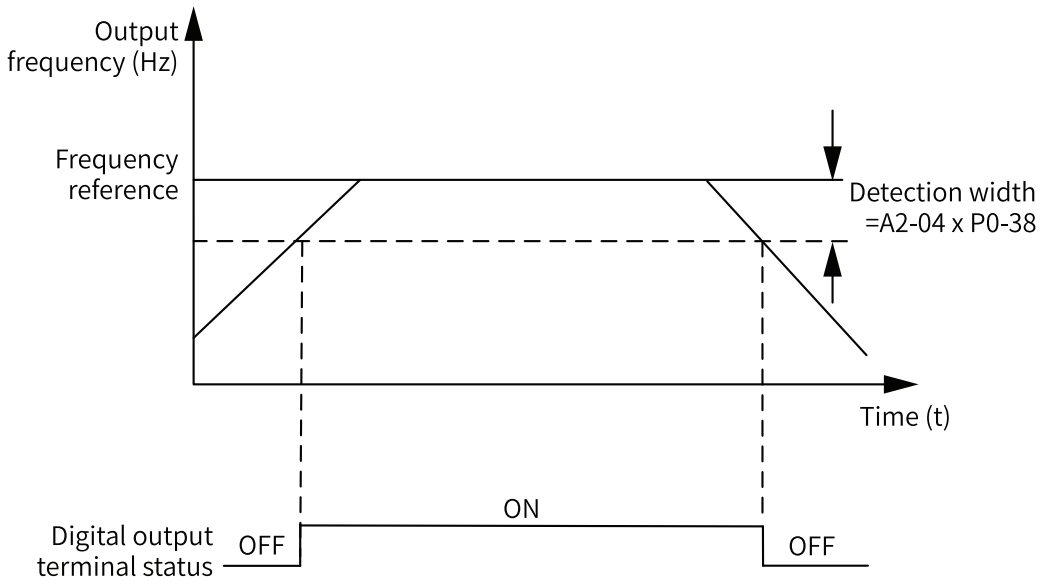


Figure 11-2 Detection amplitude sequence

Related parameters

Table 11–2 Parameters related to frequency arrival detection amplitude

Param.	Function	Default value	Value range	Description
P0-38	Frequency arrival detection window	0.0%	0.0% to 100.0%	Defines the detection window for the operating frequency of the drive, which is a percentage to A2-04. Note: 1 .Set the DO function to "4: Frequency arrival". 2 .When the operating frequency of the drive is within the range of "Target frequency±A2-04 x P0-38", the DO terminal outputs an active signal.

Application instance

The following takes RO output function as an example.

1. Set E1-00 [RO output function selection] to "4: Frequency arrival".
2. Set the frequency of the drive.
3. During operation of the drive, when the operating frequency during acceleration reaches the result of "Frequency reference - A2-04 x P0-38 [Frequency arrival detection window]", the RO terminal outputs an active signal.
4. When the operating frequency during deceleration is lower than the result of "Frequency reference - A2-04 x P0-38 [Frequency arrival detection window]", the RO terminal stops outputting the active signal.

11.1.3 Detection Value for Frequency Arrival

Function description

This function is used to detect the operating frequency of the drive, within a certain range of any frequency.

Operating principles

The drive provides two sets of frequency detection parameters, allowing separate settings for the frequency arrival value and the frequency detection range. When the operating frequency of the drive is within the range of "Frequency arrival detection value±Frequency arrival detection amplitude", the DO terminal outputs an active signal when E1-04 [DO output function selection] is set to "26: Frequency 1 arrival" or "27: Frequency 2 arrival".

The following figure for frequency arrival function takes frequency 1 as an example.

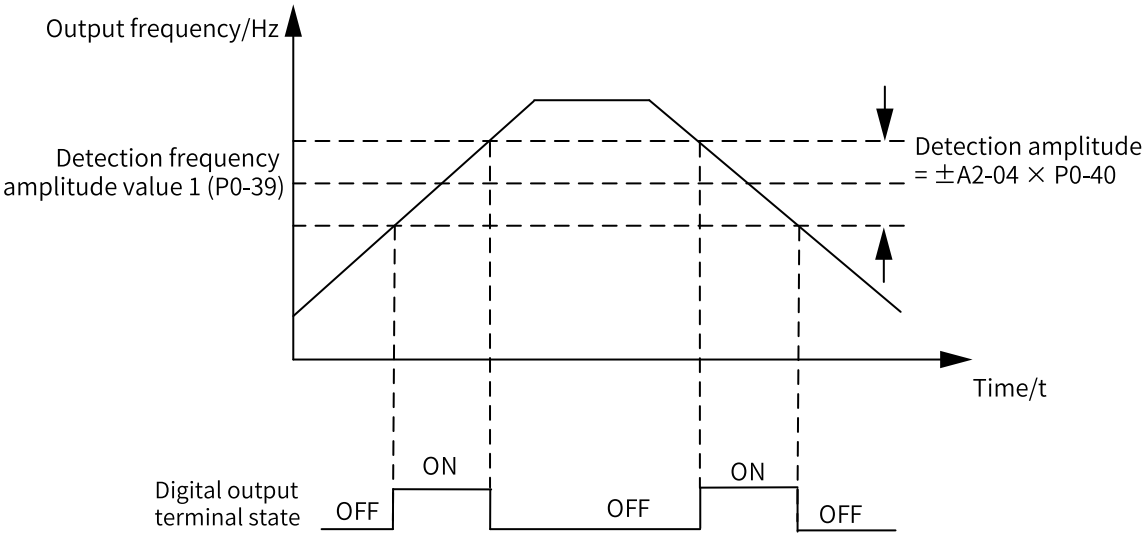


Figure 11-3 Frequency arrival

Related parameters

Table 11–3 Parameters related to detection value for frequency arrival

Param.	Name	Default value	Value range	Description
P0-39	Frequency arrival detection value 1	50.00 Hz	0.00% to A2-17	Defines the detection value 1 for the operating frequency of the drive. Note: 1 .Set the DO function to "26: Frequency 1 arrival". 2 .When the operating frequency of the drive is within the range of P0-39±A2-04 x P0-40, the DO terminal can be configured to output an active signal.
P0-40	Frequency arrival detection amplitude 1	0.1%	0.1 % to 100.0%	Defines detection amplitude 1 for the operating frequency of the drive, which is a percentage to A2-04. Note: Same as P0-39
P0-41	Frequency arrival detection value 2	50.00 Hz	0.00% to A2-17	Defines frequency detection value 2 for the operating frequency of the drive. Note: 1 .Set the DO function to "27: Frequency 2 arrival". 2 .When the operating frequency of the drive is within the range of P0-41±A2-04 x P0-42, the DO terminal can be configured to output an active signal.
P0-42	Detection frequency amplitude 2	0.1%	0.1 % to 100.0%	Defines detection window 2 for the operating frequency of the drive, which is a percentage to A2-04. Note: Same as P0-41.

Application instance

The following takes the detection value 1 for RO output frequency as an example.

1. Set E1-00 [RO output function selection] to "26: Frequency 1 arrival".
2. Set P0-39 [Frequency arrival detection value 1] and P0-40 [Frequency arrival detection amplitude 1].
3. The target frequency of the drive to a value higher than P0-39 [Frequency arrival detection value 1].
4. During operation of the drive, if the operating frequency during acceleration/deceleration reaches the result of "P0-39 [Frequency arrival detection value 1]±A2-04 x P0-40 [Frequency arrival detection amplitude 1]", the RO terminal outputs an active signal.

11.1.4 Frequency Upper Limit Arrival

Function description

This function is used to detect whether the operating frequency of the drive reaches the upper limit frequency and output the corresponding signal. You can limit the maximum output frequency of the drive by setting the upper limit.

Operating principles

The frequency upper limit is divided into positive frequency upper limit and negative frequency upper limit according to the operating direction.

The active positive frequency upper limit is limited by combination of three parameters: C4-10 [Maximum motor frequency], d1-03 [Digital reference of the positive frequency upper limit 1], and d1-05 [Source of positive frequency upper limit 2]. The minimum value among these three parameters is used as the positive frequency upper limit.

The active negative frequency upper limit is limited by combination of three parameters: C4-10 [Maximum frequency of the motor], d1-04 [Digital reference of the negative frequency upper limit 1], and d1-06 [Source of negative frequency upper limit 2]. The minimum value among these three parameters is used as the negative frequency upper limit.

When the upper limit frequency is reached, set E1-04 [DO output function selection] to "17: Frequency upper limit arrival". When the operating frequency of the drive reaches the active frequency upper limit, the DO terminal outputs an active signal. The upper limit frequency arrival function is shown in the figure below.

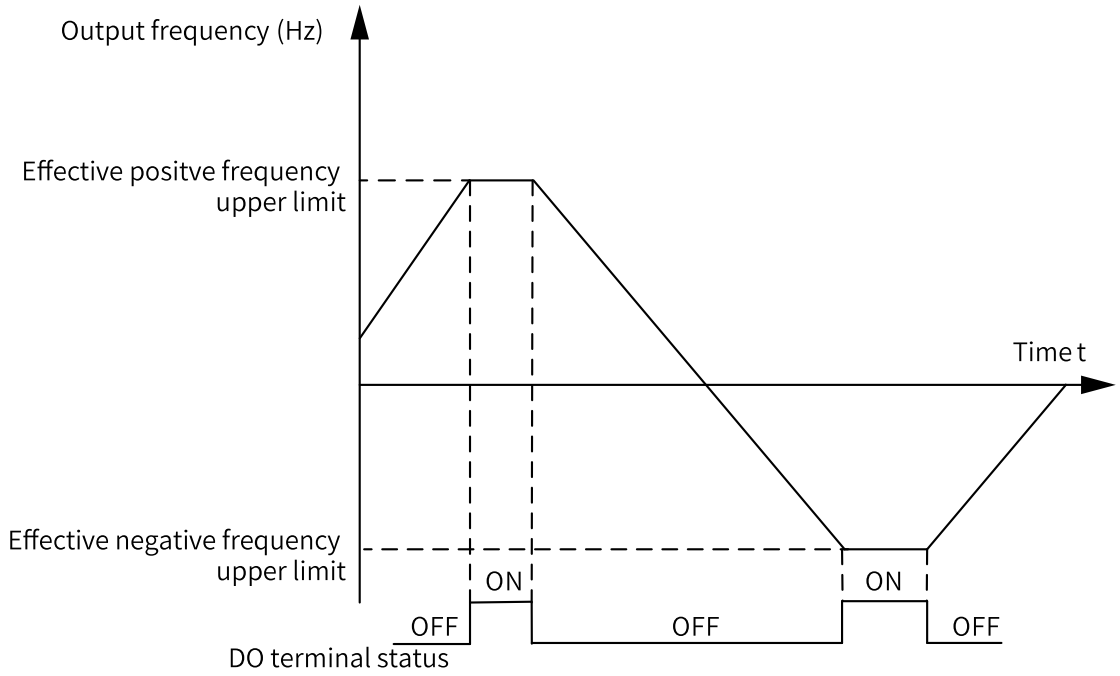


Figure 11-4 Diagram of frequency upper limit arrival

Related parameters

Table 11–4 Parameters related to frequency upper limit arrival

Param.	Name	Default value	Value range	Description
d1-03	Digital reference of positive frequency upper limit 1	800.0%	d1-07 to 800.0%	Limits the maximum positive operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Note: The positive frequency upper limit is the smaller of d1-03 and d1-05.
d1-04	Digital reference of negative frequency upper limit 1	800.0%	-800.0% to d1-08	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Note: The negative frequency upper limit is the smaller of d1-04 and d1-06.
d1-05	Source of positive frequency upper limit 2	0	0: 800% 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the highest operating frequency in the forward direction, which is expressed as a percentage to the motor rated frequency. Value description: 0: 800% - The positive frequency upper limit to 800%. 6: Multi-reference - When multi-reference is used as the positive frequency upper limit, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operation time and acceleration/deceleration time. Multi-reference parameters are used to set the positive frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The positive frequency upper limit is set through PID. 9: Communication - The positive frequency upper limit is set through communication. The positive frequency upper limit can be set through remote communication. Other: F connector - The positive frequency upper limit depends on the value of the selected F connector. Note: The positive frequency upper limit is the minimum value among C4-10, d1-03, and d1-05.

Param.	Name	Default value	Value range	Description
d1-06	Source of negative frequency upper limit 2	1	0: -800% 1: Inverted value of positive frequency upper limit 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Limits the maximum negative operating frequency. It is a per-unit value based on the rated frequency of the motor, that is, the value 100% indicates the rated motor frequency. Value description: 0: -800% - The negative frequency upper limit is -800%. 1: Inverted value of positive frequency upper limit 2 - The inverted value of d1-05 is used as the negative frequency upper limit. 6: Multi-reference - When multi-reference is used as the negative frequency upper limit source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 values. 7: Simple PLC - Simple PLC is a multi-speed operation command that can control the operating time and torque ramp-up/down time. Multi-reference parameters are used to set the negative frequency upper limit. The simple PLC module is used to set the operating time and acceleration/deceleration time of each frequency. Up to 16 speeds can be set. 8: PID - The PID output is used as the negative frequency upper limit. 9: Communication - The negative frequency upper limit is set through communication. The negative frequency upper limit can be input through remote communication. Other: F connector - The negative frequency upper limit is set through the F connector. Note: The negative frequency upper limit is the smaller of d1-04 and d1-06.
C4-10	Maximum frequency of the motor	50.00 Hz	C4-06 to 599.00 Hz	Defines the allowable maximum frequency of the motor in Hz.

Application instance

The following takes RO output frequency upper limit arrival as an example.

1. Set E1-00 [RO output function selection] to "17: Frequency upper limit reached".
2. Set C4-10 [Maximum frequency of the motor], d1-03 [Digital reference of positive frequency upper limit], d1-04 [Digital reference of negative frequency upper limit 1], d1-05 [Source of positive frequency upper limit 2], and d1-06 [Source of negative frequency upper limit 2].
3. When the operating frequency reaches the active frequency upper limit during operation of the drive, the RO terminal outputs an active signal.

11.1.5 Frequency Lower Limit Arrival

Function description

This function is used to detect whether the frequency reference of the drive reaches the lower limit frequency. If yes, a corresponding signal is output. You can limit the minimum frequency reference of the drive by setting the frequency lower limit.

Operating principles

The lower limit frequency is divided into positive lower limit and negative lower limit according to the running direction.

The effective positive frequency lower limit is restricted by two parameters, C4-11 [Minimum frequency of the motor] and d1-07 [Positive frequency lower limit]. The higher of C4-11 and d1-07 is used as the final effective positive frequency lower limit.

The effective negative frequency lower limit is restricted by two parameters, C4-11 [Minimum frequency of the motor] and d1-08 [Negative frequency lower limit]. The inverted absolute value of the higher of C4-11 and d1-08 is used as the final effective negative frequency lower limit. See details in *"9.3.6 Setting Frequency Reference Limits" on page 355*.

When the frequency lower limit is reached, if E1-04 [DO output function selection] is set to "18: Frequency lower limit arrival (no output at stop)" and E1-04 [DO output function selection] is set to "37: Frequency lower limit arrival (no output at stop)", the DO outputs an active signal as long as the frequency reference reaches the effective frequency lower limit, regardless of the drive state.

The following takes the positive frequency lower limit arrival function as an example.

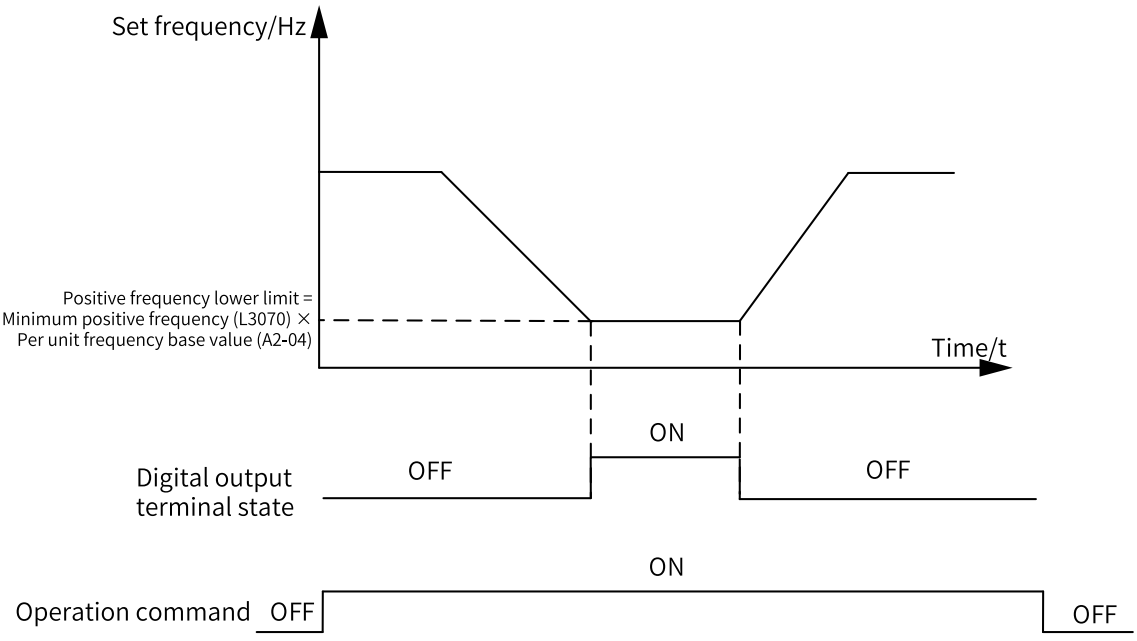


Figure 11-5 18: Frequency lower limit arrival (no output at stop)

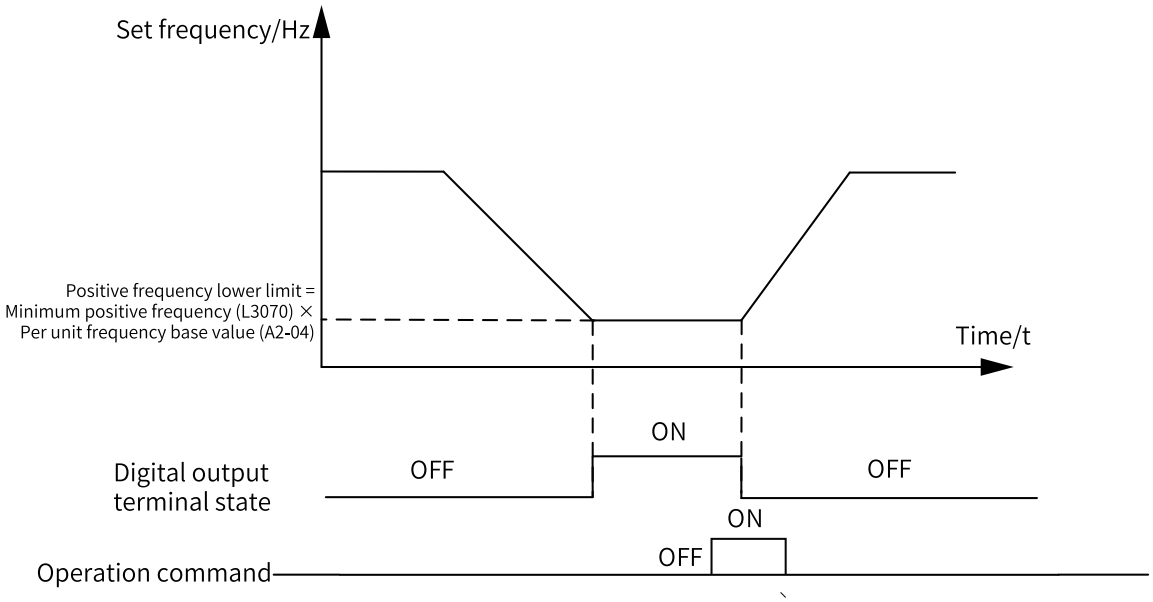


Figure 11-6 37: Frequency lower limit arrival (output even at stop)

Related parameters

Table 11–5 Parameters related to frequency lower limit arrival

Param.	Name	Default value	Value range	Description
d1-07	Positive frequency lower limit	0.0%	0.0% to d1-03	Defines the positive frequency lower limit, which is a percentage to the rated frequency of the motor.
d1-08	Negative frequency lower limit	0.0%	d1-04 to 0.0%	Defines the negative frequency lower limit, which is a percentage to the rated frequency of the motor.
C4-11	Minimum frequency of the motor	0.00	0.00 to C4-10	Defines the allowable minimum frequency of the motor in units of Hz.

Application instance

The following takes RO frequency lower limit arrival as an example.

1. Set E1-00 [RO output function selection] to "18: Frequency lower limit arrival (no output at stop)".
2. Set C4-11 [Minimum frequency of the motor], d1-07 [Digital reference of positive frequency lower limit 1], and d1-08 [Digital reference of negative frequency lower limit 1].
3. During operation of the drive, if the frequency reference reaches the effective frequency lower limit, the RO terminal outputs an active signal.

11.1.6 Target Speed Arrival

Function description

When the actual motor speed reaches the target speed and remains in this state for a specified period of time, the RO terminal outputs an active signal.

Operating principles

You can set the target speed arrival detection window through P0-51. When the actual motor speed detected by the drive is within the target speed±window range (P0-51) for a specified period of time, the DO outputs an active signal when you set E1-04 [DO output function selection] to "Other: B connector" and select "L0110 Target speed arrival", as shown below.

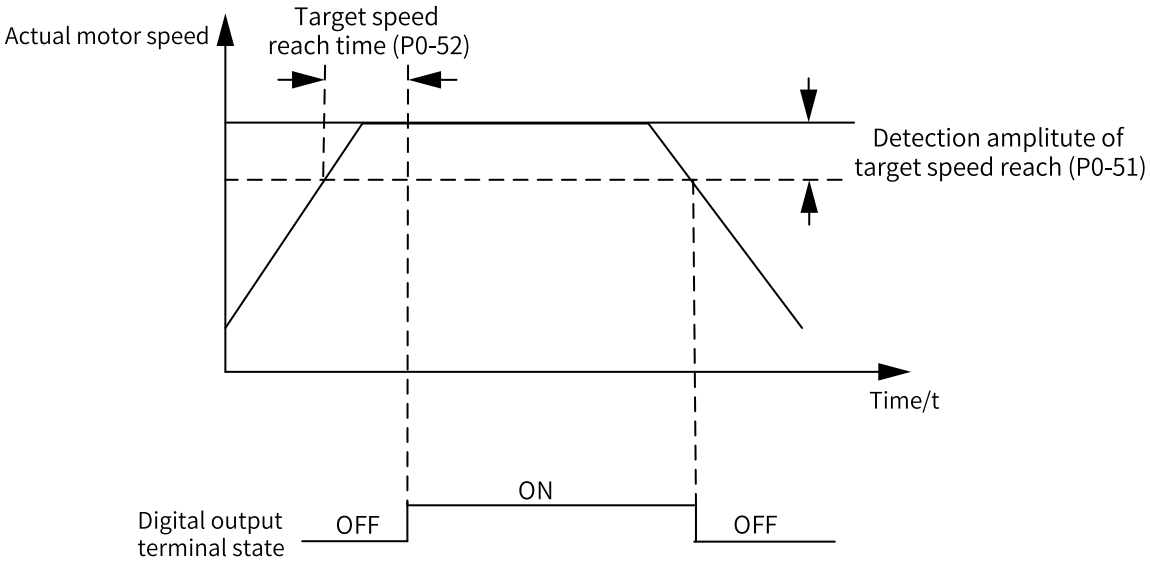


Figure 11-7 Target speed arrival

Related parameters

Table 11–6 Parameters related to target speed arrival

Param.	Name	Default value	Value range	Description
P0-51	Target speed arrival detection window	3.0%	0.0% to 600.0%	Defines the operating frequency of the drive and the window for detecting whether the actual motor speed reaches the target speed (frequency). Note: 1 .When both the operating frequency of the drive and the detected actual motor speed are within the target speed±window range (P0-51), and such state persists for a specified period of time, the DO terminal outputs an active signal. 2 .If the detection window is set to 0, the target speed arrival function is inactive.
P0-52	Target speed arrival time	3.00s	0.00s to 100.00s	Defines the duration for the operating frequency and the actual motor speed to reach the target speed (frequency). Note: Same as P0-51.

Application instance

The following takes the target speed of RO as an example.

1. Set E1-00 [RO output function selection] to "L0110 Target speed arrival" under "Other: B connector".
2. Set P0-51 [Target speed arrival detection window] and P0-52 [Target speed arrival time].
3. When the drive is running, and the detected actual motor speed remains within the target speed ±window range (P0-51) for a specified period of time, the RO outputs an active signal.

11.1.7 Speed Comparison Arrival

Function description

When the actual motor speed reaches the speed comparison threshold and such status lasts for a specified period of time, the DO outputs an active signal.

Operating principles

Name	Parameter setting	Other related parameters	Condition	Action upon arrival
Speed compari-son arrival 1	Set P0-53 [Speed comparison arrival threshold 1]	Observe P0-55 [Speed comparison arrival time 1]	When the motor operating speed (absolute value) exceeds the speed comparison threshold and such status lasts for the speed comparison arrival time, then the DO	assigned with "L0270 speed comparison arrival 1" or "L0271 speed comparison arrival 2" in "Other: B connector" outputs an active signal.
Speed compari-son arrival 2	Set P0-56 [Speed comparison threshold 2].	Observe P0-58 [Speed comparison threshold time 2].		

The speed comparison arrival function is shown in the figure below, which takes speed comparison arrival 1 as an example.

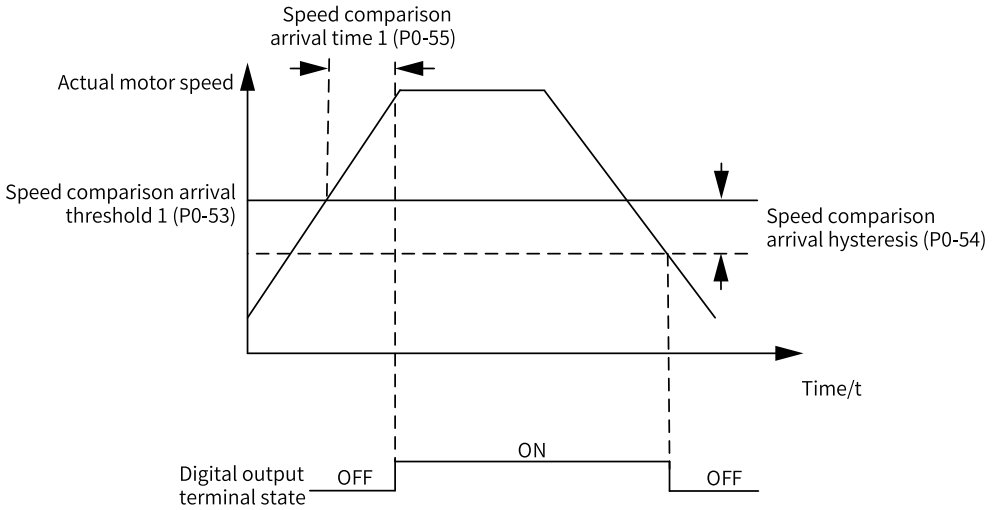


Figure 11-8 Speed arrival

Related parameters

Table 11–7 Parameters related to frequency upper limit arrival

Param.	Name	Default value	Value range	Description
P0-53	Speed comparison arrival threshold 1	100.0%	0.0% to 600.0%	Defines speed comparison arrival threshold 1 of the motor operating speed (absolute value). Note: 1. During normal operation, when the motor operating speed (absolute value) exceeds P0-53 and such status persists for the time defined by P0-55, the multi-function DO terminal that assigned with "Speed comparison arrival 1" outputs an active signal. 2. When any one of the following conditions is met, the multi-function DO assigned with "Speed comparison arrival" outputs an inactive signal. (1) P0-53 [Speed comparison arrival threshold 1] is set to 0. (2) The motor operating speed is 0. (3) The operating direction is opposite to the previous one. (4) P0-53 > P0-54, and the motor operating speed (absolute value) < |P0-53- P0-54|
P0-54	Speed comparison arrival hysteresis 1	3.0%	0.0% to 600.0%	Defines speed comparison threshold hysteresis 1 of the motor operating speed (absolute value). Note: See P0-53.
P0-55	Speed comparison arrival time 1	3.00s	3.00s to 100.00s	Defines the speed comparison arrival time of the motor operating speed (absolute value). Note: See P0-53.
P0-56	Speed comparison arrival threshold 2	100.0%	0.0% to 600.0%	Defines speed comparison reach threshold 2 of the motor operating speed (absolute value). Note: During normal operation, when the motor speed (absolute value) exceeds the speed set by P0-56 while P0-56 is not 0, and this status lasts for the time defined by P0-58, the multi-function DO assigned with "Speed comparison arrival 1" outputs an active signal. When any one of the following conditions is met, the multi-function DO assigned with "Speed comparison arrival" outputs an inactive signal. (1) P0-56 [Speed comparison arrival threshold 2] is set to 0. (2) The motor operating speed is 0. (3) The operating direction is opposite to the previous one. (4) P0-56 > P0-57, and the motor operating speed (absolute value) < |P0-56-P0-57|.

Param.	Name	Default value	Value range	Description
P0-57	Speed comparison arrival hysteresis 2	3.0%	0.0% to 600.0%	Defines the speed comparison threshold hysteresis 2 of the motor operating speed (absolute value). Note: See P0-56.
P0-58	Speed comparison arrival time 2	3.00s	3.00s to 100.00s	Defines speed comparison arrival time 2 of the motor operating speed (absolute value). Note: See P0-56.

Application instance

The following takes RO output speed comparison arrival 1 as an example.

1. Set E1-00 [RO output function selection] to "L0270 Speed comparison arrival 1" in "Other: B connector".
2. Set P0-53 [Speed comparison arrival threshold 1], P0-54 [Speed comparison hysteresis 1], and P0-55 [Speed comparison arrival time 1].
3. During operation of the drive, if the actual motor speed detected during acceleration exceeds the value of P0-53 [Speed comparison arrival threshold 1], and such status lasts for the time defined by P0-55 [Speed comparison arrival time 1], the RO outputs an active signal.
4. During operation of the drive, if the actual motor speed detected during deceleration is lower than the result of P0-53 [Speed comparison arrival threshold 1] minus P0-54 [Speed comparison arrival hysteresis 1], the RO outputs an active signal.

11.2 Current Detection

11.2.1 Zero Current Detection

Function description

When the output current of the drive keeps lower than or equal to the zero current detection level for a period longer than the zero current detection delay, the DO outputs an active signal.

Operating principles

When the output current of the drive keeps lower than or equal to P0-47 [Zero current detection level] for a period of time longer than P0-48 [Zero current detection delay time], the DO terminal assigned with "34: Zero current status function", the DO outputs an active signal. You can also check whether the drive enters the zero current state through L0260 [Zero current state] or bit10 of L1005 [System status word 4].

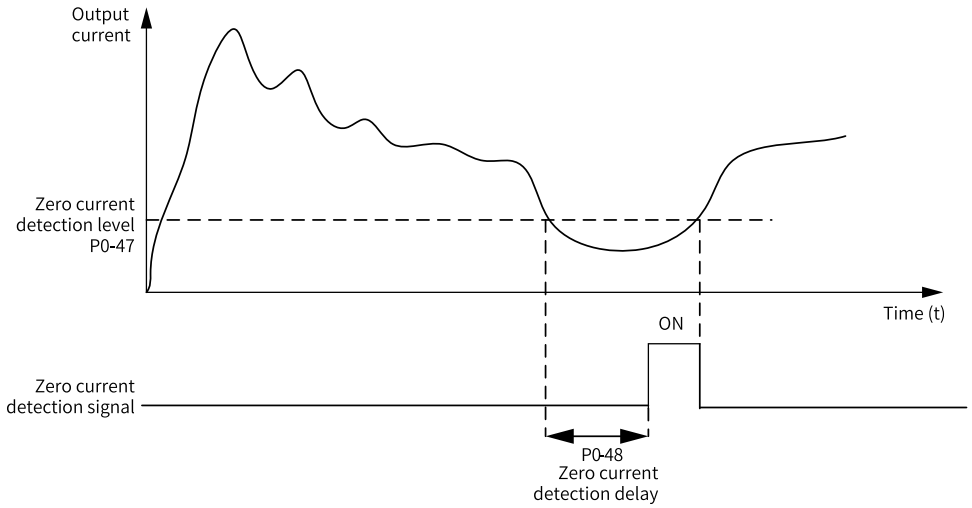


Figure 11-9 Zero current detection

Related parameters

Table 11–8 Parameters related to zero current detection

Param.	Name	Default value	Value range	Description
P0-47	Zero current detection level	5.0%	0.0% to 300.0% (Base current)	Defines the zero current detection value of the output current of the drive, which is a percentage to the rated motor current.
P0-48	Zero current detection delay	0.10s	0.01s to 600.00s	Defines the zero current detection delay of the output current of the drive.

11.2.2 Output Current Limit Violation

Function description

When the output current of the drive keeps exceeding the setpoint for a specified period of time, the DO terminal outputs an active signal.

Operating principles

When the output current of the drive keeps exceeding P0-49 [Output current threshold limit] for a period longer than P0-50 [Output current limit violation detection delay], the DO terminal assigned with "36: Output current limit violation" outputs an active signal. You can also check whether the output current limit of the drive is exceeded through L0261 [Output current limit violated] or bit11 of L1005 [System status word 4].

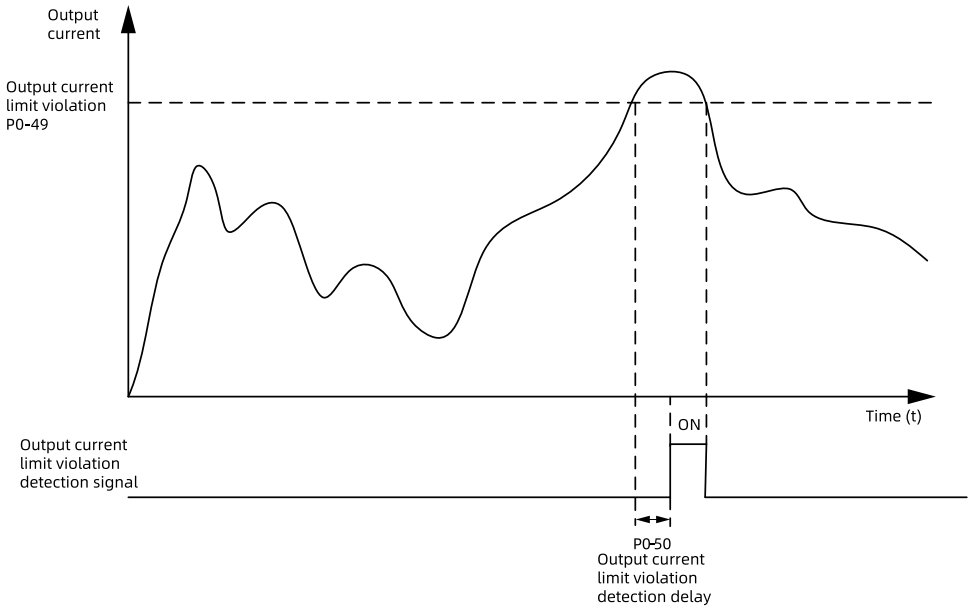


Figure 11-10 Output current limit violation detection

Related parameters

Table 11–9 Parameters related to output current limit violation

Param.	Name	Default value	Value range	Description
P0-49	Output current threshold limit	200.0%	0.0% to 300.0% (Base current)	Defines the output current threshold limit of the drive, which is a percentage to the rated current of the drive.
P0-50	Delay time for output current limit violation detection	0.00s	0.00s to 600.00s	Defines the output current limit violation detection delay.

11.2.3 Current Arrival

Function description

This function is used to detect whether the output current of the drive reaches the setting range (any). If yes, the DO terminal outputs an active signal.

Operating principles

When the output current of the drive is within "(Current arrival 1±Window of current arrival 1) x Base current", the DO terminal assigned with "28/29: Current 1/2 arrival" outputs an active signal. The drive provides two sets of current arrival and detection window parameters, as shown below.

You can also check whether the corresponding state is reached through L0258 [Current 1 arrival], L0259 [Current 2 arrival], or bit8 and bit9 of L1005 [System status word 4].

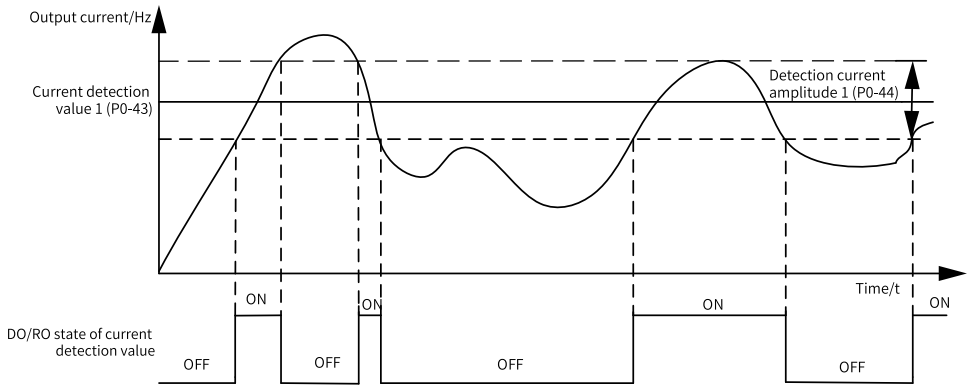


Figure 11-11 Sequence for current arrival

Related parameters

Table 11–10 Parameters related to current arrival

Param.	Name	Default value	Value range	Description
P0-43	Current arrival 1	100.0%	0.0% to 300.0% (Base current)	Defines current arrival 1 of the output current of the drive, which is a percentage to the rated current of the motor. Note: When the output current of the drive is within "(Current arrival 1±Window of current arrival 1) x Rated current of the motor", the DO terminal can be configured to output an active signal.
P0-44	Window of current arrival 1	0.0%	0.0% to 300.0% (Base current)	Defines the current arrival 1 window of the output current of the drive, which is a percentage to the rated current of the motor.
P0-45	Current arrival 2	100.0%	0.0% to 300.0% (Base current)	Defines current arrival 2 of the output current of the drive, which is a percentage to the rated current of the motor. Note: When the output current of the drive is within "(Current arrival 2±Window of current arrival 2) x Rated current of the motor", you can configure the active signal through the DO terminal.
P0-46	Window of current arrival 2	0.00 %	0.0% to 300.0% (Base current)	Defines the current arrival 2 window of the output current of the drive, which is a percentage to the rated current of the motor.

11.3 Fan Control

Application scenarios

The fan is used to cool the drive and prevent overtemperature, which could trigger an overtemperature fault.

Function description

The drive provides three fan control modes, which can be switched through A4-11 [General fan control mode].

- Undervoltage state: The fan does not operate.

- Non-undervoltage state:
  - A4-11 = 0 (Fan operates during operation):
    1. Operational state: The fan starts upon S-ON. After switching to the stop state, it keeps operating for 10s and then stops.
    2. Non-operational state: The fan starts when the drive temperature (U0-82) or the ambient temperature (U0-83) is higher than 70℃. When both temperatures are below 68℃, the fan stops after a delay of 10s. When both temperatures are between 68℃ to 70℃, the fan keeps the original state.
  - A4-11 = 1 (Fan operates continuously): The fan operates continuously.
  - A4-11 = 2 (Fan operates based on temperature): The fan state is independent of the drive state, but only related to the temperature. When the drive temperature (U0-82) or the ambient temperature (U0-83) is higher than 70℃, the fan keeps working. When both temperatures are below 68℃, the fan stops after a delay of 10s. When both temperatures are between 68℃ to 70℃, the fan keeps the original state.
- Fan protection function:
  - When a fan fault is detected (such as fan stall), A080.1 is reported and the fan stops.
  - During the alarm period (A080.1), the fan remains stopped unless A080.1 is cleared.
  - The ones of H1-10 defines the fault level (alarm by default) of the fan fault.

Note

Only drives of 2.2 kW model are equipped with the cooling fan.

Related parameters

Table 11–11 Parameters related to fan control

Param.	Name	Default value	Value range	Description
A4-11	General fan control mode	0	0: Operating during operation of the drive (working at temperatures above 70℃ in the stop state) 1: Operating continuously 2: Operating based on temperature	Defines the general operation mode of the fan. Value description: 0 - Operating during operation of the drive Operational state: The fan starts upon S-ON. After switching to the stop state, it keeps operating for 10s and then stops. Non-operational state: The fan starts when the drive temperature (U0-82) or the ambient temperature (U0-83) is higher than 70℃. When both temperatures are below 68℃, the fan stops after a delay of 10s. When both temperatures are between 68℃ to 70℃, the fan keeps the original state. 1 - Operating continuously 2 - Operating based on temperature The fan state is independent of the drive state, but only related to the temperature. When the drive temperature (U0-82) or the ambient temperature (U0-83) is higher than 70℃, the fan keeps working. When both temperatures are below 68℃, the fan stops after a delay of 10s. When both temperatures are between 68℃ to 70℃, the fan keeps the original state.
U0-82	Heatsink temperature	0.0 ℃	-20.0℃ to +120℃	Displays the heatsink temperature of the drive.
U0-83	Drive cavity temperature	0.0 ℃	-20.0℃ to +120℃	Displays the drive cavity temperature.

11.4 Set Time Arrival

11.4.1 Cumulative Power-on Time Arrival

Application scenarios

When the DO (RO) terminal function is set to 24 [Cumulative power-on time arrival], the DO (RO) terminal outputs an active signal after the cumulative power-on time exceeds the user-defined cumulative power-on time threshold, indicating that the set power-on time has been arrival.

Function description

The following show how to set the cumulative power-on time threshold.

1. Set the DO (RO) terminal function to 24 [Cumulative power-on time arrival].

2. Set the cumulative power-on time threshold through P0-16 [Power-on time threshold in hours] and P0-17 [Power-on time threshold in seconds]. The cumulative power-on time threshold is the sum of P0-16 and P0-17. Note that if both P0-16 [Power-on time threshold in hours] and P0-17 [Power-on time threshold in seconds] are set to 0, the cumulative operating time threshold is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the cumulative power-on time threshold of the drive is set to an active value, the DO (RO) outputs an active signal as long as "Ad-02 [Cumulative power-on time in hours] x 3600 + Ad-03 [Cumulative power-on time in seconds]" exceeds "P0-16 [Power-on time threshold in hours] x 3600 + P0-17 [Power-on time threshold in seconds]".

Related parameters

Param.	Name	Default value	Value range	Description
Ad-02	Cumulative power-on time - hours	0	0h to 65535 h	Displays the cumulative power-on time in hours.
Ad-03	Cumulative power-on time - seconds	0	0s to 3599s	Displays the cumulative power-on time in seconds.
P0-16	Power-on time threshold in hours	0	0 to 65535h	Defines the power-on time threshold in hours. Note: 1 .The power-on time is determined by the combination of P0-16 and P0-17. After the cumulative power-on time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-16 and P0-17 are set to 0, this function is disabled.
P0-17	Power-on time threshold in seconds	0	0 to 3599s	Defines the power-on threshold in seconds. Note: 1 .The power-on time is determined by the combination of P0-16 and P0-17. After the cumulative power-on time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-16 and P0-17 are set to 0, this function is disabled.

Precautions

The cumulative operating time is not automatically cleared. When A0-00 [Parameter initialization] is set to 2 [Clear log information], the values of Ad-02 [Cumulative power-on time in hours] and Ad-03 [Cumulative power-on time in seconds] can be cleared. In this case the cumulative power-on time is counted from zero again.

11.4.2 Cumulative Operating Time Arrival

Application scenarios

When the DO (RO) terminal function is set to 12 [Cumulative operating time arrival], the DO (RO) terminal outputs an active signal after the cumulative operating time of the drive exceeds the user-defined cumulative operating time threshold, indicating that the set target has been reached.

Function description

The following show how to set the cumulative operating time threshold.

1. Set the DO (RO) terminal function to 12 [Cumulative operating time arrival].
2. Set the cumulative operating time threshold through P0-18 [Operating time threshold in hours] and P0-19 [Operating time threshold in seconds]. The cumulative operating time threshold is the sum of P0-18 and P0-19. Note that if both P0-18 [Operating time threshold in hours] and P0-19 [Operating time threshold in seconds] are set to 0, the cumulative operating time threshold is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the cumulative operating time threshold of the drive is set to an active value, the DO (RO) outputs an active signal as long as "Ad-00 [Cumulative operating time in hours] x 3600 + Ad-01 [Cumulative operating time in seconds]" exceeds "P0-18 [Operating time threshold in hours] x 3600 + P0-19 [Operating time threshold in seconds]".

Related parameters

Param.	Name	Default value	Value range	Description
Ad-00	Cumulative operating time - hours	0	0 h to 65535 h	Displays the cumulative operating time in hours.
Ad-01	Cumulative operating time - seconds	0	0s to 3599s	Displays the cumulative operating time in seconds.
P0-18	Set operating time threshold in hours	0	0 h to 65535 h	Defines the operating time of the drive in hours. Note: 1 .The operating time is determined by the combination of P0-18 and P0-19. After the cumulative operating time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-18 and P0-19 are set to 0, this function is disabled.
P0-19	Set operating time threshold in seconds	0	0s to 3599s	Defines the operating time of the drive in seconds. Note: 1 .The operating time is determined by the combination of P0-18 and P0-19. After the cumulative operating time reaches the set value, the multi-function DO terminal assigned with the related function outputs the ON signal. 2 .When both P0-18 and P0-19 are set to 0, this function is disabled.

Precautions

The cumulative operating time is not automatically cleared. When A0-00 [Parameter initialization] is set to 2 [Clear log information], the values of Ad-00 [Cumulative operating time in hours] and Ad-01 [Cumulative operating time in seconds] can be cleared. In this case the cumulative operating time is counted from zero again.

11.4.3 Current Operating Time Arrival

Application scenarios

When the DO (RO) terminal function is set to 40 [Current operating time arrival], the DO (RO) terminal outputs an active signal after the current operating time of the drive exceeds the threshold, indicating that the set target time has been reached.

Function description

Observe the following steps to set this function.

1. Set the DO (RO) terminal function to 40 [Current operating time arrival].
2. Set the arrival time through P0-20 [Current operating time threshold]. Note that if P0-20 [Current operating time threshold] is set to 0, this function is inactive, and the DO (RO) terminal always outputs an inactive signal.

When the arrival time is set to a valid value, the DO (RO) terminal outputs an active signal as long as U0-26 [Current operating time] exceeds P0-20 [Current operating time threshold].

Related parameters

Param.	Name	Default value	Value range	Description
P0-20	Current operating time threshold	0.0 min	0.0 min to 6500.0 min	Defines the current operating time threshold of the drive. Note: 1 .If the current operating time reaches the value set in this parameter, the DO terminal assigned with "Current operating time arrival" outputs an active signal, indicating that the current operating time is reached. 2 .The setpoint 0 indicates this function is disabled.
U0-26	Current operating time	-	-	Displays the current operating time in minute. The maximum value is 6553.5. If the maximum value is reached, timing stops.

11.5 Load Monitoring

Application scenarios

The load monitoring function is used to monitor input signals (such as output current, output torque, and output power) related to the output speed of the drive.

This function includes overload monitoring and load loss monitoring.

- Load loss monitoring is used to detect whether the load is lost, such as belt breakage or mechanical shaft breakage.
- Overload monitoring is used to detect whether the load is blocked, such as motor stall.

Function description

After the motor actual speed enters the user-defined monitoring range, the drive samples the current motor speed and monitoring signal, and finds the corresponding upper and lower boundary points of the monitoring signal on the multi-point curve based on the current motor speed.

- If the current monitoring signal exceeds the upper boundary point, overload occurs.
- If the current monitoring signal exceeds the lower boundary point, load loss occurs.
- If the current monitoring signal is between the upper and lower boundary points, the load normal.

The monitoring signal is generally a signal related to motor speed, which can be set through P0-66 [Load monitoring signal selection]. The monitoring signal can be selected as output current, output torque, or output power, or you can select other signal from "Other: F connector," following the method described in the "Parameter Interconnection" section.

The current status of the selected monitoring signal can be checked through P0-67 [Load monitoring signal status].

You can set the allowable overload/load loss time as needed through P0-85 [Overload permission time] and P0-86 [Load loss permission time]. If the system detects that the duration of overload/load loss exceeds the set time, an overload/load loss action can be triggered. The corresponding action can be selected through P0-68 [Load monitoring overload action] or P0-69 [Load monitoring load loss action].

Operating principles

The schematic of the load monitoring function is shown below. The lower boundary curve is formed by the x-coordinate (P0-70 to P0-74) and the y-coordinate (P0-80 to P0-84). The upper boundary curve is formed by the x-coordinate (P0-70 to P0-74) and the y-coordinate (P0-75 to P0-79).

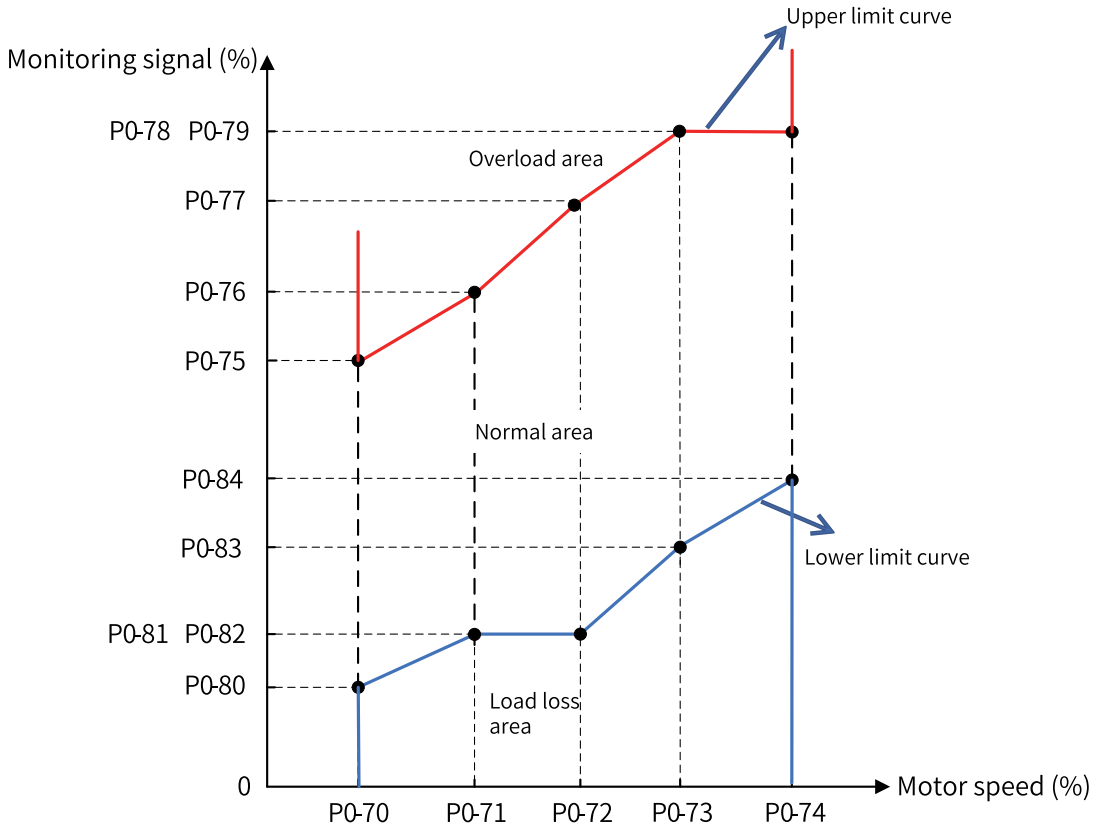


Figure 11-12 Schematic of load monitoring signal

When the motor actual speed falls within the user-defined x-coordinate range (P0-70 to P0-74), load monitoring starts. The system calculates the points of the monitoring signals (output current, output torque, output power) on the upper and lower boundary curves based on the current motor speed signal, and compares them with the monitoring signals sampled by the current system.

- If the monitored signal sampled by the system exceeds the upper boundary point, overload occurs.
- If the monitored signal sampled by the system exceeds the lower boundary point, load loss occurs.
- If the monitored signal sampled by the system is between the upper and lower boundary points, the load is normal.

Related parameters

Param.	Name	Default value	Value range	Description
P0-66	Load monitoring signal selection	0	0: Monitoring not enabled 1: Monitor output current 2: Monitor output torque 3: Monitor output power Other: F connector	Used to select the monitoring signal, which can be the output current, output torque, or output power. The monitoring signal can also be selected from the connector. Value description: 0: Monitoring not enabled 1: Monitor output current (L3234) 2: Monitor output torque (L3260) 3: Monitor output power (L3266) Other: F connector
P0-67	Load monitoring signal state	0	0 to 65535	Displays the monitoring signal state. Value description: 0 - The monitoring signal is within the normal range. 1 - The monitoring signal is below the normal range (load loss). 4 - The monitoring signal is above the normal range (overload).
P0-85	Allowable overload time	20.0 s	0.0s to 6553.5s	Defines the response delay from overload detection to triggering P0-68.
P0-86	Allowable load loss time	20.0 s	0.0s to 6553.5s	Defines the response delay from load loss detection to triggering P0-69.
P0-68	Overload response in load monitoring state	0	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the drive when overload is detected. [No alarm/fault]: No alarm or fault is reported. [Alarm]: Overload alarm A046.2 is reported when the monitoring signal keeps higher than the set overload curve for a period longer than the value of P0-85 [Allowable overload time]. [Fault] Overload fault E046.1 is reported when the monitoring signal keeps higher than the set overload curve for a period longer than the value of P0-85[Allowable overload time]. [Alarm/Fault]: If the monitoring signal keeps higher than the set overload curve for a period longer than half of P0-85 [Allowable overload time], overload alarm A046.2 is reported. If the period is longer than or equal to P0-85, overload fault E046.1 is reported.

Param.	Name	Default value	Value range	Description
P0-69	Load loss response in load monitoring state	0	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/fault	Defines the response of the drive when load loss is detected. [No alarm/fault]: No alarm or fault is reported. [Alarm]: Overload alarm A046.4 is reported when the monitoring signal keeps lower than the set overload curve for a period longer than the value of P0-86 [Allowable load loss time]. [Fault] Overload fault E046.3 is reported when the monitoring signal keeps lower than the set overload curve for a period longer than the value of P0-86 [Allowable load loss time]. [Alarm/Fault]: If the monitoring signal keeps lower than the set overload curve for a period longer than half of P0-86, overload alarm A046.4 is reported. If the period is longer than or equal to P0-86, overload fault E046.3 is reported.
P0-70	X-coordinate point 1 in load monitoring state	0.0%	0.0% to 600.0%	Defines the Nth speed point on the x-axis in load monitoring state. Note: When the motor speed is negative, the absolute speed value is used as the x-coordinate point to determine the range of the monitoring signal.
P0-71	X-coordinate point 2 in load monitoring state	0.0%	0.0% to 600.0%	
P0-72	X-coordinate point 3 in load monitoring state	0.0%	0.0% to 600.0%	
P0-73	X-coordinate point 4 in load monitoring state	0.0%	0.0% to 600.0%	
P0-74	X-coordinate 5 in load monitoring state	0.0%	0.0% to 600.0%	
P0-75	Upper limit 1 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the first overload point on the load curve.
P0-76	Upper limit 2 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the second overload point on the load curve.
P0-77	Upper limit 3 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the third overload point on the load curve.
P0-78	Upper limit 4 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fourth overload point on the load curve.

Param.	Name	Default value	Value range	Description
P0-79	Upper limit 5 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fifth overload point on the load curve.
P0-80	Lower limit 1 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the first load loss point on the load curve.
P0-81	Lower limit 2 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the second load loss point on the load curve.
P0-82	Lower limit 3 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the third load loss point on the load curve.
P0-83	Lower limit 4 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fourth load loss point on the load curve.
P0-84	Lower limit 5 on load monitoring curve	0.0%	0.0% to 400.0%	Defines the fifth load loss point on the load curve.

Precautions

The conditions for activating the load monitoring module include the following.

- P0-66 [Load monitoring signal] is not set to 0.
- Speeds on the load monitoring curve are incremental (that is, P0-70 < P0-71 < P0-72 < P0-73 < P0-74).
- The actual motor speed is within the range of P0-70 to P0-74.
- The set overload threshold is higher than the set load loss threshold under the same speed point on the load monitoring curve.

Application instance

The following example takes the output current as the monitored signal.

1. Set P0-66 [Load monitoring signal selection] to 1 [Monitor output current].
2. Set P0-68 [Load monitoring overload action] to 1 [Alarm], and set P0-69 [Load loss response in load monitoring state] to 1 [Alarm].
3. Set P0-85 [Allowable overload time] and P0-86 [Allowable load loss time].
4. Set the x-coordinate P0-70 to P0-74.
5. Set P0-80...P0-84 and P0-75...P0-79.
6. After the drive starts and runs, analyze based on the following curve. After the motor speed signal enters the monitoring range (> P0-70), the monitored current signal is below the lower boundary curve, so P0-67 outputs 1 to indicate load loss. If this duration exceeds P0-86 [Allowable load loss time], an alarm message is output. When the motor speed signal is between P0-72 and P0-73, the

monitored current signal is above the upper boundary curve, so P0-67 outputs 4 to indicate overload. If this duration exceeds P0-85 [Allowable overload time], an alarm message is output.

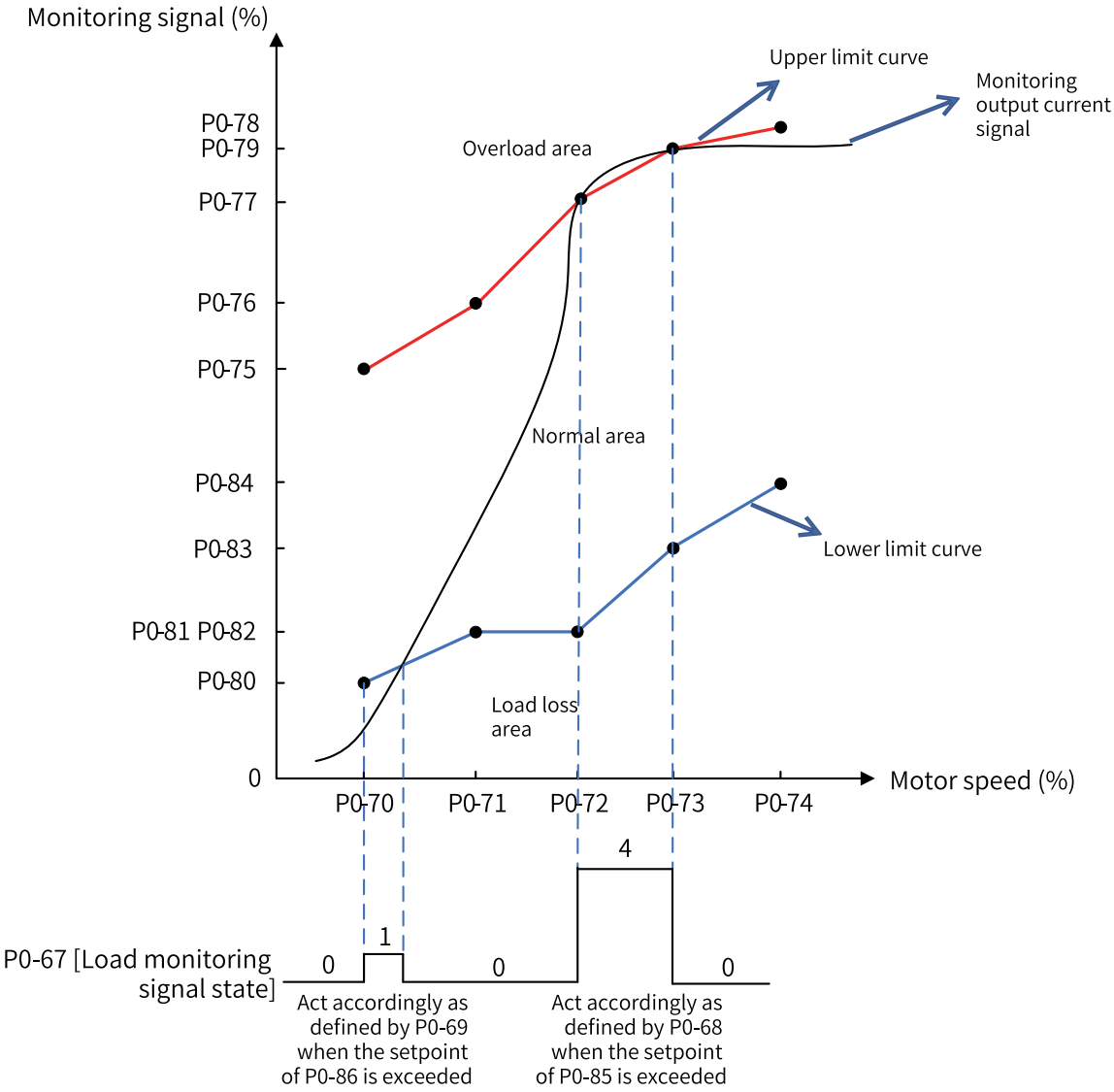


Figure 11-13 Monitoring example

11.6 Process Functions

11.6.1 Process PID Control

Application scenarios

The PID-controlled output is used as the operating frequency. The PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

Function description

As a general process control method, PID process control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and derivative calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the drive output frequency.

- Proportional gain Kp: Once the deviation between the PID output and the input is generated, the PID adjusts the control output so that the controlled value changes to reduce deviation. The speed of the deviation reduction depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction. (A proportional gain of 100.0 indicates that when the deviation between PID feedback and PID reference is 100.0%, the PID regulator regulates the output reference at the amplitude of the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Integral time Ti: Determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be. (When the deviation between PID feedback and PID reference is 100.0%, the integral regulator performs continuous regulation within the time. The regulation value reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)
- Derivative time Td: Determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be. (Derivative time indicates the time within which the feedback change reaches 100.0%. The regulation value reaches the maximum range. For example, the maximum frequency applies during frequency adjustment.)

Related parameters

Param.	Name	Default value	Value range	Description
P2-00	Process PID	0	0: Inhibited	The process PID is not used for calculation and the PID output is cleared.
			1: Enable	The PID function is enabled. The PID output is calculated based on the set parameter.
			Other: B connector	Select a parameter in the bit connector to control operation of the PID function.
P2-01	PID action direction	0	0: Direct acting	If the feedback signal is lower than the PID reference signal, the drive output frequency increases.
			1: Negative	If the feedback signal is lower than the PID reference signal, the drive output frequency decreases.
			Other: B connector	Select the parameter in the bit connector to control PID direction. The value 0 represents positive action and 1 represents negative action.

Param.	Name	Default value	Value range	Description
P2-02	PID reference source	0	0: PID value reference	Used to select the PID reference setting channel. The PID reference source is a relative value. The value 100% corresponds to 100% of the feedback signal of the controlled system. The PID reference is set by P2-03 (PID reference value).
			5: Multi-reference	In the multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The four multi-reference terminals have 16 state combinations, corresponding to 16 target frequency values. Note: When P2-00 is set to 5 [Multi-reference], b8-08 (Source of multi-reference 0) cannot be set to 5 (PID reference).
			6: Simple PLC	The PID reference is set through simple PLC.
			8: Communication	The PID reference is set through remote communication.
			Other: F connector	The parameter in the floating-point connector is used as the PID reference value.
P2-03	PID value reference	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter must be set. When the parameter value is set to 100%, it corresponds to the maximum feedback value.
P2-04	PID feedback source	0	5: Communication	The PID feedback reference is set through remote communication.
P2-05	PID reference feedback range	1000	0 to 65535	Dimensionless unit that only used to display the PID reference and feedback range For example, if this parameter is set to 1000, the PID reference (0% to 100%) and feedback value (0 to 1000) are linearly related. For example, 1000 (PID reference feedback dimension) /100 (PID output %) = 10 (Dimension coefficient), where a PID output of 0% corresponds to an engineering value of 0, and a PID output of 100% corresponds to an engineering value of 1000.
P2-06	PID reference change time	0.00s	0.00s to 650.00s	Indicates the time required for PID setting to change from 0.0% to 100.0%.
P2-07	PID feedback filter time	0.00s	0.00s to 60.00s	Defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but degrades the response of the process closed-loop system. Note: An excessively high setpoint may result in slow PID feedback speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID feedback speed and large system vibration.

Param.	Name	Default value	Value range	Description
P2-08	PID output filter time	0.00s	0.00s to 60.00s	Used to filter the PID output value to smooth the output frequency. However, the filter time slows down the response of the process closed-loop system. Note: An excessively high setpoint may result in slow PID output speed and large deviation from the actual speed. An excessively low setpoint may result in fast PID output speed and large system vibration.
P2-09	PID inversion cutoff frequency	2.00 Hz	0.00 Hz to A2-07	When the frequency source is only the PID, the PID inversion cutoff frequency is the minimum value of the current PID output. When the frequency source is "main frequency + PID", P2-09 acts on the "main frequency + PID" and outputs the minimum frequency value after being processed by "main frequency + PID". This parameter is inactive when P2-09 is set to 0. Note: When using this function, you need to select connector L2480 (General PID inversion cutoff frequency) as the minimum output source of PID.
P2-11	PID parameter switchover condition	0	0: Not switched	Used for switchover between two groups of PID parameters. PID parameters are not switched. The first group of PID parameters are used, namely P2-14 to P2-16.
			1: Switched by DI	Assign the DI with function 43 (PID parameter switchover). When this terminal is disabled, parameter group 1 (P2-14 to P2-16) is used. When this terminal is enabled, parameter group 2 (P2-17 to P2-19) is used.
			2: Switched automatically based on deviation	When the absolute value of the deviation between PID feedback and PID reference is lower than PID parameter switchover deviation 1 (P2-12), group 1 is selected. When the absolute value of the deviation between PID feedback and PID reference is larger than PID parameter switchover deviation 2 (P2-13), group 2 is selected. When the deviation is between P2-12 (PID parameter switchover deviation 1) and P2-13 (PID parameter switchover deviation 2), the PID parameters are the linearly interpolated value of the two groups of PID parameter values, as shown in *"Figure 11-16 PID parameter switchover" on page 618*.
			3: Switched automatically based on operating frequency	In this mode, when the operating frequency of the drive is between 0 and the maximum frequency, the PID parameters are the linearly interpolated value of the two groups of parameter values, as shown in *"Figure 11-16 PID parameter switchover" on page 618*.

Param.	Name	Default value	Value range	Description
P2-12	PID parameter switchover deviation 1	20.0%	0.0 % to P2-13	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-13	PID parameter switchover deviation 2	80.0 %	P2-12 to 800.0 %	The value 100% corresponds to the maximum deviation between the reference and feedback.
P2-14	Proportional gain Kp1 of PID parameter 1	20.0	0.0 to 1000.0	Indicates the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	Integral time Ti1 of PID parameter 1	2.00s	0.01s to 10.00s	Indicates the integral time Ti in PID control. It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
P2-16	Derivative time Td1 of PID parameter 1	0.000s	0.000s to10.000s	Defines the derivative time Td in PID control. The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.
P2-17	Proportional gain Kp2 of PID parameter 2	20.0	0.0 to 1000.0	Indicates the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A higher Kp value indicates faster deviation reduction but higher possibility of oscillation. A lower Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-18	Integral time Ti2 of PID parameter 2	2.00s	0.01s to 10.00s	Indicates the integral time Ti in PID control. It decides the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the regulation intensity can be.
P2-19	Derivative time Td2 of PID parameter 2	0.000s	0.000s to10.000s	Defines the derivative time Td in PID control. The derivative time determines the regulation intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulation intensity can be.
P2-20	PID initial value	0.0%	0.0% to 800.0%	When the drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value hold time.
P2-21	Hold time of PID initial value	0.00s	0.00s to 650.00s	When the drive starts, the PID starts closed-loop algorithm only after the PID output is fixed to the PID initial value and lasts for the time longer than the PID initial value hold time.
P2-22	PID deviation dead zone	0.0%	0.0% to 800.0%	When the deviation is within the PID deviation dead zone, no adjustment is required. This parameter is used to ensure the accuracy and stability of the system output.

Param.	Name	Default value	Value range	Description
P2-23	PID derivative limit	0.10%	0.00% to 600.0%	P2-23 is used to set the PID derivative output range. In PID control, the derivative may easily cause system oscillation. Therefore, the PID derivative action is limited to a small range.
P2-26	Source of maximum PID output	0	0: 100.0%	Defines the source of the maximum PID output. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the maximum output value of PID is limited by this parameter. When this parameter is set to 0, the default maximum PID output value is 100.0%.
			5: Pulse reference	The maximum output value of PID is set through DI. The maximum output value of PID is calculated based on the relationship curve between the pulse frequency and operating frequency.
			6: Multi-reference	When multi-reference is used as the source of the maximum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values.
			7: Simple PLC	The maximum value of PID output is defined by simple PLC output.
			8: PID	The maximum value of PID output is the current PID output.
			9: Communication	The maximum output value of PID is set through communication. The maximum value of PID output can be inputted through remote communication.
			Other: F connector	The parameter in the floating-point connector is used as the maximum PID output.

Param.	Name	Default value	Value range	Description
P2-27	Source of minimum PID output	0	0: -100.0%	Used to select the source of minimum PID output value. When the PID is used for frequency setting, the PID output is limited by frequency limit. When the PID is used for non-frequency setting, the minimum output value of PID is limited by this parameter. When this parameter is set to 0, the default minimum PID output value is -100.0%.
			5: Pulse reference	The minimum value of PID output is set through DI. The minimum output value of PID is calculated based on the relationship curve between the pulse frequency and operating frequency.
			6: Multi-reference	When multi-reference is used as the source of the minimum PID output value, combinations of different DI states correspond to different values. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values.
			7: Simple PLC	The minimum output value of PID output is defined by simple PLC output.
			8: PID	The minimum output value of PID output is the current PID output.
			9: Communication	The minimum output value of PID is set through communication. The minimum value of PID output can be inputted through remote communication.
			Other: F connector	The parameter in the floating-point connector is used as the minimum PID output.
P2-28	Forced value of PID output	0	0: 0.0%	Used to select the source of forced value of PID output. When P2-29 [Forced value assignment of PID output] is set to 1, the PID output is the forced value, that is, the value set by P2-28. When P2-29 [Forced value assignment of PID output] is set to 1 and P2-28 is set to 0, the PID output remains 0.0%, that is, the PID does not generate output.
			5: Pulse reference	The forced value of the PID output is the pulse frequency reference of the DI terminal.
			6: Multi-reference	The forced output value of PID is the multi-reference output value.
			7: Simple PLC	The forced value of PID output is defined by simple PLC output.
			8: PID	The PID output value is the current PID output.
			9: Communication	The PID output value is set through communication.
			Other: F connector	The parameter in the floating-point connector is used as the forced PID output value.

Param.	Name	Default value	Value range	Description
P2-29	Force value assignment of PID output	0	0: Inactive	The forced output value assignment is invalid, and the PID calculation is performed normally.
			1: Enable	The PID stops calculation and performs forced value assignment. The PID output is the forced value, that is, the value set by P2-28.
			Other: B connector	Select the parameter in the bit connector to set whether to enable forced value assignment. 0: Inactive 1: Enable
P2-30	Upper limit for PID feedback loss detection	100.0%	P2-31 to 800.0 %	Defines the upper limit of PID feedback loss detection, which is used to determine whether PID feedback is lost. When the PID feedback keeps exceeding this parameter for a period longer than P2-32 [PID feedback loss detection time], the drive reports E31.1. When this parameter is set to 800.0%, PID feedback loss detection is disabled.
P2-31	Lower limit for PID feedback loss detection	0.0%	0.0 % to P2-30	Defines the lower limit of PID feedback loss detection, which is used to determine whether PID feedback is lost. When the PID feedback keeps lower than this parameter for a period longer than P2-32 [PID feedback loss detection time], the drive reports E31.1. When this parameter is set to 0, PID feedback loss detection is disabled.
P2-32	PID feedback loss detection time	0.0s	0.0s to 20.0s	Defines the duration for detecting PID feedback signal loss.
P2-33	Selection of PID operation at stop	0	0: No operation at stop	Used to determine whether to continue the PID operation when the drive stops. Generally, the PID operation stops when the drive stops. When the drive stops, the PID function is not calculated and the PID output is cleared.
			1: Operation performed at stop	When the drive stops, the PID function is still calculated. The PID output changes based on PID feedback and PID reference.
			Other: B connector	Select the parameter in the bit connector to set whether to enable operation at stop. 0: No operation at stop 1: Operation performed at stop

Param.	Name	Default value	Value range	Description
P2-34	PID integral property	10	Ones: Integral pause/separation 0: Inactive 1: Active	When integral pause/separation is invalid, the integral remains invalid no matter whether the multi-functional DI is valid. When the integral pause/separation is valid and the DI assigned with the PID integral pause function is valid (F4-00 = 22), the PID integral operation stops. In this case, only proportional and derivative operations take effect.
			Tens: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation	When the PID operation output reaches the maximum or minimum value, you can select whether to stop the integral operation. If "Stop integral operation" is selected, the PID integral operation stops, which may help reduce the PID overshoot. If "Continue integral operation" is selected, the PID integral operation continues, which may result in PID overshoot.
P2-36	PID operation during jogging	0	0: Inhibited 1: Allowed	Defines whether PID operation is allowed during jog. Value description: 0: Inhibited - PID operation disabled during jogging 1: Allowed - PID operation allowed during jogging
P2-37	PID execution interval	1	0 to 20	Defines the PID execution interval. The higher the setpoint, the longer the calculation cycle. The lower the setpoint, the shorter the calculation cycle.
P2-38	Active mode for PID ramp reference	-	0: Activated when PID enabled 1: Activated when PID operation starts Other: B connector	0: Activated when PID enabled When the PID function is enabled, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. 1: Activated when PID operation starts When PID operation starts, the PID ramp reference is valid and the PID reference value is calculated based on the PID reference time. Other: B connector Select the parameters in the bit connector to select the active mode of PID ramp reference.

Application instance

1. Set P2-00 [Process PID enable] to 1 to enable process PID function.
2. Set P2-02 [PID reference source] to select the target PID reference source. If P2-02 [PID reference source] is set to 0, you need to set P2-03 [PID value reference]. The value 100% of this parameter corresponds to the maximum value of PID feedback.

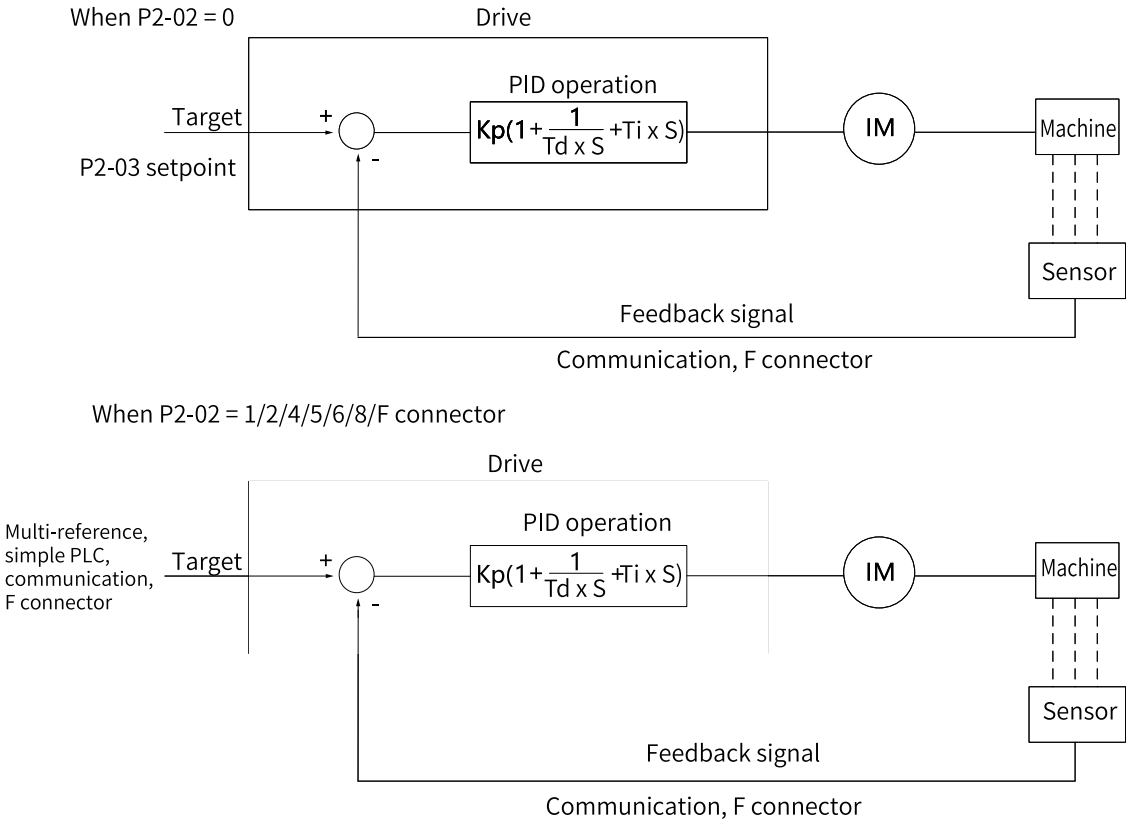


Figure 11-14 Schematic of PID process control

3. Set P2-04 to select a PID feedback source.
4. Set P2-01 to select the PID action direction.

   The following figure shows the logic of process PID control parameter configuration.

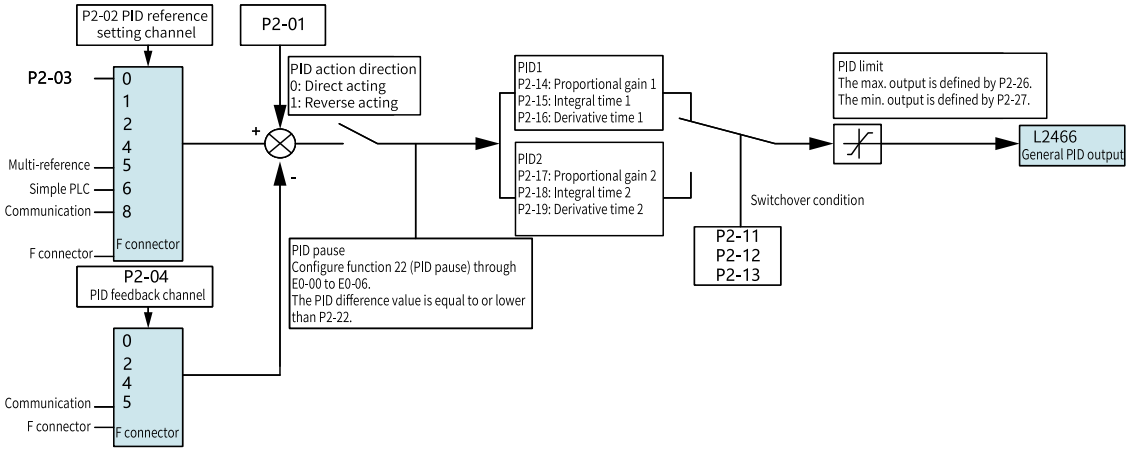


Figure 11-15 Block diagram for process PID control parameter setting

5. Select PID reference or connector L2466 as the control variable source.

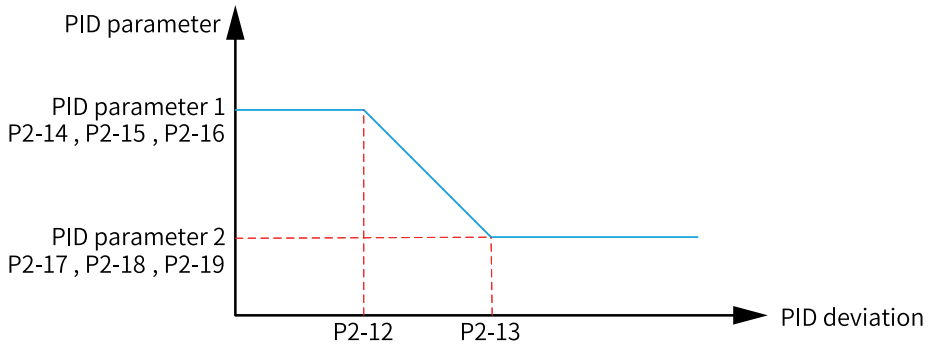


Figure 11-16 PID parameter switchover

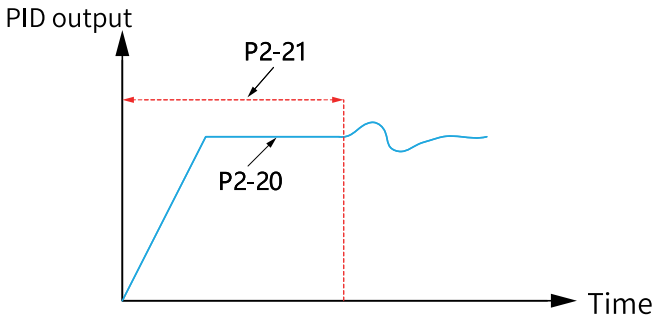


Figure 11-17 PID output function

11.6.2 Simple PLC Function

Application scenarios

Simple PLCs are generally used in scenarios where multiple speeds are required. When an individual frequency cannot meet the application needs, and the execution time and frequency cannot be accurately controlled by the operating panel or other frequency sources, you can enable the simple PLC function to control different operating frequencies at different moments, as well as the operating time of different frequencies.

You need to set the frequency and operating time through P1-00 to P1-56. When using the simple PLC function, set frequency source (F0-29) to 7 (Simple PLC).

Function description

The simple PLC module performs a simple combination of 16 multi-references based on the setting of each operating time. In applications requiring multiple speeds, for example, when the conveyor belt is used to handle goods, the simple PLC can be used together with the main frequency source [F0-29] or auxiliary frequency source [F0-31]. You can control the acceleration/deceleration time and operating time of each speed by configuring simple PLC acceleration/deceleration time for segments 0 to 15.

When using the simple PLC module, you need to manually enable the simple PLC module. In addition, you need to configure the simple PLC references 0 to 15, operating time, acceleration/deceleration time, and operation mode. Then configure the source for enabling simple PLC

calculation. When simple PLC calculation is enabled, the simple PLC module starts operating according to the set operating time and mode.

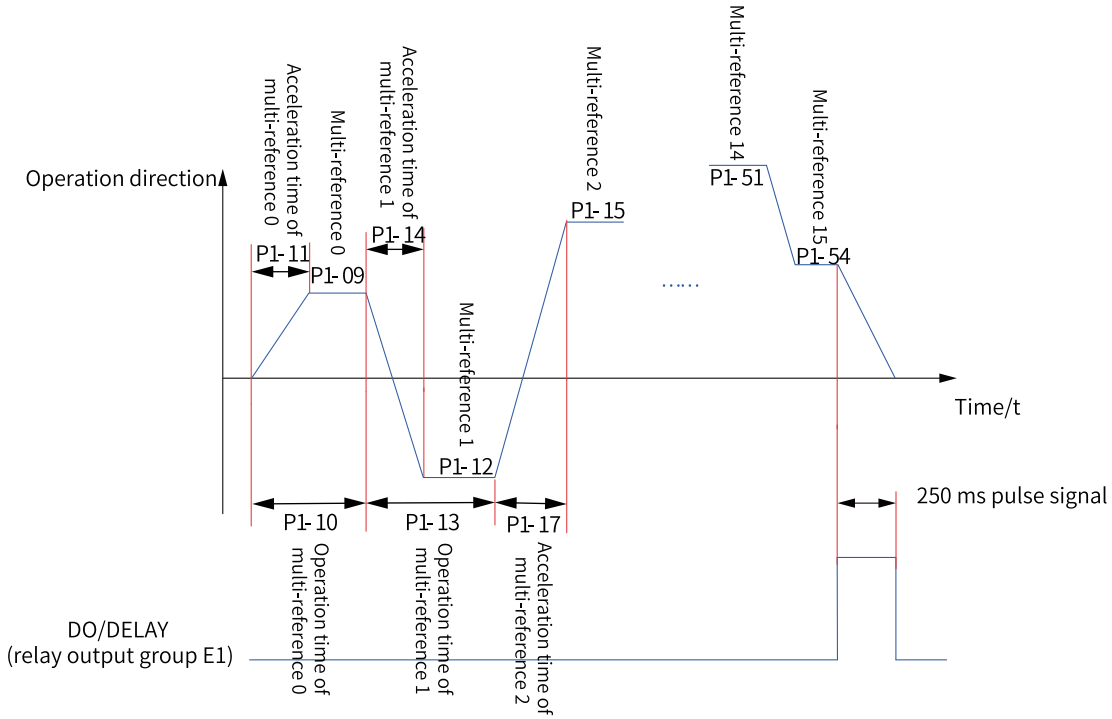


Figure 11-18 Operation diagram of the simple PLC

Related parameters

Param.	Function	Default value	Value range	Description
P1-00	Simple PLC module	0: Disable	0: Disable 1: Enable	Used to enable/disable the simple PLC module. 0: Disable - The simple PLC module is disabled. In this case, the current STEP and current STEP operating time (in hours and seconds) of the simple PLC, as well as the per-unit value obtained in the simple PLC step, are all cleared. 1: Enable - The simple PLC module is enabled, but whether the PLC module is calculated and outputted normally depends on P1-01.
P1-01	Simple PLC calculation enable source	L0114 Motor operation flag	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	Defines the source for enabling simple PLC calculation. 1. If the simple PLC calculation function is enabled, the simple PLC module runs according to the operation mode of the simple PLC. The simple PLC module also calculates the current STEP based on the running time and outputs the current STEP, current STEP running time (hours and seconds), and current STEP per-unit value. 2. If the simple PLC calculation enable source is disabled, the current STEP, current STEP operating time (in hours and seconds) of the simple PLC is the value when the calculation is stopped. The per-unit value obtained in the simple PLC step is the value of multi-reference i when the calculation is stopped.

Param.	Function	Default value	Value range	Description
P1-02	Simple PLC operation mode	0: Keep multi-reference 0 output after running for one cycle	0: Keep multi-reference 0 output after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running one cycle 3: Output 0 after running for one cycle	Defines the operation mode of the simple PLC. 0: Keep multi-reference 0 output after running for one cycle After an individual cycle of operation of done by the simple PLC, the multi-reference 0 output is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 1: Keep final values after running for one cycle After an individual cycle of operation of done by the simple PLC, the final value is kept and the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms. 2: Repeat after running for one cycle The simple PLC starts running again after completing a cycle. The simple PLC cycle completion flag outputs a high level for 250 ms after each cycle is completed. 3: Output 0 after running for one cycle After an individual cycle of operation of done by the simple PLC, the value obtained in the PLC step is outputted as 0. In this case, the individual cycle completion flag is set to 1. The simple PLC outputs a high level for 10 ms for a single stop command. The simple PLC cycle completion flag outputs a high level for 250 ms.
P1-03	Simple PLC function selection	0	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation enable configuration 0: Current STEP retained when calculation deactivated, and recalculated when enabled 1: Current STEP retained when calculation deactivated, and continue when enabled	Defines the simple PLC function. Ones: 0: Current operating segment and operating time are not recorded. 1: The current operating segment and operating time are recorded upon power failure, and both the ones and tens need to be set to 1. Tens: 0: Current segment retained when disabled, which is recalculated after enabled 1: Current segment retained when disabled, and operation continued after enabled

Param.	Function	Default value	Value range	Description
P1-04	Simple PLC status reset	0: Inactive	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	Used to reset the simple PLC status. Invalid: When the simple PLC state reset is invalid, the simple PLC operates according to the setting. Valid: When the simple PLC status reset is valid, the simple PLC module is restored to the initial state. The operation segment of the simple PLC is 0, and the output of the simple PLC is the setpoint of the multi-reference 0 defined by P1-09.
P1-05	Current STEP of the simple PLC	0	Displays the current STEP of the simple PLC.	Displays the current step number and speed of the simple PLC.
P1-06	Current STEP operating time (in hours) of the simple PLC	0	Displays the current STEP operating time (in hours) of the simple PLC.	Displays the current STEP operating time (in hours) of the simple PLC.
P1-07	Current STEP operating time (in seconds) of the simple PLC	0	Displays the current STEP operating time (in seconds) of the simple PLC.	Displays the current STEP operating time (in seconds) of the simple PLC.
P1-08	Simple PLC operating time unit	0: s (second)	0: s (second); 1: h (hour)	Defines the simple PLC operating time unit.
P1-09	Multi-reference 0 set by simple PLC	0.0%	-800.0 % to +800.0%	Defines the target frequency of multi-reference 0 of the simple PLC, which is a percentage to the rated motor frequency.
P1-10	Operating time of multi-reference 0 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operating time of multi-reference 0 set by simple PLC, which is the sum of ramp-up/down time and operating time at constant speed and target frequency.

Param.	Function	Default value	Value range	Description
P1-11	Ramp-up/down time of multi-reference 0 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05).	0: Acceleration/ Deceleration time of ramp 1 (B7-04/B7-05). 1: Acceleration/ Deceleration time of ramp 2 (B7-10/B7-11). 2: Acceleration/ Deceleration time of ramp 3 (B7-16/B7-17). 3: Acceleration/ Deceleration time of ramp 4 (B7-22/B7-23).	Defines the ramp-up/down time of multi-reference 0 set by simple PLC.
…	…	…	…	…
P1-54	Multi-reference 15 set by simple PLC	0.0%	-800.0 % to +800.0%	Defines the target frequency of multi-reference 15 of the simple PLC, which is a percentage to the rated motor frequency.
P1-55	Operating time of multi-reference 15 set by simple PLC	0.0s	0.0s to 6553.5s	Defines the operation time of multi-reference 15 set by simple PLC, which is the sum of acceleration or deceleration time and operation time at constant speed and target frequency.
P1-56	Ramp-up/down time of multi-reference 15 set by simple PLC	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05)	0: Acceleration/ Deceleration time of ramp 1 (acceleration time B7-04/ deceleration time B7-05) 1: Acceleration/ Deceleration time of ramp 2 (acceleration time B7-10/ deceleration time B7-11) 2: Acceleration/ Deceleration time of ramp 3 (acceleration time B7-16/ deceleration time B7-17) 3: Acceleration/ Deceleration time of ramp 4 (acceleration time B7-22/ deceleration time B7-23)	Defines the acceleration/deceleration time of multi-reference 15 set by simple PLC.

Application instance

1. Set P1-00 [Simple PLC module enable] to 1 to enable the simple PLC module function.
2. Set P1-01 [Simple PLC calculation enable source] to 1 to enable the 16 multi-references values of simple PLC.
3. Set P1-02 [Simple PLC operation mode] to 0, that is, the drive remains at P1-09 (Multi-reference 0 set by simple PLC) after all 16 setpoints of the simple PLC are done executing.
4. Set P1-03 [Simple PLC function selection] to 0, that is, the 16 multi-references set by the simple PLC is non-retentive at power failure and calculation starts from multi-reference 0 again at next power-on.
5. Set P1-04 [Simple PLC state reset] to 0 to disable the reset function of the simple PLC.
6. Set P1-08 [PLC operating time unit] to 0 to set the operating time in seconds (s).
7. Set P1-09 [Multi-reference 0 set by simple PLC] to 10%, that is, the frequency of multi-reference 0 during operation = 10% [P1-09] x rated frequency [F1-06].
8. Set P1-10 [Simple PLC operating time 0] to 5s, which is the sum of the acceleration/deceleration time at start and operating time.
9. Set P1-11 [Simple PLC acceleration/deceleration time selection 0] to 0, which means that the target frequency acceleration/deceleration time is converted based on ramp 1 acceleration/ deceleration time (B7-04/B7-05).
10. Set P1-12 to P1-14, P1-15 to P1-17, P1-18 to P1-20, P1-21 to P1-23, P1-24 to P1-26, P1-27 to P1-29, P1-30 to P1-32, P1-33 to P1-35, P1-36 to P1-38, P1-39 to P1-41, P1-42 to P1-44, P1-45 to P1-47, P1-48 to P1-50, P1-51 to P1-53, and P1-54 to P1-56, together with P1-09 to P1-11, a total of 16 groups of simple PLC parameters;
11. Run the AC drive, that is, the drive runs at variable speed according to the target frequency set in 16 groups of parameters. P1-05 [Current STEP of simple PLC] can be used to observe the simple PLC stage. P1-07 [Current STEP operating time (in seconds) of simple PLC] can be used to observe the number of operating hours in the current stage.

11.6.3 Motorized Potentiometer

Application scenarios

The motorized potentiometer function is applicable to industries such as logistics and ceramics that require flexible speed control.

In these applications, the motorized potentiometer replaces the physical potentiometer as the frequency source and provides parameters P3-05 [Motor potentiometer increase command source] and P3-06 [Motor potentiometer decrease command source]. Speed control is performed through the acceleration/deceleration button of these two user-defined sources instead of the rotary knob.

Operating principles

The motorized potentiometer function can be used to simulate the potential difference of analog potentiometer input. The per-unit value calculated based on P3-07 (Maximum value of potentiometer), P3-08 (Minimum value of potentiometer), P3-03 (Increase time), and P3-04 (Decrease time) is used as the output value of the potentiometer. The motorized potentiometer function can be used as the source for functions such as the main frequency or jog frequency.

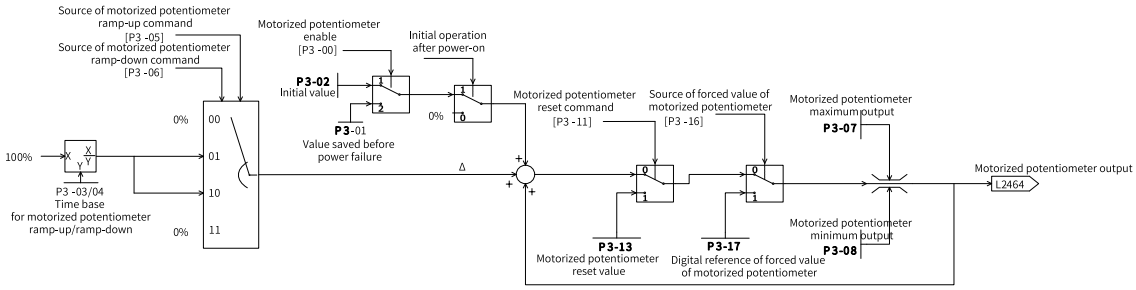


Figure 11-19 Schematic of motorized potentiometer function

Related parameters

Param.	Name	Default value	Value range	Description
P3-00	Motorized potentiometer enable selection	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether the motorized potentiometer function is enabled. Value description: 0: Inhibited - The motorized potentiometer is not enabled. 1: Enable - The motorized potentiometer is enabled. 3 to 12: DI1 to DI10 - Depends on the DI terminal state (0: Inhibited; 1: Enabled). Other: B connector - Depends on the B connector state (0: Inhibited; 1: Enabled).
P3-01	Retention of motorized potentiometer upon power failure	0	0: Disable 1: Enable	Defines whether the motorized potentiometer is retentive at power failure. Value description: 0: Disable - Non-retentive upon power failure 1: Enable - Retentive upon power failure Note: When this parameter is set to 1, if the motorized potentiometer is enabled before power failure, then the output value of the motorized potentiometer upon next power-on is the value outputted the moment before power failure occurs. When memory retention is disabled, the output value of the motorized potentiometer at next power-on is P3-02 [Initial value of the motorized potentiometer].
P3-02	Initial value of motorized potentiometer	0.0%	-600.0 % to +600.0%	Indicates the initial value of the motorized potentiometer.
P3-03	Time base for motorized potentiometer ramp-up	20.00s	0.00 to 655.35s	Defines the ramp-up rate of the motorized potentiometer, which is the time taken to increase from 0% to 100%.
P3-04	Time base for motorized potentiometer ramp-down	20.00s	0.00 to 655.35s	Defines the ramp-down rate of the motorized potentiometer, which is the time taken to decrease from 100% to 0%.

Param.	Name	Default value	Value range	Description
P3-05	Source of motorized potentiometer ramp-up command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines the motorized potentiometer ramp-up command is valid. Value description: 0: Invalid - The ramp-up command is invalid. 1: Valid - The ramp-up command is valid. 3 to 12: DI1 to DI10 - Depends on the terminal state of the DI1 to DI10. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. After the ramp-up command is active, the value is increased according to the rate defined by P3-03. 2. If the ramp-up command and ramp-down command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-06	Source of motorized potentiometer ramp-down command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether the motorized potentiometer ramp-down command is valid. Value description: 0: Invalid - The ramp-down command is invalid. 1: Valid - The ramp-down command is valid. 3 to 12: DI1 to DI10 - Depends on the terminal state of the DI1 to DI10. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. The value 0 indicates this function is inactive and the value 1 indicates this function is active. Note: 1. After the ramp-down command is activated, the value is decreased according to the rate defined by P3-04. 2. If the ramp-up command and ramp-down command are set simultaneously, both commands are invalid and the current output remains unchanged.
P3-07	Maximum value of motorized potentiometer output	600.0 %	P3-08 to 600.0 %	Defines the maximum range that can be outputted by the motorized potentiometer.
P3-08	Minimum value of motorized potentiometer output	-600.0 %	-600.0 % to P3-07	Defines the minimum range that can be outputted by the motorized potentiometer.

Param.	Name	Default value	Value range	Description
P3-09	Source 1 of motorized potentiometer pause command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether the motorized potentiometer pause command 1 is valid. Value description: 0: Invalid - The pause command is invalid. 1: Valid - The pause command is valid. 3 to 12: DI1 to DI10 - Depends on the terminal state of the DI1 to DI10. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. 0: Invalid; 1: Valid Note: When the pause command is 1, the motorized potentiometer change pauses. When the pause command is 0, the pause is inactive.
P3-10	Source 2 of motorized potentiometer pause command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether the motorized potentiometer pause command 2 is valid. The function description is the same as P3-09.
P3-11	Source 1 of motorized potentiometer reset command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether motorized potentiometer reset command 1 is valid. Value description: 0: Invalid - The reset command is invalid. 1: Valid - The reset command is valid. 3 to 12: DI1 to DI10 - Depends on the terminal state of the DI1 to DI10. 0: Invalid; 1: Valid Other: B connector - Whether the reset command is valid depends on the state of B connector. 0: Invalid; 1: Valid Note: When the reset command changes from 0 to 1, the output value of the motorized potentiometer is reset to the values of P3-13 and P3-14.
P3-12	Source 2 of motorized potentiometer reset command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines whether motorized potentiometer reset command 2 is valid. The function description is the same as P3-11.
P3-13	Reset value source of motorized potentiometer	0	0: Digital reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of motorized potentiometer reset value. Value description: 0: P3-14 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Other: F connector - The source is defined by the value of the selected connector.

Param.	Name	Default value	Value range	Description
P3-14	Digital reference of motorized potentiometer reset value	0.0%	-600.0 % to +600.0%	Defines the digital reference of the reset value of motorized potentiometer. Note: When P3-13 is set to 0, the reset value of the motorized potentiometer is the setpoint of P3-14.
P3-15	Source of motorized potentiometer forced command	0	0: Inhibited 1: Enable 3 to 12: DI1 to DI10 Other: B connector	Defines the whether the forced command of the motorized potentiometer is valid. Value description: 0: Invalid - The forced command is invalid. 1: Valid - The forced command is valid. DI1 to DI7 - Depends on the terminal state of the DI. 0: Invalid; 1: Valid Other: B connector - Depends on the state of B connector. 0: Invalid; 1: Valid Note: When the forced command (P3-15) is 1, the output value of the motorized potentiometer is set to the values defined by P3-16 and P3-17.
P3-16	Forced value source of motorized potentiometer	0	0: Digital reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Other: F connector	Defines the source of the forced value after the forced command of the motorized potentiometer is activated. Value description: 0: P3-17 6: Multi-reference output value 7: Simple PLC output value 8: General PID output value 9: Reference value set through communication (address 7310H). Other: F connector - The source is defined by the value of the selected connector.
P3-17	Digital reference of motorized potentiometer forced value	0.0%	-600.0 % to +600.0%	Defines the digital reference of motorized potentiometer reset value. Note: When P3-16 is set to 0, the forced value of motorized potentiometer reset value is the setpoint of P3-17.
P3-38	High bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the high bits (those higher than 65535) of the motorized potentiometer saved by P3-38 at next power-on after the memory retention function (P3-01) is enabled.
P3-39	Low bits of the value saved by motorized potentiometer	0	0 to 65535	Defines the low bits (those lower than 65535) of the motorized potentiometer saved by P3-39 at next power-on after the memory retention function (P3-01) is enabled.

Application instance

The following describes how to use the output of the motorized potentiometer as the frequency source.

1. Set P3-00 [Motorized potentiometer enable] to 1, which means that the jog potentiometer function is activated.
2. Set b5-00 [Main frequency source] to L2464 (Final output value of jog potentiometer) in "Other [F connector]".
3. Set P3-03 [Ramp-up time base of motorized potentiometer] to 10s and P3-04 [Ramp-down time base of motorized potentiometer] to 10s.
4. Set P3-05 [Ramp-up command source of motorized potentiometer] to 3 [DI1] and P3-06 [Ramp-down command source of motorized potentiometer] to 4 [DI2]. Set P3-07 [Maximum output value of motorized potentiometer] to 100% and P3-08 [Minimum output value of motorized potentiometer] to 0%.
5. After setting is done, when DI1 is valid and DI2 is invalid, the output of the potentiometer increases from 0% to 10% per second until P3-03 [Ramp-up time base of motorized potentiometer] is 10s where 100% rated frequency is outputted. On the contrary, when DI1 is invalid and DI2 is valid, the output of the potentiometer decreases from 100% to 10% per second until P3-04 [Ramp-down time base of motorized potentiometer] is 10s where the 0% rated frequency is outputted.

11.6.4 Brake Control

Before the drive runs, the mechanical brake is used to lock the motor and the driven device in the zero speed state.

The brake control logic conditions can be set through parameters in group P4. You can set the parameter P4-00 to determine whether to enable brake control and feedback detection. When brake control is enabled, set related parameters based on the actual working conditions of the equipment and load for effective control by the brake logic to achieve operation safety.

- If P4-00 is set to 2, the brake with feedback is selected and the system detects the brake feedback status set by P4-03. If the brake release feedback signal is not obtained within the time set by P4-04, a fault is reported, indicating that brake release fails.
- If P4-00 is set to 1, the brake is controlled by the time reference and the actual status is not detected.

P4-17, P4-18, and P4-19 can be used to set the brake release conditions. For example, you can set the brake to be released only when the output torque is greater than a specified value. This ensures that the gravity load does not slip at the moment of brake release. In particular, the system speed loop does not act and no torque is output before the brake release. Therefore, after setting the brake release conditions, set the starting torque through P4-06 to meet the brake release conditions.

11.6.4.1 Typical Brake Configuration

The following shows typical brake configurations for you reference. The default values of parameters in group P4 are not listed in the following table.

1. Simple brake configuration

Param.	Name	Setpoint
P4-00	Brake function selection	1: Enable brake without detection information

2. The brake does not generate feedback and needs to be configured with a starting torque only to prevent unintended movement of the motor upon brake release.

Param.	Name	Setpoint
P4-00	Brake function selection	1: Enable brake without detection information
P4-01	Brake release actuation time	Set this parameter according to the actual brake release time.
P4-02	Brake apply actuation time	Set this parameter according to the actual brake apply time.
P4-06	Starting torque source in vector control	2: Digital reference of starting torque
P4-07	Digital reference of starting torque	Set this parameter according to the estimated load weight.

3. The brake does not generate feedback and needs to be configured with a starting speed only to prevent unintended movement of the motor upon brake release.

Param.	Name	Setpoint
P4-00	Brake function selection	1: Enable brake without detection information
P4-01	Brake release actuation time	Set this parameter according to the actual brake release time.
P4-02	Brake apply actuation time	Set this parameter according to the actual brake apply time.
P4-09	Starting speed source	1: Digital reference of starting speed
P4-10	Digital reference of starting speed	Set this parameter according to the estimated load weight.

4. The brake does not generate feedback. The retentive torque is required to be used as the starting torque.

Param.	Name	Setpoint
P4-00	Brake function selection	1: Enable brake without detection information
P4-01	Brake release actuation time	Set this parameter according to the actual brake release time.
P4-02	Brake apply actuation time	Set this parameter according to the actual brake apply time.
P4-06	Starting torque source in vector control	1: Retentive torque
P4-07	Digital reference of starting torque	The setpoint is used as the retentive torque upon initial start. You can set this parameter according to the estimated load weight.
P4-08	Retentive starting torque gain factor	Set this parameter to 100% in normal scenarios. To adjust the proportion of the retentive torque, set this parameter.
P4-16	Brake release command source	Defines the condition for controlling the brake through external control signals.When this parameter is set to 0, the brake cannot be released. When the brake is released, setting P4-16 to 0 will not lead to brake apply.
P4-17	Comparison value source of brake release	This parameter specifies an additional condition for determining brake release. If P4-17 is set to 0, the condition is invalid. When P4-17 is set to a connector value, the brake release state applies only when the connector value keeps greater than the threshold for a period defined by P4-19 after the brake release condition is met.
P4-18	Comparison threshold for brake release	
P4-19	Brake release delay	

5. The brake can be released only when the brake generates feedback and the output torque is higher than 35% of the rated torque.

Param.	Name	Setpoint
P4-00	Brake function selection	2: Enable brake with detection information
P4-01	Brake release actuation time	Set this parameter according to the actual brake release time.
P4-02	Brake apply actuation time	Set this parameter according to the actual brake apply time.
P4-03	Brake feedback point source	4: DI3 (When the brake feedback source is set to DI3, the value 1 indicates brake release and 0 indicates brake apply.)
P4-06	Starting torque source in vector control	2: P4-07
P4-07	Digital reference of starting torque	40% (the value must be greater than 35%)
P4-17	Comparison value source of brake release	1: Output torque
P4-18	Comparison threshold for brake release	35 %
P4-19	Brake release delay	0.2s (You can decrease this value to avoid fluctuation of measured value and accelerate brake release.)

Note

If the brake release comparison condition is not set, the brake can be released after the set start torque is reached. However, the actual torque may be deviated.

6. Typical settings and troubleshooting

Brake release time setting:

- An excessively short brake release time can result in severe brake wear, leading to overshoot during brake release.
- An excessively long brake release time can result in slow response, leading to unintended movement upon brake release.
- Set a short brake time and observe the output torque through the oscilloscope. When the torque drops significantly, the time when the brake release command is received to the time when the torque drops is the actual brake release time.

Brake apply time setting:

- An excessively short brake apply time can result in premature torque termination before the brake fully applies, leading to unexpected movement of heavy load.
- An excessively long brake apply time may result in the risk of divergence during operating at 0 speed in SVC mode.
- Set the brake apply time to the same value as the brake release time. When unintended movement occurs upon brake apply, slowly increase the brake apply time.

When unexpected load movement occurs upon brake release, do as follows.

- Increase the speed loop stiffness by increasing the value of F2-00 and decreasing the value of F2-01 properly.

- Set P4-09 to 2 to make the starting speed direction of the brake be the same as the motor direction. Set the brake starting frequency through P4-10.
- Set the brake starting torque through P4-06, P4-07, and P4-08, and adjust the brake starting torque properly [Note 1].

Caution

- [Note 1]: The fixed brake starting torque is not suitable for machines with counterweight. Load changes may reverse the brake release speed.
- The brake feedback source is set to parameter interconnection, which can be any DI or bit connector.
- If the brake feedback source is the DI, check that the DI command from the feedback point source will not cause the AC drive to run or get faulty and ensure that the brake function is normal.

11.6.4.2 Sequence Diagrams

- Vector control

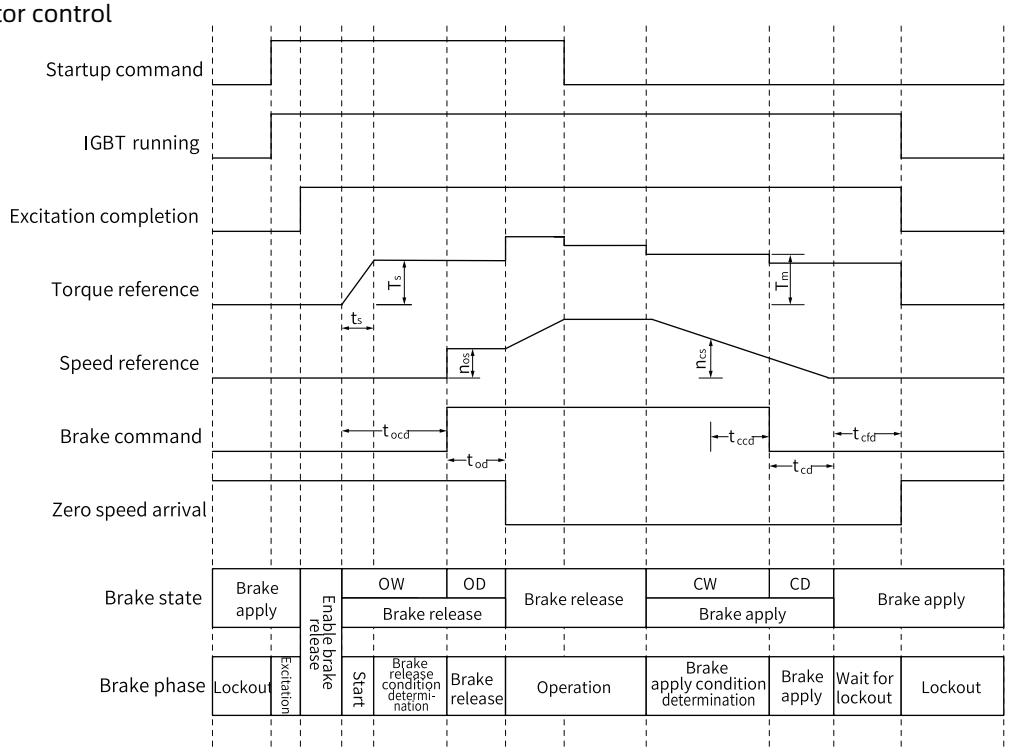


Figure 11-20 Brake sequence diagram in vector control

Symbol	Description	Symbol	Description
T_s	Starting torque upon brake release	T_m	Retentive torque upon brake apply
n_{os}	Starting speed upon brake release	n_{cs}	Speed threshold upon brake apply
t_s	Acceleration time set for brake starting torque	t_{ocd}	Brake release comparison delay
t_{od}	Brake release actuation time	t_{ccd}	Brake apply delay
t_{cd}	Brake apply actuation time	t_{cfd}	Brake feedback fault delay
OW	Brake release waiting time	OD	Brake release delay
CW	Brake apply waiting time	CD	Brake apply delay

- V/f control

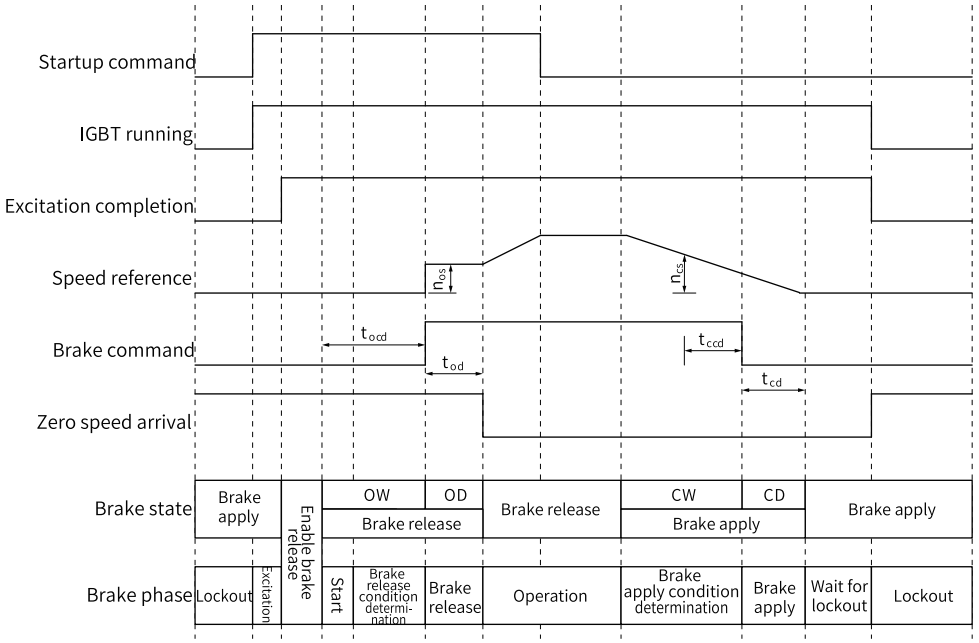


Figure 11-21 Brake sequence diagram in V/f mode

Symbol	Description	Symbol	Description
n_{os}	Starting speed upon brake release	n_{cs}	Speed threshold upon brake apply
t_{ocd}	Brake release comparison delay	t_{od}	Brake release actuation time
t_{ccd}	Brake apply delay	t_{cd}	Brake apply actuation time
OW	Brake release waiting time	OD	Brake release delay
CW	Brake apply waiting time	CD	Brake apply delay

11.6.4.3 Overview of Brake Phase

All brake actions can be performed only after the operating command is received and the motor is prepared. For asynchronous motors, brake starts after motor pre-excitation. For synchronous motors, brake starts after the motor magnetic pole angle is obtained.

In case of a fault or an emergency stop command, a brake that is being released immediately enters the apply phase with the brake apply command outputted.

Brake release and apply actions are generally triggered by operation commands.

In the case of OFF2 emergency stop, coast to stop, or P4-11 = 1, the brake module immediately outputs the apply signal (U1-16 = 0).

Param.	Name	Description
P4-11	Source of forced brake apply command	0: Inactive 1: Brake apply signal (U1-16 = 0) outputted immediately

Note

The forced brake command is to forcibly apply the brake. In this case, the drive does not exit the running state and may output torque.

This function is generally used for brake force test. You can use the forced brake apply command to test whether the brake mechanism meets the brake force requirements during high-speed operation.

It is recommended to use a user-defined fault during configuring emergency stop. In the emergency stop state, the brake module immediately outputs an apply signal when an OFF2 emergency stop command is sent upon a fault, and the drive enters the stop state at the same time.

Brake release permission

The brake can proceed to the next phase only after the brake release permission command (P4-16) is activated. Brake release permission is enabled by default.

Brake release preparation phase

Brake release preparation includes three phases: starting torque establishment, brake release condition judgement, and brake release.

1. Establishing the starting torque:
   This function is only valid in the vector control mode. To prevent unexpected movement of the gravity load upon brake release, sufficient torque will be outputted first based on the value of P4-06. If P4-06 is set to 0, no torque is outputted before brake release.

2. Brake release condition judgement:
   After the starting torque is established, you can set additional startup conditions through P4-17 to P4-19. No additional condition applies by default. After the starting torque is established, the brake releases.

   Starting torque = Starting torque retentive value x P4-08 [Starting torque retention gain factor]

   The starting torque retentive value is the output torque upon previous braking.

   P4-09 is used to set the source of the starting speed.

   0: The starting speed is disabled.

   1: The start speed is enabled. When the starting speed is set to a positive value, the speed direction is forward (positive frequency). When the start speed is set to a negative value, the speed direction is reverse (negative frequency).

   2: The starting speed is enabled. The absolute value of the starting speed is the absolute value of "Digital reference of starting speed". When the starting speed reference is positive, the speed direction is the same as the final operating direction of the motor. Otherwise, it is opposite to the motor direction.

3. Brake release:
   The brake release signal (U1-16 = 1) is outputted in this phase. In addition, the ramp function generator (RFG) is enabled. If P4-09 is active, the RFG starts accelerating from the speed defined by P4-10. Otherwise, the RFG starts accelerating from 0.

Param.	Name	Description	
P4-06	Starting torque source in vector control	Used to set the starting torque source in the vector control mode. 0: The starting torque is disabled. 1: The starting torque is enabled and the starting torque = Retentive torque value x Retentive gain factor (P4-08). If no torque value is recorded, the function of option 1 equals that of option 2. 2: The starting torque is enabled, and the starting torque is defined by P4-07 (Digital reference of starting torque).	
P4-07	Digital reference of starting torque	When P4-06 (Starting torque source in vector control) is set to 2, the starting torque is the value of P4-07.	
P4-08	Retentive starting torque gain factor	Starting torque = Starting torque retentive value x P4-08 [Starting torque retention gain factor] The starting torque retentive value is the output torque upon previous braking.	
P4-09	Starting speed source	Used to set the starting speed source. 0: The starting speed is disabled. 1: The start speed is enabled. When the starting speed is set to a positive value, the speed direction is forward (positive frequency). When the start speed is set to a negative value, the speed direction is reverse (negative frequency). 2: The starting speed is enabled. The absolute value of the starting speed is the absolute value of "Digital reference of starting speed". When the starting speed reference is positive, the speed direction is the same as the final operating direction of the motor. Otherwise, it is opposite to the motor direction.	
P4-10	Digital reference of starting speed	The starting speed is the speed value corresponding to the current per-unit value parameter.	
P4-16	Brake release permission source	0: Inactive 1: Active 2: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7	10: DI8 11: DI9 12: DI10 Other: B connector (reserved)
P4-17	Comparison value source of brake release	If the value of P4-17 is higher than P4-18 for a period longer than P4-19, brake release starts.	
P4-18	Comparison threshold for brake release	Defines the comparison threshold for the brake release delay.	
P4-19	Brake release delay	Defines the brake release delay.	

Note

You can set different starting torque through P4-06 and P4-09 based on the application needs.

Brake release action phase

Brake release includes the brake release detection and brake release completion.

- Brake release detection: When receiving the brake release command, the RFG output remains unchanged and the drive waits for the completion of brake release.
  - If P4-00 is set to 1, the drive waits for the duration set by P4-01 and exits current phase after the duration expires.
  - When P4-00 is set to 2 and the duration defined by P4-01 expires, the feedback point of P4-03 is detected. If the feedback point is detected as low level, the drive exits current phase. If the feedback point detected keeps at high level for a duration longer that the value of P4-04, a fault will be triggered and the brake cannot be released.
- Brake release completion: The RFG is enabled and the RFG output speed is allowed to increase based on the time reference. The brake output state remains unchanged unless a stop or brake apply command is received. If P4-00 is set to 2, whether the feedback point of P4-03 is at a low level is always detected.

Brake apply preparation phase

When the brake apply command is received, the brake does not apply immediately but enters the preparation phase.

- Brake apply condition judgement: When the actual speed keeps lower than the value of P4-12 for a period longer than P4-13, or the ramp output speed keeps lower than the value of P4-14 for a period longer than P4-15 (0 indicates inactive condition), the brake apply conditions are met, and the retentive torque and brake apply output phase starts.
- Retentive torque: When P4-06 is set to 1, the torque before brake apply is recorded as the torque output for the next startup.
- Brake apply: In this phase, the brake apply signal (U1-16 = 0) is outputted and then brake apply starts.

Brake apply phase

Brake apply includes the brake apply detection and brake apply completion.

- Brake apply detection: After the brake apply command is received, the drive waits for completion of brake apply. Before the brake is applied, the drive keeps outputting current to prevent unintended motor movement.
  - If P4-00 is set to 1, the drive waits for the duration set by P4-02 and exits current phase after the duration expires.
  - When P4-00 is set to 2 and the duration set by P4-02 expires, the feedback point of P4-03 is detected. If the feedback point is detected as high level, the drive exits current phase. If the feedback point detected keeps at low level for the duration longer than the value of P4-04, a fault will be triggered and the brake cannot be applied.

- Brake apply completion: When the brake has been applied, the ramp output speed is set to 0 forcibly. The brake output keeps in the closed state unless an operation and brake release command is received.

Lockout waiting phase

The lockout waiting phase starts from the time when the brake apply command is active to the time when the zero speed is reached.

When the motor feedback speed keeps lower than the zero speed defined by d0-09 for a period defined by d0-10, zero speed is reached and the PWM output is blocked.

11.6.4.4 Common Functions

Selecting the starting torque and starting speed

The starting torque is active only in the vector control mode. Generally, different configurations can be selected based on the control mode, as shown below.

Control mode	Starting torque	Starting speed
FVC	Yes	No
SVC	Yes	As needed
V/f	Inactive	NO or as needed

For details on the retentive starting torque see the section **"Automatic Torque Retention"**. Other options function in the same way as the starting speed, except that the starting torque and starting speed are used in different brake phases. Enable the starting torque first and then the starting speed. Assume that when the drive outputs a positive speed, the motor rotates in the forward direction. When the drive outputs a negative speed, the motor rotates in the reverse direction. See details below.

- Digital reference: The starting torque/speed is defined by the digital reference only regardless of the operation command or final target speed. If the digital reference value is positive, the motor rotates in the forward direction. If the digital reference value is negative, the motor rotates in the reverse direction.
- Determined by digital reference and motor operating direction: When the digital reference value is positive, the motor rotation direction (starting torque/speed phase) is consistent with the target speed direction. When the digital reference value is negative, the motor rotation direction (starting torque/speed phase) is opposite to the target speed direction. When the target speed is 0, the final operating direction is determined by the direction in last operation at non-zero speed. The speed direction upon initial power-on is positive by default. For details, see the following table.

Digital reference value	Target speed (final operating direction)	Motor operating direction (starting torque/speed phase)
Positive	Positive	Forward
Positive	Negative	Reverse
Negative	Positive	Reverse
Negative	Negative	Forward

Automatic torque retention

When P4-06 is set to 1, the internal torque retention function of the drive is activated, which records the torque before brake apply each time upon stop. The torque recorded is used as the starting torque at next startup. This helps reduce the load drop during brake release. The torque retention can adapt to the load change during operation.

When torque retention is enabled, a torque error may occur during the stop process due to external brake faults.

When automatic torque retention is activated for the first time, the initial value of the retentive torque is the value of P4-07.

You can adjust the automatic torque retention coefficient through P4-08. If P4-08 is set to 80% and the retentive torque during the stop process is 50%, the starting torque will be 40%.

Excitation OFF delay

To improve operational efficiency, the excitation current of an asynchronous motor may need to be outputted for a certain period during stop, even after the brake has been applied. This allows the motor, within a short period of time after stop, to be started again upon brake release directly without excitation (which may take 3s to 5s).

When the motor feedback speed keeps lower than the zero speed defined by d0-09 for the period defined by d0-10, the motor reaches zero speed, with PWM output blocked. Therefore, if the value of d0-10 increases, excitation can last longer after the motor reaches the zero speed, eliminating the need for excitation upon next brake release.

In addition, if the brake apply actuation time defined by P4-02 is increased, you can force the brake to output current through the brake module, maintaining excitation for a period of time after stop.

Param.	Name	Function
d0-09	Zero speed threshold	Defines the threshold for determining the motor zero speed during decelerate-to-stop. An excessively low setpoint may cause the motor stop failure when the motor speed is near zero but exceeds this threshold. An excessively high setpoint may cause the motor to rotate when the drive output has been blocked. Set this parameter based on the actual stop performance. The value 100% corresponds to the rated motor frequency.
d0-10	Zero speed time threshold	The drive blocks the output when the motor actual speed keeps lower than the zero speed threshold during decelerate-to-stop for a period of time defined by this parameter.

Starting torque restriction

In some lifting load scenarios, the brake can be released only when the load torque is greater than the threshold for safety reasons. The speed loop does not work before the brake releases. Therefore, the torque cannot be outputted even if the speed is set. In this case, set the starting torque through A7-06. The torque can be detected through the following two methods.

1. Detect the torque through the drive, which can be achieved through the comparison function defined by P4-17. Set a starting torque higher than the threshold through P4-06, set P4-17 to 1 (Output torque), P4-18 to a value equal to the comparison threshold, and set the delay through

P4-19. When the absolute value of P4-17 keeps greater than the value of P4-18 for a period longer than P4-19, the drive enters the brake release state.

2. Detect the torque through the PLC. After conditions are met, the PLC sends a status bit to the drive through communication. Set a starting torque higher than the threshold through P4-06, and then set the status bit received from PLC through P4-16. After an operation command is received, the brake release state does not apply until this bit is set to 1. When the brake is released, setting P4-16 to 0 will not lead to brake apply.

Note

When torque detection is not configured, the system enters the next stage when the set starting torque reaches the target value. In this case, the actual output torque may be slightly deviated.

11.6.4.5 Related Parameters

Param.	Name	Value range	Description
P4-00	Brake function selection	0: Disable brake 1: Enable brake without detection information 2: Enable brake with detection information	Used to set the brake function. 0: Disable brake 1: Enable brake without brake feedback 2: Enable brake with brake feedback
P4-01	Brake release actuation time	0.00s to 30.00s	Defines the duration from brake apply to brake release, that is, the actuation time of the brake mechanism. As the brake mechanism ages, its actuation time progressively increases. In this case, you can adjust this parameter based on the actual operating condition of the brake.
P4-02	Brake apply actuation time	0.00s to 30.00s	Defines the duration from brake release to brake apply, that is, the actuation time of the brake mechanism. As the brake mechanism ages, its actuation time progressively increases. In this case, you can adjust this parameter based on the actual operating condition of the brake.

Param.	Name	Value range	Description
P4-03	Brake feedback point source	0: Inactive 1: Active 2: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector (reserved)	When brake feedback is enabled, you need to set the brake feedback point source, which can be the DI or bit connector.
P4-04	Brake feedback fault delay	0.00s to 30.00s	When the brake action is done but not corresponding feedback is received within the time defined by this parameter, the drive determines that the brake mechanical is abnormal and report a brake fault.
P4-05	Starting torque direction	0: Digital reference of starting torque 1: Defined by digital reference of starting torque and motor operating direction	Used to set the starting torque direction. 0: The starting torque is defined by P4-07 (Digital reference of starting torque). A positive value indicates positive torque and a negative value indicates negative torque. 1: The absolute value of the starting torque is that of P4-07 (Digital reference of starting torque). When the value of P4-07 is positive, the starting torque direction is consistent with the final operating direction of the motor. When the value of P4-07 is negative, the starting torque direction is opposite to the final operating direction of the motor.
P4-06	Starting torque source in vector control	0: Disable 1: Retentive torque 2: Digital reference of starting torque Other: F connector (reserved)	Used to set the starting torque source in the vector control mode. 0: The starting torque is disabled. 1: The starting torque is enabled, and the starting torque = retentive torque (LC-69) x retentive gain factor (P4-08). If no torque value is recorded, the function of option 1 equals that of option 2. 2: The starting torque is enabled, and the starting torque is defined by P4-07 (Digital reference of starting torque).
P4-07	Digital reference of starting torque	-200.0% to +200.0%	When P4-06 (Starting torque source in vector control) is set to 2, the starting torque is the value of P4-07.

Param.	Name	Value range	Description
P4-08	Retentive starting torque gain factor	0.0% to 300.0%	Starting torque = LC-69 (Starting torque retentive value) x P4-08 (Starting torque retentive gain factor) The starting torque retentive value is the output torque upon previous braking.
P4-09	Starting speed source	0: Disable 1: Digital reference of starting speed 2: Defined by digital reference of starting speed and motor operating direction	Used to set the starting speed source. 0: The starting speed is disabled. 1: The start speed is enabled. When the starting speed is set to a positive value, the speed direction is forward (positive frequency). When the start speed is set to a negative value, the speed direction is reverse (negative frequency). 2: The starting speed is enabled. The absolute value of the starting speed is the absolute value of "Digital reference of starting speed". When the starting speed reference is positive, the speed direction is the same as the final operating direction of the motor. Otherwise, it is opposite to the motor direction.
P4-10	Digital reference of starting speed	-30.0% to +30.0%	The starting speed is the speed corresponding to the current per-unit value parameter.
P4-11	Source of forced brake apply command	0: Inactive 1: Active 2: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector (reserved)	Used to set the forced brake apply command source. The brake applies forcibly when a forced brake command is sent in any state. 0: Disable forced brake apply 1: Enable forced brake apply 2: Disable forced brake apply 3 to 18: The DI is used to set whether to enable forced brake apply. If the terminal is active, the forced brake apply command is valid. Otherwise, the forced brake command is invalid. Other: The parameter connected to B connector is used to set whether to enable forced brake apply.
P4-12	Actual speed monitoring threshold for brake apply	0.0% to 100.0%	When the feedback speed reaches the value of P4-12 (Actual speed monitoring threshold for brake apply) and such state lasts for the duration defined by P4-13 (Actual speed monitoring time for brake apply), brake apply starts.
P4-13	Actual speed monitoring time for brake apply	0.00s to 300.00s	

Param.	Name	Value range	Description
P4-14	Speed monitoring threshold for brake apply	0.0% to 100.0%	When the set speed reaches the value of P4-14 (Set speed monitoring threshold for brake apply) and such state lasts for the duration of P4-13 + P4-15, brake apply starts.
P4-15	Speed monitoring time for brake apply	0.00s to 60.00s	
P4-16	Brake release permission source	0: Inactive 1: Active 2: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector (reserved)	Defines the source for the brake release permission command.
P4-17	Comparison value source of brake release	0: Disable 1: Output torque 2: Speed reference 3: Output current	If the value of P4-17 is higher than P4-18 for a period longer than P4-19, brake release starts.
P4-18	Comparison threshold for brake release	0.0% to 300.0%	Defines the comparison threshold for the brake release delay.
P4-19	Brake release delay	0.00s to 30.00s	Defines the brake release delay.
P4-20	Starting torque ramp-up time	0.00s to 5.00s	Defines the time taken to for the starting torque to ramp up from 0% to 200%. For example, if the time is set to 0.3s, it takes 0.3s to ramp up from 0% to 200%.
P4-21	Brake auxiliary function selection	bit0 to bit2: Reserved bit3: Dynamic performance parameter auto-tuning of brake release enabled 0: Disable 1: Allowed bit4 to bit15: Reserved	When dynamic motor parameter auto-tuning is selected, if bit3 of this parameter is not set to 1, E84.6 can be reported upon dynamic parameter auto-tuning. Note: Use this function with caution for hoisting mechanisms.
P4-22	Brake release timeout period	0s to 655.35s	During the brake release phase, if the release condition is not met after the time defined by this parameter elapses, E84.3 can be reported.

11.6.5 Limit Protection

Application scenario

The limit protection function is mainly applied in scenarios with fixed safe operating ranges, such as stacker crane applications in the logistics industry.

Function description

The limit protection logic is as follows.

(1) If the positive limit (#51 DI) is reached or exceeded, E150.1 is reported.

(2) If the negative limit (#52 DI) is reached or exceeded, E150.2 is reported.

(3) During forward operation, if event ① occurs during forward operation or event ② occurs during reverse operation, OFF3 (quick stop) is triggered.

(4) When event ① occurs, forward operation is inhibited. When event ② occurs, reverse operation is inhibited.

(5) When the positive limit is reached during forward operation, if the positive limit disappears, the positive limit is exceeded. In this case, the "Positive limit exceeded" flag is set to 1.

(6) When the "Positive limit exceeded" flag is set to 1 in reverse operation, if the positive limit is active, the device is considered to have returned to the positive limit. In this case, the "Positive limit exceeded" flag is cleared.

(7) When the negative limit is reached during reverse operation, if the negative limit disappears, the negative limit is exceeded. In this case, the "Negative limit exceeded" flag is set to 1.

(8) When the "Negative limit exceeded" flag is set to 1 in forward operation, if the negative limit is active, the device is considered to have returned to the negative limit. In this case, the "Negative limit exceeded" flag is cleared.

(9) When the hardware limit function is disabled (P0-99 = 0), the flags indicating positive limit reached/position limit exceeded/negative limit exceeded are cleared, with the operation limit deactivated.

(10) The tens of H1-14 can be used to set the fault level of the limit fault.

Related parameters

Param.	Name	Default value	Value range	Description
P0-99	Hardware position limit function	0	0: Inactive 1: Enable	0 - Disable: Disable the hardware limit. 1 - Enable: Enable the hardware limit.
L11-72	Limit protection flag	0	bit0: Limit operation flag 0: Inactive 1: Active bit1: Positive hardware limit protection 0: Inactive 1: Active bit1: Negative hardware limit protection 0: Inactive 1: Active	Used to monitor the limit protection flag.

Param.	Name	Default value	Value range	Description
H1-14	Protective action selection 14 upon fault	0x003F	Ones: Reserved Tens: Limit fault (E150) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Hundreds: 24 V safety power supply fault (E155) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: Automatic fault reset failure (E159) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protective actions upon different faults.

Precautions

When the limit switch is pressed, the limit fault E150.x will be continuously reported, and the drive cannot run. In this case, the following solutions are available.

(1) Set P0-99 to 0 to disable the limit function. Then reset fault E150.x and run the drive to make the device move to the normal operating range.

(2) Set the tens of H1-14 to a value greater than or equal to D. In this case, you can also run the drive to move the device to the normal operating range.

11.7 Free Function Module

11.7.1 Introduction To the Free Function Module

In complex engineering applications, this drive can associate multiple status signals and control signals together through the free function module to meet engineering control requirements. The application functions include logic operation, arithmetic function, word-to-bit conversion, data conversion, switch function, control function, multi-point curve, and constant setting modules. You can set related parameters as needed to achieve simple logic operation.

Function type	Name	Function description	Links
Free function module	Word-to-bit module	This module can be used to enable mutual conversion between 16-bit data and 16 bits.	*"11.7.2.1 Introduction To Word-to-bit Module" on page 647*
	Data conversion module	This module enables conversion between different types of data (such as 16-bit word data and 32-bit double-word data).	*"11.7.3.1 Introduction To Data Conversion Module" on page 652*
	Logical operation module	This module can be used to perform simple logic operations, such as AND, OR, and XOR.	*"11.7.4.1 Introduction To Logic Operation Module" on page 656*
	Arithmetic operation module	This module can be used to perform simple arithmetic operations on numerical values, such as addition, subtraction, multiplication, division, comparison, and absolute value.	*"11.7.5.1 Introduction To Arithmetic Operation Module" on page 660*
	Switch selection module	The module controls the output to be equal to input 1 or input 2 through module input selection signal. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.	*"11.7.6.1 Introduction To Switch Selection Module" on page 666*
	Control function block	This module can be used to process input signals to eliminate signal errors.	*"11.7.7.1 Introduction To Control Function Module" on page 669*
	Multi-point curve module (A To B)	The multi-point curve module can define up to ten curve points to define the input-output relationship in segments. After setting the multi-point curve, set the module input value, and the corresponding output value will be calculated based on the curve relationship.	*" " on page*
	Constant value module	The output value of the constant value module is always equal to the input value.	*" " on page*

11.7.2 Word-To-Bit Module

11.7.2.1 Introduction To Word-to-bit Module

Function description

This module can be used to enable mutual conversion between 16-bit data and 16 bits.

Applicable scenario

User-defined status words are generally generated through the word-to-bit module for view by the user, and the user-defined control words can also be parsed through the word-to-bit module to meet control requirements.

11.7.2.2 Word-To-Bit Module (A To H)

Function description

The word-to-bit module is used to convert a 16-bit data into 16 individual bits (bit0 to bit15).

Operating principles

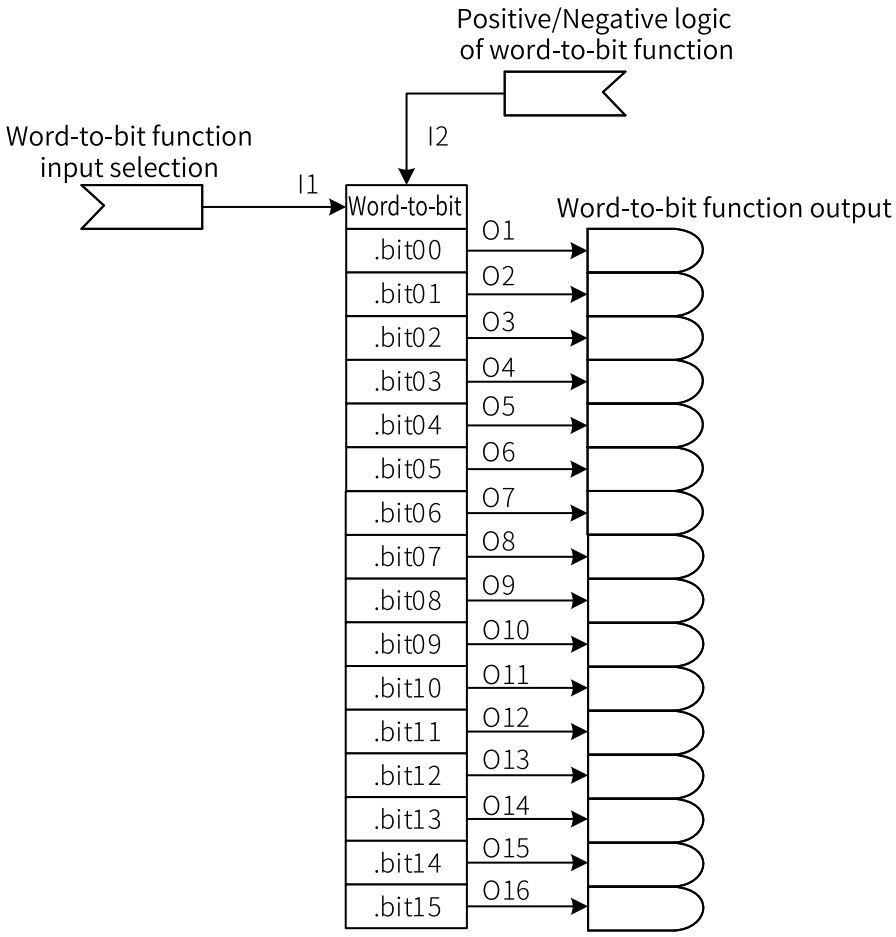


Figure 11-22 Diagram of the word-to-bit module

When the word-to-bit function module receives a 16-bit word at input I1, the outputs O1 to O16 correspond to bit0 to bit15 of input I1.

When the input I is a 32-bit double-word, the outputs O1 to O16 correspond to the high 16 bits (bit0 to bit15) of the input I1.

The input I2 of the word-to-bit function module is used to set the logic during conversion. When bit0 to bit15 of input I2 are 1, the outputs O1 to O16 that correspond to input I1 are inverted.

Connection parameters

This drive provides four word-to-bit modules (A to D). The corresponding inputs and outputs of each module are as follows.

Source of parameter value for input I1: Word connector and double-word connector.

Source of parameter value for input I2: Unsigned number.

Location for saving outputs O1 to O16: Bit connector.

Parameters for inputs and outputs of each word-to-bit module are shown in the table below.

Word-to-bit module		A	B	C	D
Input	I1	o3-00	o3-01	o3-02	o3-03
	I2	o3-04	o3-05	o3-06	o3-07
Output	O1 (bit0)	L0304	L0320	L0336	L0352
	O2 (bit1)	L0305	L0321	L0337	L0353
	O3 (bit2)	L0306	L0322	L0338	L0354
	O4 (bit3)	L0307	L0323	L0339	L0355
	O5 (bit4)	L0308	L0324	L0340	L0356
	O6 (bit5)	L0309	L0325	L0341	L0357
	O7 (bit6)	L0310	L0326	L0342	L0358
	O8 (bit7)	L0311	L0327	L0343	L0359
	O9 (bit8)	L0312	L0328	L0344	L0360
	O10 (bit9)	L0313	L0329	L0345	L0361
	O11 (bit10)	L0314	L0330	L0346	L0362
	O12 (bit11)	L0315	L0331	L0347	L0363
	O13 (bit12)	L0316	L0332	L0348	L0364
	O14 (bit13)	L0317	L0333	L0349	L0365
	O15 (bit14)	L0318	L0334	L0350	L0366
	O16 (bit15)	L0319	L0335	L0351	L0367

Application instance

The received user-defined control word can be converted to bit data through the word-to-bit module, allowing reading of the control commands sent by the user. For example, the command word for control channel 1 can be converted to bit data through word-to-bit module A.

Control word bit	Definition	Description
bit0	ON_OFF1 (start/stop)	The drive starts upon 0->1 and stops at 0.
bit1	OFF2 (coast to stop) stop	The value 1 indicates coast-to-stop is active.
bit2	OFF3 (quick stop) stop	The value 1 indicates quick stop is active.
bit3	Operation permission	The value 1 indicates operation permission is active.
bit4	Reset command	The fault reset function is active upon 0->1.
bit5	JOG1 (Jog 1)	The value 1 indicates the jog 1 command is active.
bit6	2JOG2	The value 1 indicates the jog 2 command is active.
bit7	Speed inversion	The value 1 indicates the speed is inverted.
bit8 to bit15	Reserved	-

Parameters need to be set are described in the following table.

Param.	Description	Setpoint	Description
o3-00	Input of word-to-bit function A	L1044 [User-defined command word of control channel 1]	The input of word-to-bit module A is the user-defined control word.
o3-04	Direct logic and inverted logic of word-to-bit function A	0x0000	The output bits of word-to-bit function A are kept to their original values.

In this case, the validity of the coast-to-stop command can be queried through L0305 [bit1 of word-to-bit module A output], and the validity of the fault reset command can be queried through L0308 [bit4 of word-to-bit module A output].

11.7.2.3 Bit-to-Word Module (A to D)

Function description

The bit-to-word module is used to combine 16 bits (bit0 to bit15) into a 16-bit data.

Operating principles

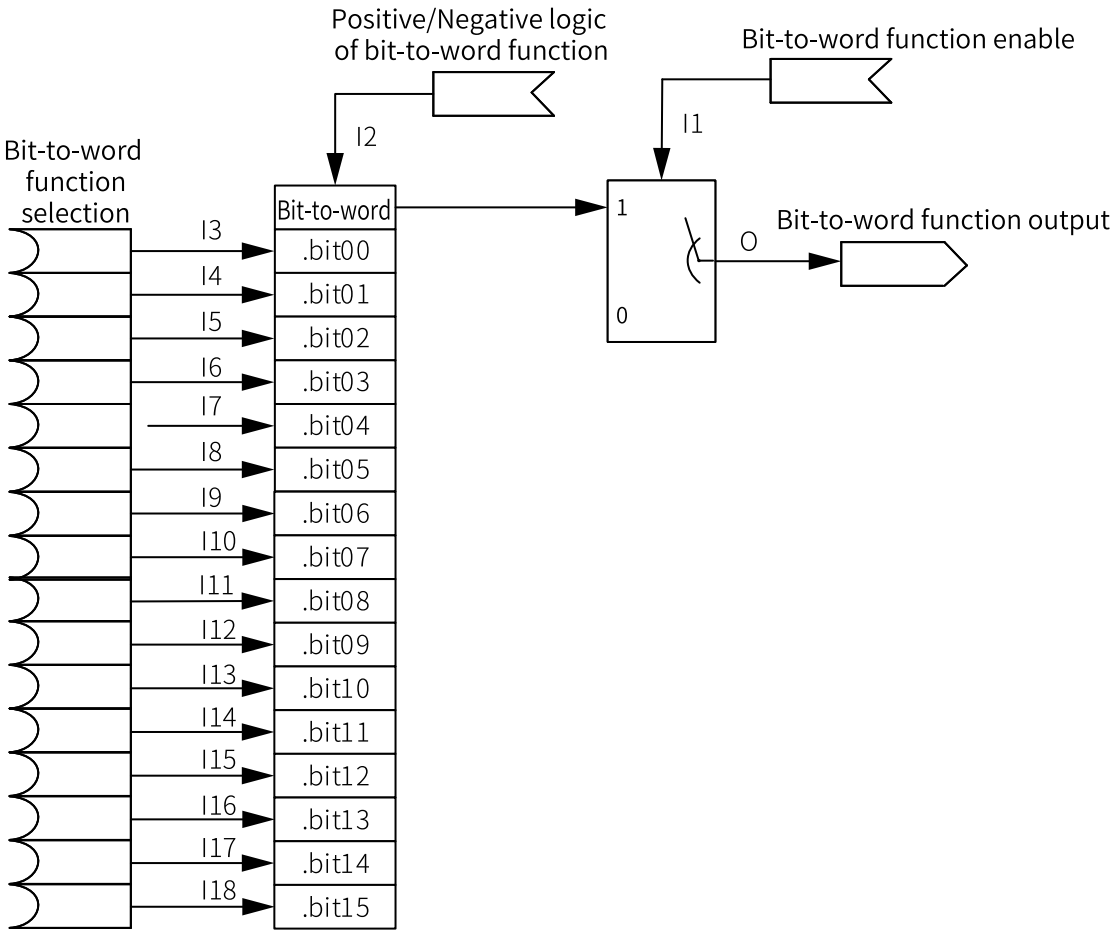


Figure 11-23 Diagram of the bit-to-word module

The inputs I3 to I18 of the bit-to-word module represent bit00 to bit15 of a hexadecimal number, forming a 16-bit word data to be output to O.

The input I1 of the bit-to-word module is the enable control bit, When I1 is 1, the module function is valid. When I1 is 0, the output O is 0.

The input I2 of the bit-to-word module is used to set the positive/negative logic during conversion. When bit0 to bit15 of input I2 are 1, the corresponding bit0 to bit15 of output O are inverted.

Connection parameters

The drive provides four groups of bit-to-word modules (A to D), with the following corresponding inputs and outputs for each module.

Source of parameter value for input I1: Binary number.

Source of parameter value for input I2: Unsigned number.

Source of parameter value for inputs I3 to I18: 0, 1, DI input, and bit connector.

Location for saving output O: Word connector.

Parameters for inputs and outputs of each bit-to-word module are as shown in the following table.

Bit-to-word module		A	B	C	D
Input	I1	o3-08	o3-26	o3-44	o3-62
	I2	o3-09	o3-27	o3-45	o3-63
	I3 (bit0)	o3-10	o3-28	o3-46	o3-64
	I4 (bit1)	o3-11	o3-29	o3-47	o3-65
	I5 (bit2)	o3-12	o3-30	o3-48	o3-66
	I6 (bit3)	o3-13	o3-31	o3-49	o3-67
	I7 (bit4)	o3-14	o3-32	o3-50	o3-68
	I8 (bit5)	o3-15	o3-33	o3-51	o3-69
	I9 (bit6)	o3-16	o3-34	o3-52	o3-70
	I10 (bit7)	o3-17	o3-35	o3-53	o3-71
	I11 (bit8)	o3-18	o3-36	o3-54	o3-72
	I12 (bit9)	o3-19	o3-37	o3-55	o3-73
	I13 (bit10)	o3-20	o3-38	o3-56	o3-74
	I14 (bit11)	o3-21	o3-39	o3-57	o3-75
	I15 (bit12)	o3-22	o3-40	o3-58	o3-76
	I16 (bit13)	o3-23	o3-41	o3-59	o3-77
	I17 (bit14)	o3-24	o3-42	o3-60	o3-78
	I18 (bit15)	o3-25	o3-43	o3-61	o3-79
Output	O	L1208	L1209	L1210	L1211

Application instance

The bit-to-word module can be used to user-defined control words sent to the user to meet control requirements. For example, the status word can be defined through the bit-to-word module A as follows.

Param.	Name	Setpoint	Description
o3-08	Bit-to-word module A	1 [Enable]	Bit-to-word module A enable
o3-09	Direct logic and inverted logic of bit-to-word module A	0x0000	All bits of bit-to-word module A are in direct logic.

Param.	Name	Setpoint	Description
o3-10	bit0 selection of bit-to-word module A	L0100 [Ready for power-on]	The value 1 indicates "Ready for power-on".
o3-11	bit1 selection of bit-to-word module A	L0102 [Running]	The value 1 indicates the drive is running.
o3-12	bit2 selection of bit-to-word module A	L0103 [Fault active]	The value 1 indicates the fault is activated.
o3-13	bit3 selection of bit-to-word module A	L0106 [Startup lockout]	The value 1 indicates the startup is locked out, and operation is not allowed.
o3-14	bit4 selection of bit-to-word module A	L0118 [Current control channel]	The value 0 indicates channel 1 is active, and the value 1 indicates channel 2 is active.
o3-15	bit5 selection of bit-to-word module A	L0119 [Current setting channel]	The value 0 indicates channel 1 is active, and the value 1 indicates channel 2 is active.
L1208	Output of bit-to-word module A	-	Output value of the word-to-bit module A

In this case, the output value of the bit-to-word module A (L1208) can be sent to the user, enabling user-defined status word transmission.

11.7.3 Data Conversion Module

11.7.3.1 Introduction To Data Conversion Module

Function description

This module is used to enable conversion between different types of data (such as 16-bit word data and 32-bit double-word data).

Applicable scenario

This module can be used to convert data to the expected data type for easy query and data processing.

11.7.3.2 Word-To-DWord Module (A To D)

Function description

The word-to-double-word module combines two 16-bit word data into a 32-bit data, then divides it by a user-defined 32-bit base value to obtain the converted 32-bit double-word data.

Operating principles

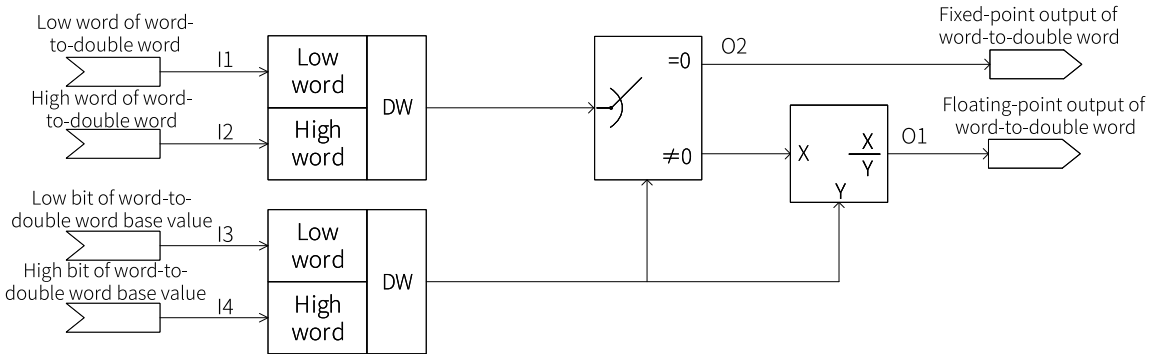


Figure 11-24 Diagram of the word-to-double-word module

The conversion formula for the input and output of the word-to-double-word module is as follows.

$$O=\begin{cases} O1:\ \dfrac{I1+I2\times 65536}{I3+I4\times 65536}, & I3+I4\times 65536\neq 0 \\ O2:\ I1+I2\times 65536, & I3+I4\times 65536=0 \end{cases}$$

(1) When the base value composed of I3 as the low 16 bits and I4 as the high 16 bits is non-zero, the output value equals the double word (with input I1 as low 16 bits and I2 as high 16 bits) divided by the base value, which is then output to O1.

(2) When the base value composed of I3 as the low 16 bits and I4 as the high 16 bits is zero, the output value equals the double word (with input I1 as low 16 bits and I2 as high 16 bit), which is output to O2 directly without being divided by the base value.

Connection parameters

This drive provides four word-to-double-word modules (A to D), with the corresponding inputs and outputs as follows.

Source of parameter value for input I1, I2: Word connector and double-word connector.

Source of parameter value for input I3, I4: 16-bit unsigned number.

Location for saving output O1: Floating-point connector.

Location for saving output O2: Double-word connector.

Parameters corresponding to the inputs and outputs of each word-to-double-word module are shown in the table below.

Word-to-double-word module	Input				Output	
	I1	I2	I3	I4	O1	O2
A	o5-00	o5-01	o5-02	o5-03	L2500	L2000
B	o5-04	o5-05	o5-06	o5-07	L2502	L2002
C	o5-08	o5-09	o5-10	o5-11	L2504	L2004
D	o5-12	o5-13	o5-14	o5-15	L2506	L2006

Note: When input I2 of the word-to-double-word module is set to option 0 [Module disabled], the word-to-double-word module is inactive, and the output is 0. When input I2 of the word-to-double-word module is set to "Other [K connector]", the module operates normally.

11.7.3.3 DWord-To-Word Module (A To D)

Function description

The double-word-to-word module divides the 32-bit double-word input data by a user-defined 32-bit base value, resulting in a converted 16-bit data.

Operating principles

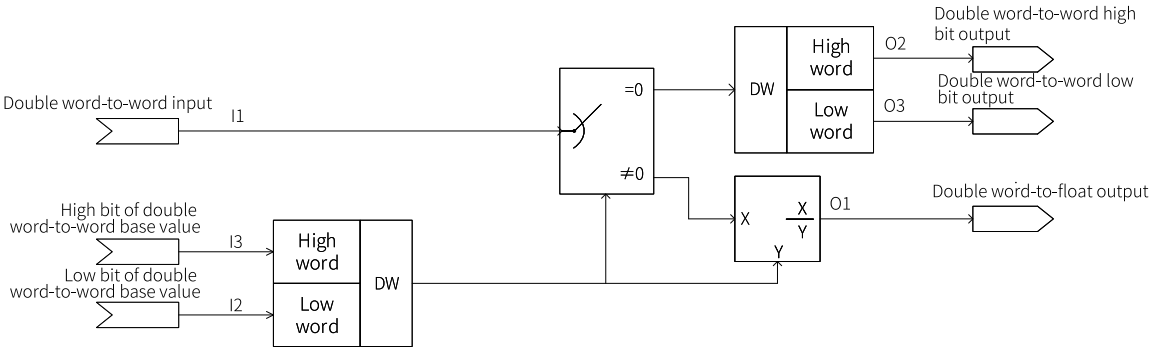


Figure 11-25 Diagram of the double-word-to-word module

The conversion formula for the input and output of the double-word-to-word module is as follows.

$$O=\begin{cases} O1:\ \dfrac{I1}{I2+I3\times 65536}, & I2+I3\times 65536\neq 0 \\ \begin{cases} O2:\ (I1\gg 16)\,\&\,0xFFFF \\ O3:\ I1\,\&\,0xFFFF \end{cases}, & I2+I3\times 65536=0 \end{cases}$$

(1) When the base value composed of I2 as the low 16 bits and I3 as the high 16 bits is non-zero, the output value equals the input I1 divided by the base value, which is then output to O1.

(2) When the base value composed of I2 as the low 16 bits and I3 as the high 16 bits is zero, the output O2 is the high 16 bits of input I1, and output O3 is the low 16 bits of input I1.

Connection parameters

The drive provides four sets of double-word-to-word modules (A to D), with the corresponding inputs and outputs as follows.

Source of parameter value for input I1: word connector and double-word connector.

Source of parameter value for inputs I2 and I3: 16-bit unsigned number.

Location for saving output O1: Floating-point connector.

Location for saving outputs O2 and O3: Word connector.

Parameters corresponding to the inputs and outputs of each of the double-word-to-word module are shown below.

Double-word-to-word	Input			Output		
	I1	I2	I3	O1	O2	O3
A	o5-32	o5-33	o5-34	L2508	L1212	L1213
B	o5-35	o5-36	o5-37	L2510	L1214	L1215
C	o5-38	o5-39	o5-40	L2512	L1216	L1217
D	o5-41	o5-42	o5-43	L2514	L1218	L1219

11.7.3.4 Function of Floating-point-Connector-to-Monitoring Parameter Module (A to H)

Function description

The floating-point-connector-to-monitoring parameter module converts the floating-point connector data inputted to monitoring parameters to be displayed in group U.

Operating principles

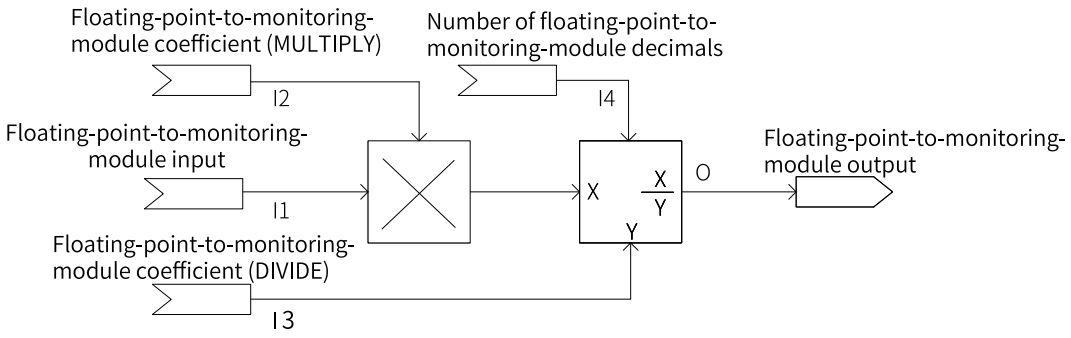


Figure 11-26 Schematic of floating-point-connector-to-monitor parameter

Input I1 of the floating-point-connector-to-monitor parameter module is the original value. Input I2 is the multiplication coefficient, and input I3 is the division coefficient. Final output O = Input value (I1) x Coefficient (I2)/Coefficient (I3)

Input I4 is used to set the number of decimal places for output value O, which can be set to 0 to 3 decimal places. The meanings of different decimal places are as follows.

(1) In the case of zero decimal places, the converted monitor parameter display value is the floating-point connector value x 100.

(2) In the case of one decimal place, the converted monitor parameter display value is the floating-point connector value x 100 x 10.

(3) In the case of two decimal places, the converted monitor parameter display value is the floating-point connector value x 100 x 100.

(4) In the case of three decimal places, the converted monitor parameter display value is the floating-point connector value x 100 x 1000.

For example, if the floating-point connector value is 40.0%, I2 and I3 are set to 1, and I4 is set to 1 decimal place, then the converted monitor parameter is 40.0% x 100 x 10 = 400.

Connection parameters

The drive provides 8 groups of floating-point-connector-to-monitor parameter modules (A to H). Inputs and outputs corresponding to each module are shown below.

Source of input I1 parameter value: Floating-point connector

Source of input I2 and I3 parameter values: 16-bit unsigned number (I3 ≠ 0)

Source of input I4 parameter value: 0, 1, 2, or 3 decimal places

Storage location of output O: monitor parameter in group U3

Parameters corresponding to the inputs and outputs of each of the double-word-to-word module are shown below.

Floating-point-to-monitoring	Input				Output
	I1	I2	I3	I4	O
A	o5-60	o5-62	o5-63	o5-61	U3-90
B	o5-64	o5-66	o5-67	o5-65	U3-91
C	o5-68	o5-70	o5-71	o5-69	U3-92
D	o5-72	o5-74	o5-75	o5-73	U3-93
E	o5-76	o5-78	o5-79	o5-77	U3-94
F	o5-80	o5-82	o5-83	o5-81	U3-95
G	o5-84	o5-86	o5-87	o5-85	U3-96
H	o5-88	o5-90	o5-91	o5-89	U3-97

11.7.4 Logic Operation Module

11.7.4.1 Introduction To Logic Operation Module

Function description

This module is used to perform simple logic operations, such as AND, OR, and XOR.

Applicable scenario

This module can be used to perform simple logic processing on DI signals and other data, enabling combined control of a single module using multiple signal sources.

11.7.4.2 Logic AND/OR Module (A To H)

Function description

The logic AND or OR function of this module can be selected through the function selection parameter. This module can be used to perform logic processing on up to two inputs. When the logic AND function is selected, the output is 1 only when all inputs are 1. Otherwise, the output is 0. When the OR function is selected, the output is 0 only when all inputs are 0. Otherwise, the output is 1.

Operating principles

The logic AND and OR modules A to D support four input values, while the logic AND and OR modules E to H support three input values. The following takes modules A to D an example to introduce the logic AND and logic OR functions.

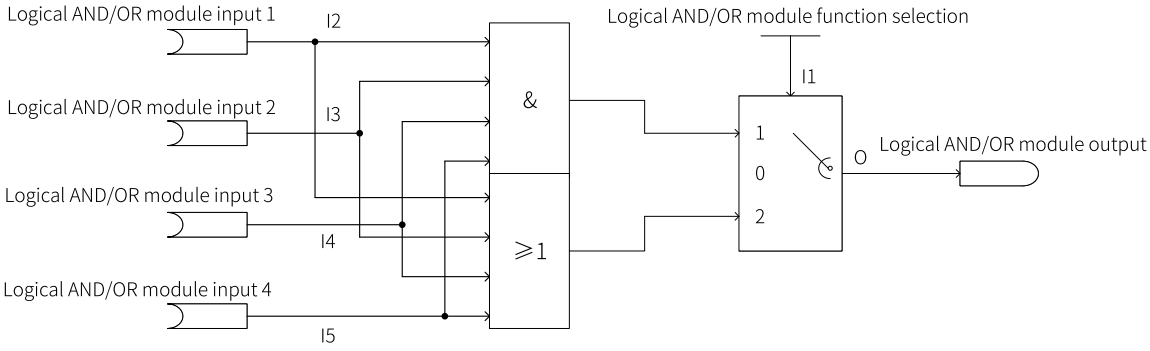


Figure 11-27 Diagram of the AND/OR module

When the logic AND/OR function selection input I1 is 0, the module is inactive, and the output O is 0.

When the logic AND/OR function selection input I1 is 1, the AND function is active, and the output O = I2 & I3 & I4 & I5. The output is 1 only when inputs I2, I3, I4, and I5 are all 1. Otherwise, the output O is 0. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
0	X	X	X	0
X	0	X	X	0
X	X	0	X	0
X	X	X	0	0
1	1	1	1	1

When the logic AND/OR function selection input I1 is 2, the logic OR is active, and the output O = I2 & I3 & I4 & I5. The output is 0 only when inputs I2, I3, I4, and I5 are all 0. Otherwise, the output O is 1. The truth table is as follows.

Input				Output
I2	I3	I4	I5	O
1	X	X	X	1
X	1	X	X	1
X	X	1	X	1
X	X	X	1	1
0	0	0	0	0

Connection parameters

The drive provides eight sets of AND/OR modules (A to H), with the corresponding inputs and outputs for each module as follows.

Source of input I1 parameter value: 0 [Disabled], 1 [Logic AND], and 2 [Logic OR].

Source of input I2, I3, I4, I5 parameter values: 0, 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of each AND/OR module are shown in the table below.

Logic AND and logic OR	Input					Output
	I1	I2	I3	I4	I5	O
A	o6-00	o6-01	o6-02	o6-03	o6-04	L0376
B	o6-05	o6-06	o6-07	o6-08	o6-09	L0377
C	o6-10	o6-11	o6-12	o6-13	o6-14	L0378
D	o6-15	o6-16	o6-17	o6-18	o6-19	L0379
E	o6-20	o6-21	o6-22	o6-23	-	L0380
F	o6-24	o6-25	o6-26	o6-27	-	L0381
G	o6-28	o6-29	o6-30	o6-31	-	L0382
H	o6-32	o6-33	o6-34	o6-35	-	L0383

11.7.4.3 Logic NOT Module (A To H)

Function description

This module can be used to implement the logic NOT function, with the output value inverted to the input value.

Operating principles

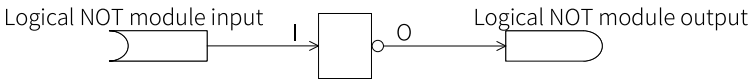


Figure 11-28 Diagram of the logic NOT module

When the input I option of the logic NOT module is set to 0 [Disable], the module is disabled, and the output is 0.

When the input I of the logic NOT module is set to any other option, the output O is inverted to the input.

Input	Output
I	O
0	1
1	0

Connection parameters

The drive provides 8 sets of logic NOT modules (A to H), with the corresponding inputs and outputs for each module as follows.

Source of input I parameter value: 0 [Disable], DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters for the inputs and outputs of each logic NOT module are shown in the table below.

Logic NOT module	Input	Output
	I	O
A	o6-80	L0384
B	o6-81	L0385

Logic NOT module	Input	Output
	I	O
C	o6-82	L0386
D	o6-83	L0387
E	o6-84	L0388
F	o6-85	L0389
G	o6-86	L0390
H	o6-87	L0391

11.7.4.4 Logic XOR/XNOR Module (A To D)

Function description

The logic XOR or XNOR function of this module can be selected through the function selection parameter. This module can be used to perform logical processing on up to two inputs. When the logic XOR function is selected, the output is 1 only when the input 1 and input 2 are different. Otherwise, the output is 0. When the logic XNOR function is selected, the output is 1 only when the input 1 and input 2 are the same. Otherwise, the output is 0.

Operating principles

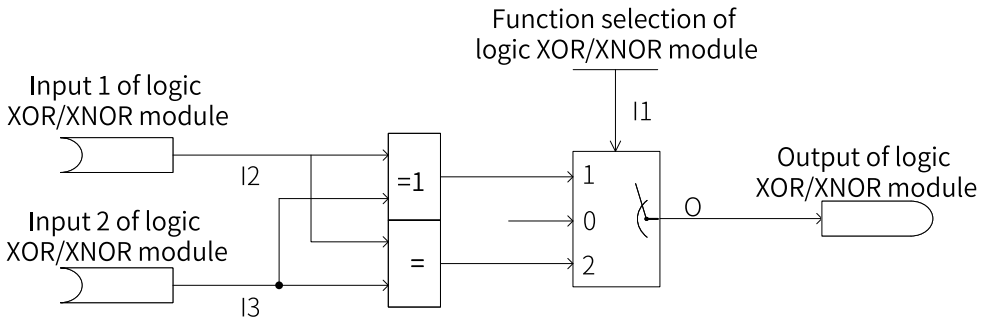


Figure 11-29 Diagram of the logic XOR/XNOR module

When the function selection input I1 of the logic XOR/XNOR module is 0, the module is inactive, and the output O is 0.

When the function selection input I1 of the logic XOR/XNOR module is 1, the logic XOR function is active. If the input I2 and input I3 are the same, the output O is 0. If the input I2 and input I3 are different, the output O is 1. The truth table is as follows.

Input		Output
I2	I3	O
0	0	0
1	0	1
0	1	1
1	1	0

When the function selection input I1 of the logic XOR/XNOR module is 2, the logic XNOR function is active. If the input I2 and input I3 are the same, the output O is 1. If the input I2 and input I3 are different, the output O is 0. The truth table is as follows.

Input		Output
I2	I3	O
0	0	1
1	0	0
0	1	0
1	1	1

Connection parameters

This product contains 8 sets of logic XOR and XNOR modules (A to H). The corresponding inputs and outputs for each module are as follows:

Source of parameter value for Input I1: 0 [Disable], 1 [XOR], and 2 [XNOR].

Source of parameter values for Input I2 and I3: 0, 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of each logic XOR/XNOR module are shown in the table below.

Logic XOR/ XNOR module	Input			Output
	I1	I2	I3	O
A	o7-00	o7-01	o7-02	L0392
B	o7-03	o7-04	o7-05	L0393
C	o7-06	o7-07	o7-08	L0394
D	o7-09	o7-10	o7-11	L0395
E	o7-12	o7-13	o7-14	L0396
F	o7-15	o7-16	o7-17	L0397
G	o7-18	o7-19	o7-20	L0398
H	o7-21	o7-22	o7-23	L0399

11.7.5 Arithmetic Operation

11.7.5.1 Introduction To Arithmetic Operation Module

Function description

This module can be used to perform simple arithmetic operations on numerical values, such as addition, subtraction, multiplication, division, comparison, and absolute value.

Applicable scenario

This module can be used to process input values through operations to obtain values that meet user requirements.

11.7.5.2 Absolute Value Module (A to H)

Function description

The absolute value module is used to perform absolute value processing on the input value and output the result. The output equals the absolute value of the input.

Operating principles

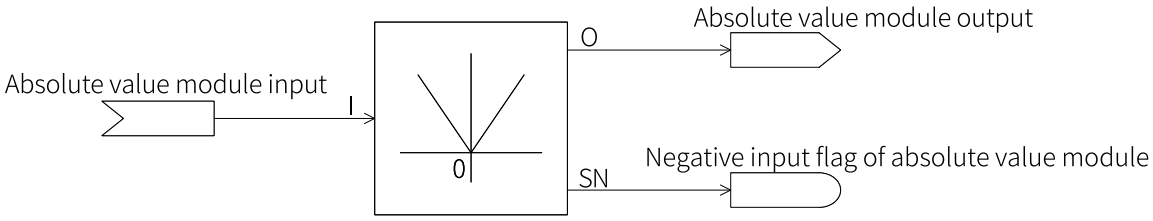


Figure 11-30 Schematic of the absolute value module

The calculation formula for the absolute value module is as follows:

$$O = |I|$$

$$SN = \begin{cases} 1, & I < 0 \\ 0, & I \geqslant 0 \end{cases}$$

(1) When the absolute value module input I is set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When the absolute value module input I is not 0 [Module disabled], the output O equals the absolute value of input I. When input I is negative, the input flag SN is 1; otherwise, it is 0.

Connection parameters

8 groups of absolute value modules (A to H) are provided, with the inputs and outputs corresponding to each of the module as follows.

Source of input I parameter values: 0 [module disabled], multi-reference value, simple PLC, PID, communication, floating-point connector.

Location for saving output O: Floating-point connector.

Storage location of output SN: Bit connector

The parameters corresponding to the input and output of the absolute value module are as follows.

Absolute value module	Input	Output	
	I	O	SN
A	o9-00	L2400	L0420
B	o9-01	L2402	L0421
C	o9-02	L2404	L0422
D	o9-03	L2406	L0423
E	o9-04	L2408	L0424
F	o9-05	L2410	L0425
G	o9-06	L2412	L0426
H	o9-07	L2414	L0427

11.7.5.3 Addition/Subtraction Module (A To H)

Function description

The addition/subtraction module is used to perform addition and subtraction operations on input values and output the result. The addition/subtraction module has four inputs. The output = Input 1 + Input 2 + Input 3 - Input 4.

Operating principles

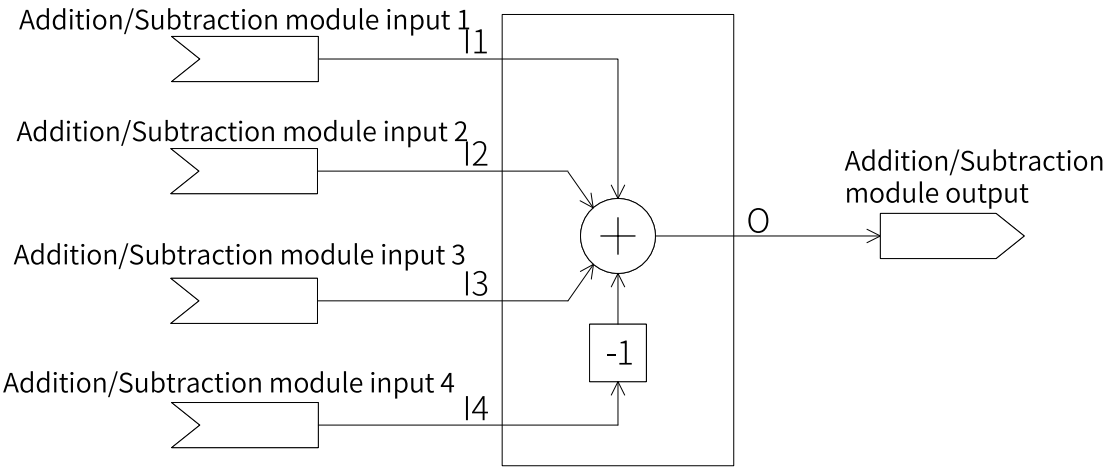


Figure 11-31 Schematic of the addition/subtraction module

The calculation formula for the addition/subtraction module is as follows:

O = I1 + I2 + I3 - I4

(1) When input I1 of the addition/subtraction module is set to 0 [Disabled], the module is inactive and the output is 0.

(2) When input I1 of the addition/subtraction module is set to any other value, the output O equals I1 + I2 + I3 - I4.

Connection parameters

8 addition/subtraction modules (A to H) are provided, with the inputs and outputs corresponding to each of the module as follows.

Source of parameter value for input I1: 0 [Disabled], multi-reference value, simple PLC, PID, communication, and floating-point connector.

Source of input I2, I3, and I4 parameter values: 0, multi-reference value, simple PLC, PID, communication, and floating-point connector

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the addition/subtraction module are as follows.

Addition/ Subtraction module	Input				Output
	I1	I2	I3	I4	O
A	o8-00	o8-01	o8-02	o8-03	L2368
B	o8-04	o8-05	o8-06	o8-07	L2370
C	o8-08	o8-09	o8-10	o8-11	L2372
D	o8-12	o8-13	o8-14	o8-15	L2374
E	o8-16	o8-17	o8-18	o8-19	L2376
F	o8-20	o8-21	o8-22	o8-23	L2378
G	o8-24	o8-25	o8-26	o8-27	L2380
H	o8-28	o8-29	o8-30	o8-31	L2382

11.7.5.4 Multiplication/Division Module (A to H)

Function description

The multiplication/division module is used to perform multiplication and division operations on the input values and output the result. The multiplication/division module has three inputs. The output value = Input 1 x Input 2/Input 3.

Operating principles

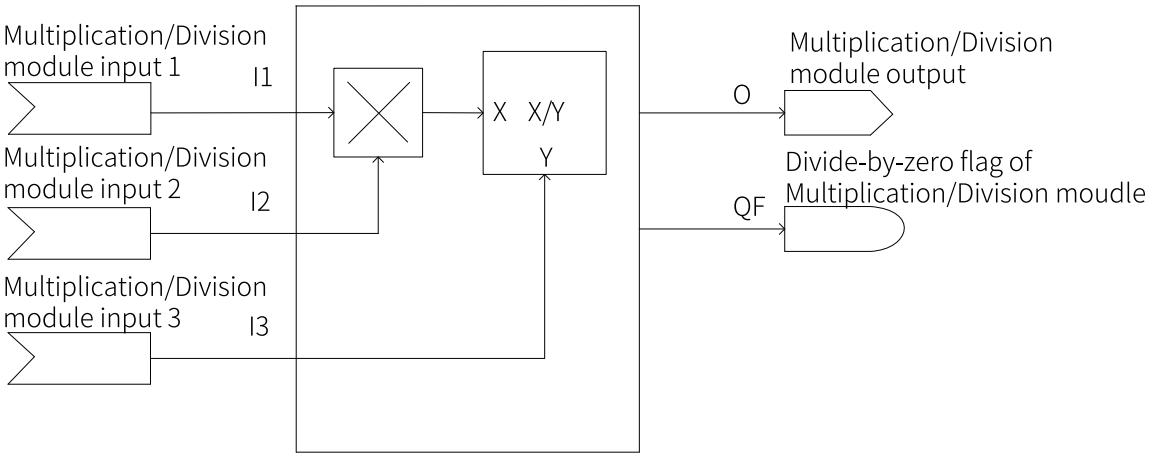


Figure 11-32 Schematic of the multiplication/division module

The calculation formula for the multiplication/division module is as follows:

$$\begin{cases} I1 \times I2, & I3 \text{ selection } 0 \text{ [value 1]} \\ \dfrac{I1 \times I2}{I3}, & I3 \neq 0 \\ 0, & I3 = 0 \end{cases}$$

$$QF = \begin{cases} 1, & I3 = 0 \\ 0, & I3 \neq 0 \end{cases}$$

(1) When input I1 of the multiplication/division module is set to 0 [Disable], the module is inactive and the output is 0.

(2) When input I3 of the multiplication/division module is set to 0 [Value 1], the output O equals the product of I1 and I2.

(3) When input I3 of the multiplication/division module is set to any other option, if the value of input I3 is 0, the output O is 0 and the divide-by-zero flag bit QF is 1. If the value of input I3 is not 0, the output O = I1 x I2/I3 and the divide-by-zero flag bit QF is 0.

Connection parameters

8 multiplication/division modules (A to H) are provided, with the following inputs and outputs correspond to each of the module.

Source of parameter value for input I1: 0 [Disabled], multi-reference value, simple PLC, PID, communication, and floating-point connector.

Source of parameter value for input I2 and input I3: 0 [Value 1], multi-reference value, simple PLC, PID, communication, and floating-point connector

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the multiplication/division module are as follows.

Multiplication/ Division module	Input			Output	
	I1	I2	I3	O	QF
A	o8-48	o8-49	o8-50	L2384	L0412
B	o8-51	o8-52	o8-53	L2386	L0413
C	o8-54	o8-55	o8-56	L2388	L0414
D	o8-57	o8-58	o8-59	L2390	L0415
E	o8-60	o8-61	o8-62	L2392	L0416
F	o8-63	o8-64	o8-65	L2394	L0417
G	o8-66	o8-67	o8-68	L2396	L0418
H	o8-69	o8-70	o8-71	L2398	L0419

11.7.5.5 Comparison Module (A to H)

Function description

The comparison mode of the input can be set by selecting the comparison module function parameter. Three modes can be set: Input 1 > Input 2, Input 1 = Input 2, or Input 1 < Input 2. The comparison module compares input 1 and input 2 according to the set mode. When the comparison condition is met, the output is 1; otherwise, the output is 0.

Operating principles

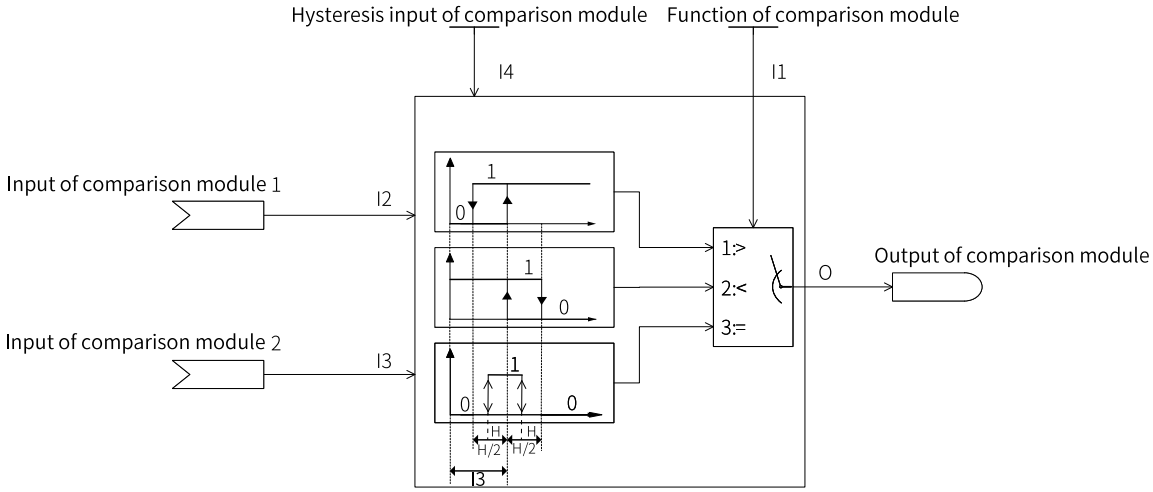


Figure 11-33 Schematic of the comparison module

(1) When comparison module function selection I1 is set to 0 [Module disabled], the module is inactive and the output is 0.

(2) When comparison module function selection I1 is set to 1 [input 1 > input 2], the output O keeps at low level before I2 increases from 0 to I3 in the forward direction. When I2 increases to a value higher than I3, the output O changes from low level to high level. When I2 keeps increasing, the output O keeps at high level. If I2 decreases but keeps higher than I3 - I4, the output O keeps at high level. Only when I2 is lower than I3 - I4, the output O changes from high level to low level.

(3) When comparison module function selection I1 is set to 2 [input 1 < input 2], the output O keeps at high level before I2 increases from 0 to I3 + I4 in the forward direction. When I2 increases to a value higher than I3 + I4, the output O changes from high level to low level. When I2 keeps increasing, the output O keeps at low level. If I2 decreases but keeps higher than I3, the output O keeps at low level. Only when I2 is lower than I3, the output O changes from low level to high level.

(4) When comparison module function selection I1 is set to 3 [input 1 = input 2], high level is outputted if I2 is within the range of I3 - I4/2 to I3 + I4/2. Otherwise, low level is outputted.

Connection parameters

8 groups of comparison modules (A to H) are provided. The corresponding inputs and outputs for each module are as follows.

Source of parameter value for Input I1: 0 [Module disabled], 1 [Input 1 > Input 2], 2 [Input 1 < Input 2], 3 [Input 1 = Input 2].

Source of parameter value for inputs I2 and I3: 0, multi-reference value, simple PLC, PID, communication, floating-point connector

Source of parameter value for input I4: Floating-point number with two decimal places

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the comparison module are as follows.

Comparison module	Input				Output
	I1	I2	I3	I4	O
A	o9-16	o9-17	o9-18	o9-19	L0400
B	o9-20	o9-21	o9-22	o9-23	L0401
C	o9-24	o9-25	o9-26	o9-27	L0402
D	o9-28	o9-29	o9-30	o9-31	L0403
E	o9-32	o9-33	o9-34	o9-35	L0404
F	o9-36	o9-37	o9-38	o9-39	L0405
G	o9-40	o9-41	o9-42	o9-43	L0406
H	o9-44	o9-45	o9-46	o9-47	L0407

11.7.6 Switch Selection

11.7.6.1 Introduction To Switch Selection Module

Function description

The module controls the output to be equal to input 1 or input 2 through module input selection signal. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Applicable scenario

This module can be used to change the parameter setpoint when the control condition changes.

11.7.6.2 Binary Selector Module (A To H)

Function description

The binary selector module has two binary number inputs, and the output equals either input 1 or input 2 based on the input selection. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Operating principles

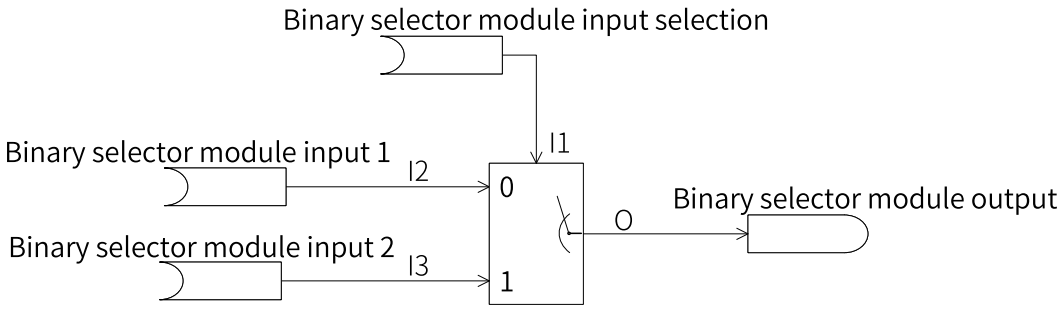


Figure 11-34 Diagram of the binary selector

When the binary selector module input I1 is set to 0 [Inactive], the module is inactive and the output is 0.

When the binary selector module input I1 is set to any other option, if the I1 input value is 0, the output O equals the module input I2. If the I1 input value is 1, the output O equals the module input I3.

Connection parameters

The input and output of the binary selector module (A to H) are as follows.

Source of parameter value for input I1: 0 [Inactive], DI input, and bit connector

Source of parameter values for input I2 and I3: logic 0, logic 1, DI input, and bit connector.

Location for saving output O: Bit connector.

Parameters corresponding to the input and output of the binary selector module are as follows.

Binary selector module	Input			Output
	I1	I2	I3	O
A	oA-00	oA-01	oA-02	L0368
B	oA-03	oA-04	oA-05	L0369
C	oA-06	oA-07	oA-08	L0370
D	oA-09	oA-10	oA-11	L0371
E	oA-12	oA-13	oA-14	L0372
F	oA-15	oA-16	oA-17	L0373
G	oA-18	oA-19	oA-20	L0374
H	oA-21	oA-22	oA-23	L0375

Note: Connector L1234 is used to display the selection results of each binary selector module.

Param.	Name	Default value	Value range	Description
L1234	Input state of binary selector module	-	-	Displays the input state of the binary selector module. bit0 to bit7 represent the selection results of binary selector modules A to H, respectively. When the bit value is 0, input 1 is selected. When the bit value is 1, input 2 is selected.

11.7.6.3 Digital Selector (A to H)

Function description

The digital selector module has two floating-point inputs, and the output equals input 1 or input 2 based on the input selection. When the input selection signal is 0, the output equals input 1. When the input selection signal is 1, the output equals input 2.

Operating principles

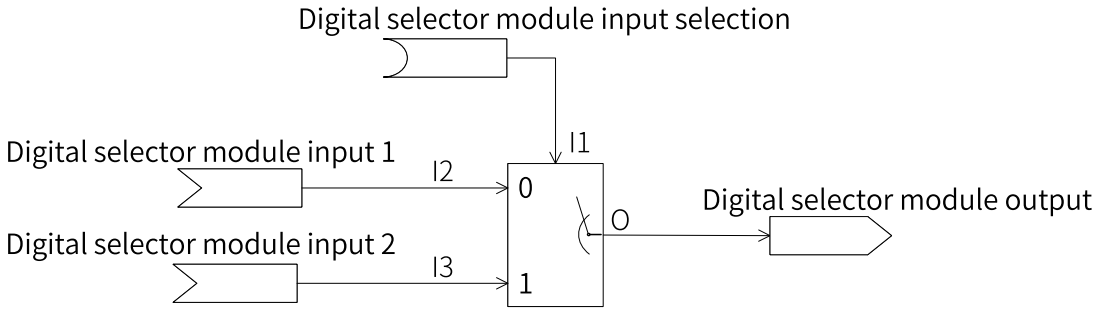


Figure 11-35 Schematic of the digital selector module

When input I1 of the digital selector module is set to 0 [Invalid], the module is inactive, and the output is 0.

When input I1 of the digital selector module is set to any other option, if the input I1 value is 0, the output O equals module input I2; if the input I1 value is 1, the output O equals module input I3.

Connection parameters

The inputs and outputs corresponding to the digital selector module (A to H) are as follows.

Source of parameter value for input I1: 0 [Inactive], DI input, and bit connector

Source of parameter value for inputs I2 and I3: 0, multi-reference value, simple PLC, PID, communication, floating-point connector

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the digital selector module are shown below.

Digital selector module	Input			Output
	I1	I2	I3	O
A	oA-24	oA-25	oA-26	L2416
B	oA-27	oA-28	oA-29	L2418
C	oA-30	oA-31	oA-32	L2420
D	oA-33	oA-34	oA-35	L2422
E	oA-36	oA-37	oA-38	L2424
F	oA-39	oA-40	oA-41	L2426
G	oA-42	oA-43	oA-44	L2428
H	oA-45	oA-46	oA-47	L2430

Note: Connector L1235 is used to display the selection results of each digital selector module.

Param.	Name	Default value	Value range	Description
L1235	Input state of digital selector module	-	-	Displays the input selection state of the digital selector module. bit0 to bit7 represent the selection results of digital selector modules A to H respectively. When the bit value is 0, input 1 is selected. When the bit value is 1, input 2 is selected.

11.7.7 Control Function

11.7.7.1 Introduction To Control Function Module

Function description

This module can be used to process input signals to eliminate signal errors.

Applicable scenario

This module is generally used to filter and limit signals such as level and frequency, which eliminates signal errors.

11.7.7.2 Filter Module (A to D)

Function description

The filter module is used to filter the input signal to generate the output value, effectively eliminating signal errors. The filtering time can also be set. The longer the filtering time, the better the effect, but an excessively long filtering time also causes the output signal to lag behind the input signal.

Operating principles

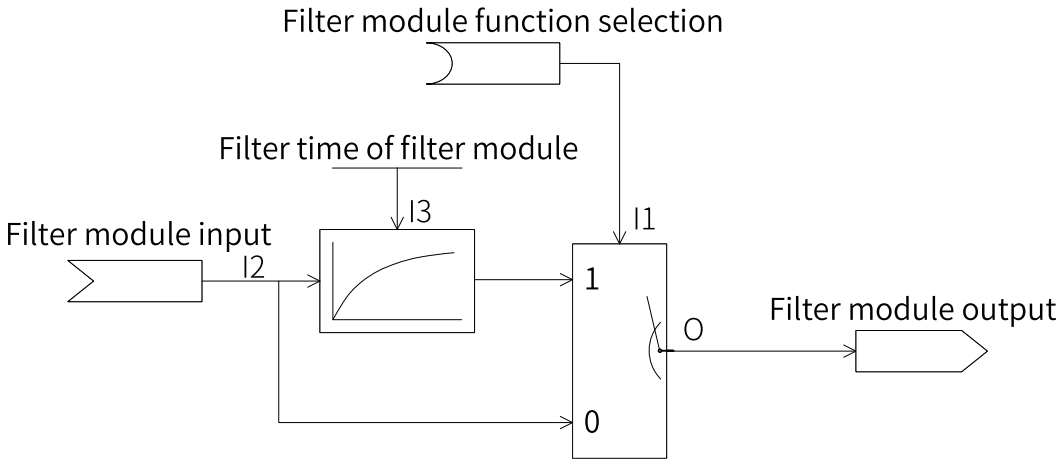


Figure 11-36 Schematic diagram of the filter module

Connection parameters

The input and output corresponding to the filter module (A to D) are as follows:

Source of parameter value for input I1: 0 [Invalid], 1 [Valid], DI input, bit connector.

Source of parameter value for input I2: 0, multi-reference value, simple PLC, PID, communication, floating-point connector.

Source of parameter value for input I3: Floating-point number with three decimal places

Location for saving output O: Floating-point connector.

Parameters corresponding to the inputs and outputs of the filter module are as follows.

Filter module	Input			Output
	I1	I2	I3	O
A	ob-00	ob-01	ob-02	L2440
B	ob-03	ob-04	ob-05	L2442
C	ob-06	ob-07	ob-08	L2444
D	ob-09	ob-10	ob-11	L2446

11.7.7.3 Level-To-Pulse Module (A To D)

Function description

The level-to-pulse module is used for mutual conversion between level signals and pulse signals. When the module function selection is set to 1, the level signal is converted to pulse signal. When the module function selection is set to 2, the pulse signal is converted to level signal.

Operating principles

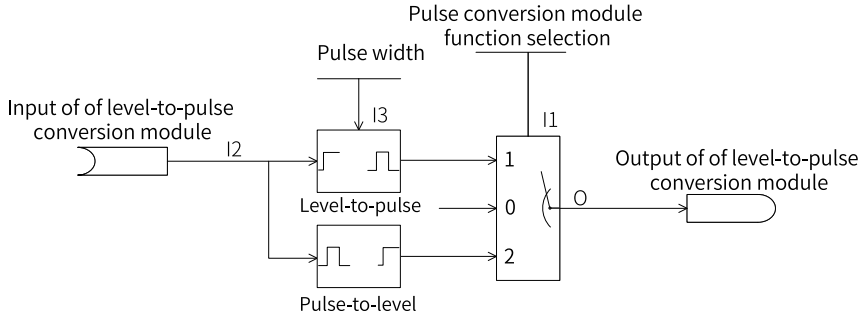
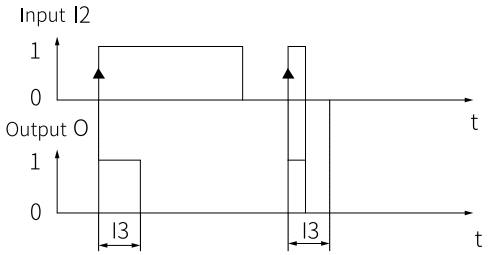


Figure 11-37 Schematic of the level-to-pulse module

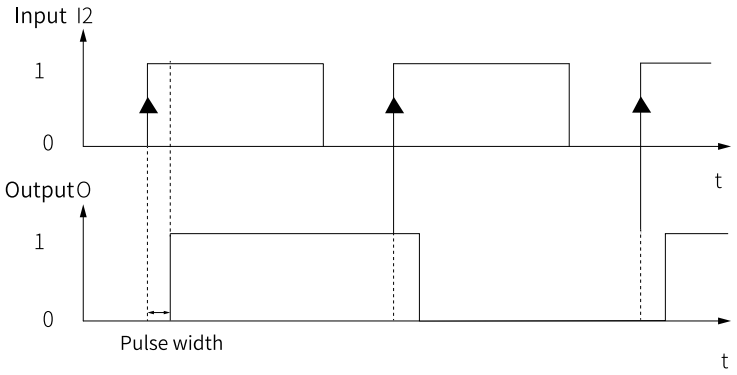
(1) When the level-to-pulse module function selection I1 is set to 0 [Disable], the module is inactive and the output is 0.

(2) When the level-to-pulse module function selection I1 is set to 1 [Level-to-pulse], the level signal can be converted to pulse signal, and the output O is set to high level within one pulse duration I3 at the rising edge of input I2. If the input I2 is 0, the output is set 0 immediately no matter whether the pulse duration I3 is reached.



(3) When the level-to-pulse module function selection I1 is set to 2 [Pulse-to-level], the pulse signal can be converted to level signal. In this case, the output is set to high level after the first rising edge of input I2 persists for a duration equal to pulse width I3, and the output is set to low level after the second rising edge of input I2 persists for a duration equal to pulse width I3. Thereafter, the output is

set to high level at every odd-numbered rising edge and set to low level at every even-numbered rising edge.



Connection parameters

The input and output of the level-to-pulse module (A to D) are as follows.

Input I1 parameter value source: 0 [Disable], 1 [Level-to-pulse], and 2 [Pulse-to-level].

Input I2 parameter value source: 0, 1, DI input, and bit connector.

Input I3 parameter value source: Floating-point number with two decimal places

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of the level-to-pulse module are as follows.

Level-to-pulse module	Input			Output
	I1	I2	I3	O
A	ob-24	ob-25	ob-26	L0408
B	ob-27	ob-28	ob-29	L0409
C	ob-30	ob-31	ob-32	L0410
D	ob-33	ob-34	ob-35	L0411

11.7.7.4 Limiting Module (A to D)

Function description

The limiting module is used to limit the numerical value of the input signal, and both upper and lower limits can be set. When the input is within the limit range, the output equals the input. When the input exceeds the upper limit, the output equals the upper limit. When the input is below the lower limit, the output equals the lower limit.

Operating principles

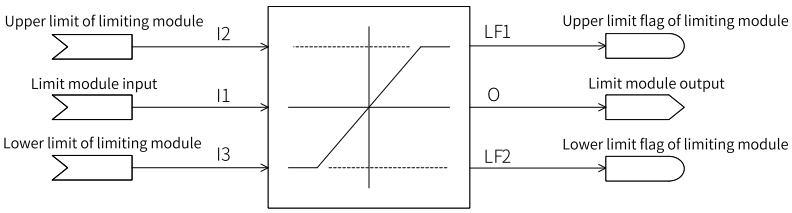


Figure 11-38 Limiting module diagram

(1) When the input I1 of the limiting module is set to 0 [Disabled], the module is inactive and the output is 0.

(2) When the input I1 is greater than the upper limit I2, the output O equals the value of I2, and the upper limit flag LF1 is set to 1.

(3) When the input I1 is lower than the lower limit I3, the output O equals the value of I3, and the lower limit flag LF2 is set to 1.

(4) When the input I1 is within the upper and lower limit range, the output O equals the input value I1.

Connection parameters

The input and output of the limiting module (A to D) are as follows:

Source of parameter value for input I1: 0 [Disabled], multi-reference value, simple PLC, PID, communication, and floating-point connector.

Source of parameter value for input I2: 0 [Upper limit invalid], multi-reference value, simple PLC, PID, communication, and floating-point connector.

Source of parameter value for input I3: 0 [Lower limit invalid], multi-reference value, simple PLC, PID, communication, and floating-point connector.

Location for saving output O: Floating-point connector.

Storage location for outputs LF1 and LF2: Bit connector

Parameters corresponding to the inputs and outputs of the limiting module are as follows.

Limiting module	Input			Output		
	I1	I2	I3	O	LF1	LF2
A	oC-00	oC-01	oC-02	L2432	L0429	L0428
B	oC-03	oC-04	oC-05	L2434	L0431	L0430
C	oC-06	oC-07	oC-08	L2436	L0433	L0432
D	oC-09	oC-10	oC-11	L2438	L0435	L0434

11.7.7.5 Logic Delay Module (A To H)

Function description

The logic delay module is used to process input signals with a delay. After the ON delay time is set, when the input signal changes from 0 to 1, the output signal will be delayed. After the OFF delay time is set, the output signal will be delayed when the input signal changes from 1 to 0.

Operating principles

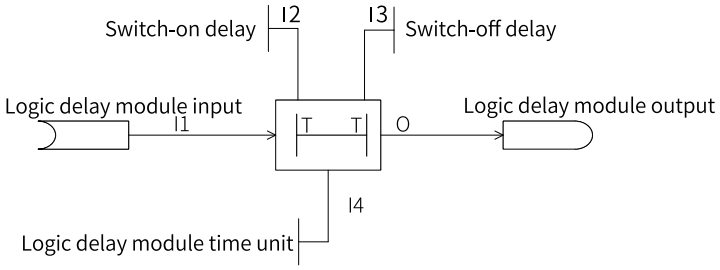
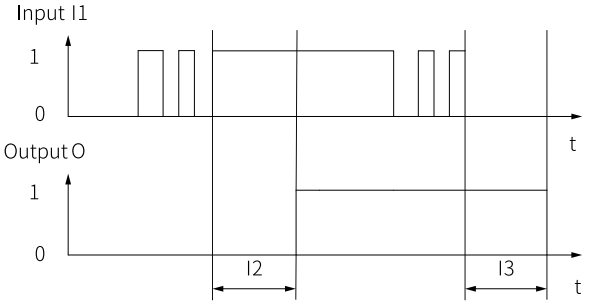


Figure 11-39 Diagram of the logic delay module

When the input I1 of the logic delay module is set to 0 [Disable], the module is inactive and the output is 0.

When the input I1 of the logic delay module is set to any other input, the output O is applied with the ON delay when the input I1 changes from low level to high level. The delay time depends on the ON delay time set by I2 and the time unit selected by I4. The output O is also applied with a OFF delay when the input I1 changes from high level to low level. The delay time depends on the OFF delay time set by I3 and the time unit selected by I4.

During the delay period, pulse signals shorter than the set delay time will be filtered out, as shown in the figure below.



Connection parameters

The inputs and outputs corresponding to the logic delay modules (A to H) are as follows.

Source of parameter value for input I1: 0 [Disable], DI input, and bit connector.

Source of parameter values for inputs I2 and I3: Unsigned number.

Source of parameter value for input I4: 0 [No delay], 1 [10 ms], 2 [100 ms], 3 [1s], 4 [10s], 5 [1 min], and 6 [2 min].

Location for saving output O: Bit connector.

Parameters corresponding to the inputs and outputs of the logic delay module are as follows.

Logic delay module	Input				Output
	I1	I2	I3	I4	O
A	oC-28	oC-29	oC-30	oC-31	L0456
B	oC-32	oC-33	oC-34	oC-35	L0457
C	oC-36	oC-37	oC-38	oC-39	L0458
D	oC-40	oC-41	oC-42	oC-43	L0459

Logic delay module	Input				Output
	I1	I2	I3	I4	O
E	oC-44	oC-45	oC-46	oC-47	L0460
F	oC-48	oC-49	oC-50	oC-51	L0461
G	oC-52	oC-53	oC-54	oC-55	L0462
H	oC-56	oC-57	oC-58	oC-59	L0463

11.7.8 Constant Value Module

Function description

The output value of the constant value module is always equal to the input value.

Applicable scenario

When the input source needs to be set to a fixed value, use the constant value module to set the value, and then select the output of the constant value module as the input source.

Operating principles

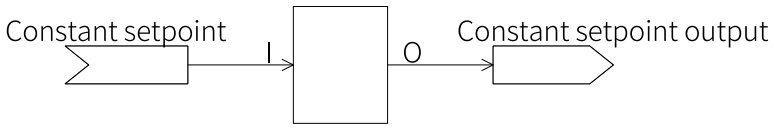


Figure 11-40 Diagram of the constant value module

The output O of the constant value module equals the setpoint I. Constant value setpoints are divided into the following two types.

(1) Floating-point number with 1 decimal place, with a setting range of -3000.0% to +3000.0%

(2) Signed integer, with a setting range of -32768 to +32767

Connection parameters

The drive provides 16 sets of constant value modules, with the following input and output corresponding to each module.

Source of input I parameter value: Floating-point number or signed integer

Location for saving output O: word connector or floating-point connector

The parameters corresponding to the input and output of the constant value module are as follows.

Constant value module	Input	Output
	I	O
Floating-point 1	o1-00	L2352
Floating-point 2	o1-01	L2354
Floating-point 3	o1-02	L2356
Floating-point 4	o1-03	L2358
Floating-point 5	o1-04	L2360
Floating-point 6	o1-05	L2362
Floating-point 7	o1-06	L2364

Constant value module	Input	Output
	I	O
Floating-point 8	o1-07	L2366
Word 1	o1-08	L1200
Word 2	o1-09	L1201
Word 3	o1-10	L1202
Word 4	o1-11	L1203
Word 5	o1-12	L1204
Word 6	o1-13	L1205
Word 7	o1-14	L1206
Word 8	o1-15	L1207

11.8 Selective Grounding

Function description

The drive supports selective grounding function, and the grounding relay can be controlled through F1-68.

① When F1-68 is 1, the grounding relay closes. In this case, the PE terminals of the control board and driver board are shorted to the enclosure ground.

② When F1-68 is 0, the grounding relay opens. In this case, the PE terminals of the control board and driver board are isolated from the enclosure ground.

Related parameters

Param.	Name	Default value	Value range	Description
F1-68	Selective grounding	1	0: Not grounded 1: Grounded	Used to control whether the PE terminals of the control board and driver board are isolated from the enclosure ground.

12 Fault and Protection

12.1 Startup Protection

Application scenarios

Set P0-21 [Startup protection selection] to 1 [Enable] to enable the startup protection of the drive, preventing risks caused by motor responses.

Startup protection can be used in the following scenarios.

If the operation command is active when the drive is powered on (for example, an input terminal is ON before power-on), the drive does not respond to the command. The drive responds only after the operation command is activated again.

Related parameters

Table 12–1 Parameters related to startup protection

Param.	Name	Default value	Value range	Description
P0-21	Startup protection	1	0: Disable 1: Enable	Defines whether the startup protection is enabled. Value description: 0: Disable Startup protection is not enabled. 1: Enable Startup protection is enabled. Note: When this parameter is set to 1, the drive does not respond to the operation command even if the operation command is active upon power-on (for example, an input terminal is ON before power-on). The drive responds only after the operation command is activated again. In addition, when this parameter is set to 1, the drive does not respond to the operation command even if the operation command is active upon fault reset. To exit the protection state, deactivate the operation command first.

12.2 Fault Reset and Restart

12.2.1 Fault Reset Mode

The drive supports two fault reset methods: manual reset and automatic reset.

After the fault is rectified, you can reset the fault through  on the operating panel or configuring DI function, or reset the fault manually through communication, as shown in *"12.2.2 Manual Fault Reset" on page 677*.

Automatic reset requires configuration of related parameters in Group H3 to be activated. See details in *"12.2.3 Automatic Fault Reset" on page 678*.

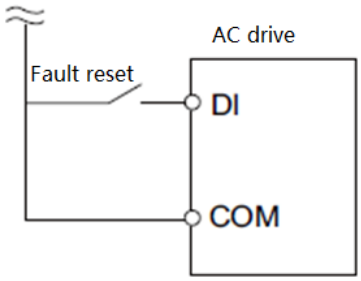
12.2.2 Manual Fault Reset

When a fault occurs on the drive, rectify the fault and reset the fault manually.

The fault can be reset manually through the following four ways.

Method 1: Reset the fault through the DI terminal.

Assign a DI (any DI function selection) with function "9: Fault reset".



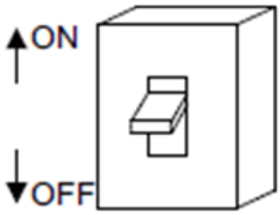
Method 2: Reset the fault through the operating panel.

Press  on the operating panel to reset the fault.



Method 3: Restart the drive to reset the fault.

Disconnect the main circuit power supply. Wait until the fault code disappears, and then switch on the power supply again.



Method 4: Reset the fault through communication.

When b1-00 (Command source) is set to 2 (Communication), writing "16" (bit4 of fault reset command) to communication address 7321H through the host controller can reset the fault after the fault is cleared.



12.2.3 Automatic Fault Reset

Application scenarios

After a fault occurs, the fault is reset automatically when the fault cause is rectified. In this case, no further action is required.

Operating principles

The automatic fault reset function of the drive is deactivated by default. The default value of H3-01 [Automatic fault reset count] is 0. To enable automatic fault reset, you need to configure related parameters. The diagram for using this function is shown below.

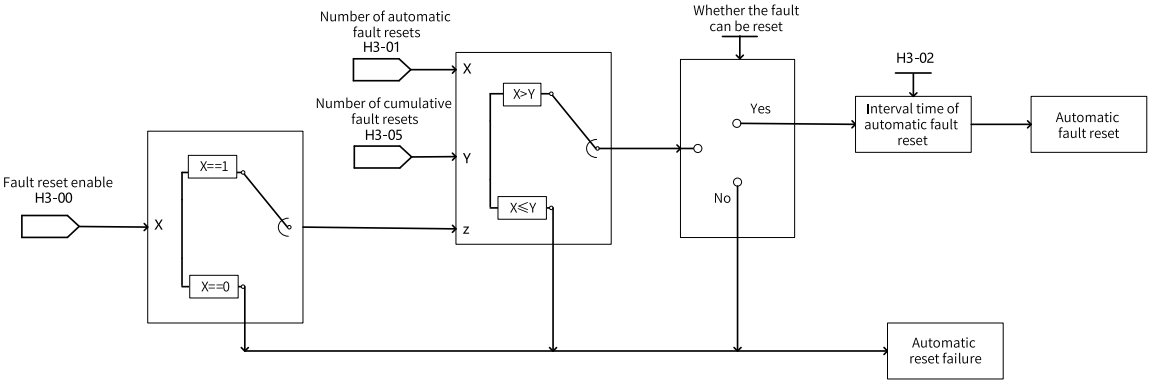


Figure 12-1 Automatic fault reset

As shown in the preceding figure, parameters to be set are as follows.

(1) Set H3-00 [Automatic fault reset enable] to 1 [Enable].

(2) Set H3-01 [Automatic fault reset count].

(3) Set H3-02 [Automatic fault reset interval time], which is the waiting time between fault occurrence and automatic fault reset.

When a fault occurs, make sure that H3-00 [Fault reset enable] is enabled and H3-01 [Automatic fault reset count] is higher than H3-05 [Cumulative fault reset count]. In this case, the drive resets the fault upon every interval time defined by H3-02 until the fault cause is rectified.

Note that unless the fault can be quickly located and eliminated, it is not recommended to set H3-02 [Automatic fault reset interval time] to an excessively low value. This is because the drive resets the

fault at configured interval time after the fault occurs. If the fault does not reach the reset condition, H3-05 [Cumulative fault reset count] increments by one. If the interval time is excessively short and the fault reset conditions are not met within a long term, the permissible number of automatic fault resets may be exhausted, which means the value of H3-05 [Cumulative fault reset count] exceeds the value of H3-01 [Automatic fault reset count].

Additionally, when the permissible number of fault resets is exhausted, you can restore the reset count by H3-04 [Waiting time for restoring automatic fault reset count] and H3-06 [Action upon fault reset count exhausted].

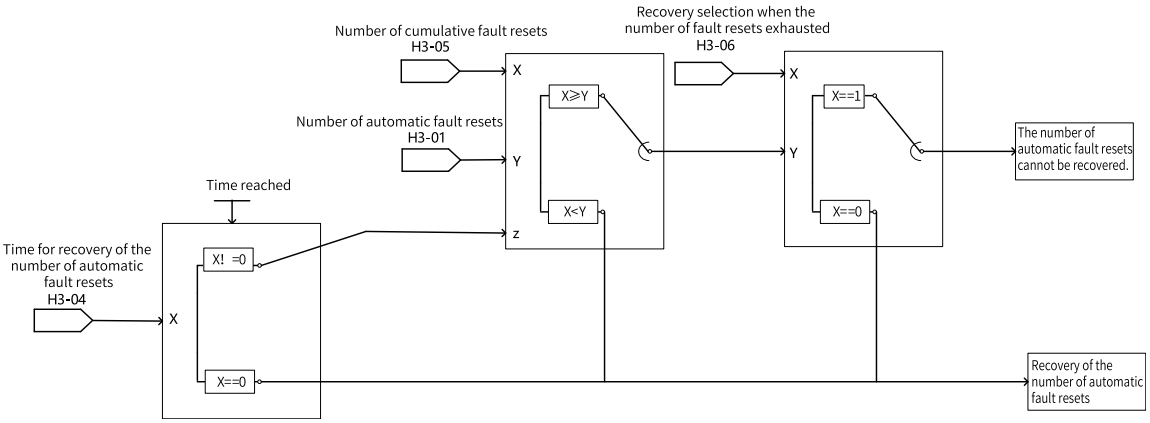


Figure 12-2 Time for restoring automatic fault reset count

As shown in the preceding figure, if H3-04 [Waiting time for restoring automatic fault reset count] is not set, H3-01 [Automatic fault reset count] can be restored continuously. If H3-04 is set, the fault reset count can be restored when H3-05 [Cumulative fault reset count] is lower than H3-01 [Automatic fault reset count].

When H3-05 [Cumulative fault reset count] is higher than H3-01 [Automatic fault reset count], whether H3-01 can be restored depends on the setting of H3-06 [Action upon fault reset count exhausted]. When H3-06 is set to 1 [Not restore automatic reset count], the reset count cannot be restored, which means the automatic fault reset count is exhausted. When H3-06 is set to 0 [Restore automatic fault reset count], the automatic fault reset count is restored.

Meanwhile, you can set ten sets of fault codes that inhibit automatic reset through H3-13 [Fault code 1 that inhibits automatic reset] to H3-22 [Fault code 10 that inhibits automatic reset].

Related parameters

Table 12–2 Parameters related to automatic fault reset

Param.	Name	Default value	Value range	Description
H3-00	Automatic fault reset selection	1	0: Disable 1: Enable	Defines whether to enable automatic fault reset. Value description: 0: Disable - Automatic fault reset is disabled. 1: Enable - Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	Defines the number of automatic fault resets. Note: If the number of reset times exceeds the value of this parameter, the drive stays in the fault state.

Param.	Name	Default value	Value range	Description
H3-02	Interval time of automatic fault reset	1.0s	0.1s to 600.0s	Defines the interval time between automatic fault resets. Note: This parameter defines the time between fault occurrence and automatic reset.
H3-03	Automatic reset disabled upon manual reset	1	0: Automatic reset deactivated 1: Automatic reset continued	Defines whether automatic reset can be terminated by manual reset during automatic reset. If the fault is terminated, the drive no longer resets the fault automatically. Value description: 0: Automatic reset deactivated - Automatic reset is terminated upon manual reset. 1: Automatic reset continued - Automatic reset continues after manual reset.
H3-04	Waiting time for restoring the number of automatic fault resets	10 min	0 min to 6000 min	Defines the waiting time for restoring the number of automatic fault resets. Note: When it is set to a non-zero value, the automatic fault reset count is restored after the time defined by H3-04 elapses. When it is set to 0, the automatic fault reset count can be restored continuously.
H3-05	Cumulative number of fault resets	0	-	Displays the cumulative number of fault resets, which cannot be modified. This parameter is cleared automatically when the number of manual resets and automatic resets are reached.
H3-06	Action when automatic fault reset count exhausted	0	0: Restore automatic fault reset count 1: Not restore automatic fault reset count	Defines whether to restore the automatic fault reset count after the fault reset count is exhausted. Value description: 0: Restore automatic fault reset count - When the automatic fault reset count is exhausted and waiting time for restoring the number of automatic fault resets elapses, the automatic fault reset count can be restored automatically. 1: Not restore automatic fault reset count - The automatic fault reset count will not be restored automatically when expired.
H3-07	Fault flag output selection	0	0: Not output during automatic fault reset 1: Output during automatic fault reset	Defines whether the fault flag is output during automatic reset, which is used to determine whether connector L0134 [Fault output] is 1 during fault reset. Value description: 0: Not output during automatic fault reset - The fault flag is not output during automatic reset. 1: Output during automatic fault reset - The fault flag is output during automatic reset.

Param.	Name	Default value	Value range	Description
H3-13	Fault code 1 that inhibits automatic reset	0.0	0.0 to 255.9	To set fault code 1 that inhibits automatic reset, enter the fault code and subcode, such as 187.1. Note: Enter the code and subcode of the fault, such as 187.1. In this case, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-15	Fault code 3 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-16	Fault code 4 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-17	Fault code 5 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-18	Fault code 6 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-19	Fault code 7 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-20	Fault code 8 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-21	Fault code 9 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13
H3-22	Fault code 10 that inhibits automatic reset	0.0	0.0 to 255.9	Same as H3-13

12.2.4 Restart After Automatic Fault Reset

Application scenarios

When this function is enabled, the drive is restarted automatically after waiting time for restart upon fault reset elapses.

Operating principles

During restart, if the drive receives a stop/manual reset command, it will stop and not restart. You can set black/whitelist for faults that allow/inhibit restart after automatic reset. Up to six fault codes can be set for the black/whitelist.

When H3-31 [Faults allowing restart after automatic reset] is set to 0 [Whitelist], H3-34 [Specified fault code 1] to H3-39 [Specified fault code 6] can be set to define six sets of fault codes that allow restart. When H3-31 is set to 1 [Blacklist], only the parameters defined by H3-34 to H3-39 do not allow restart. The following figure shows the detailed process.

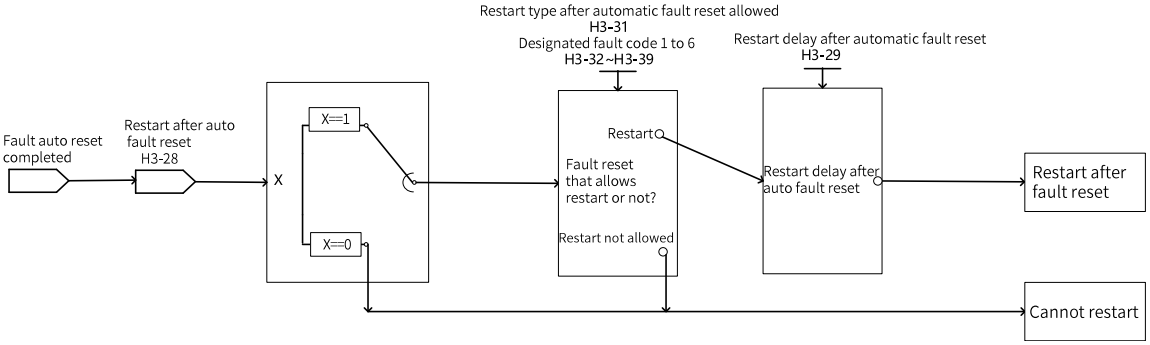


Figure 12-3 Restart after automatic fault reset

For example, set H3-00 [Automatic fault reset enable] to 1 [Enable], H3-01 [Automatic fault reset count] to 10, H3-02 [Automatic fault reset interval time] to 5s, H3-28 [Restart after automatic fault] to 1 [Enabled], and H3-29 [Restart delay after automatic fault reset] to 5s.

Generate a fault during operation of the drive on purpose, and set H2-00 [External fault 1 (NO) source] to 1 [Active]. In this case, the drive reports E015.1. Then set H2-00 to 0 to rectify the fault cause. After the fault is reset automatically, the drive starts automatically after a delay of 5s.

Related parameters

Table 12–3 Parameters related to restart after automatic fault reset

Param.	Name	Default value	Value range	Description
H3-28	Restart after automatic fault reset	0	0: Disable 1: Enable	Defines whether the drive restarts after automatic fault reset. Value description: 0: Disable - Restart is not performed after automatic fault reset. 1: Enable - Restart is performed after automatic fault reset.
H3-29	Restart delay after automatic fault reset	0.5s	0.0 to 600.0s	Defines the waiting time from automatic fault reset to automatic restart.

Param.	Name	Default value	Value range	Description
H3-30	Flying start applied forcibly after automatic fault reset	0	0: Flying start is not applied forcibly after automatic fault reset. 1: Flying start is applied forcibly after automatic fault reset.	Defines whether to enable flying start after automatic restart after fault reset. Flying start prevents the motor from being restarted when the speed is not reduced to 0 upon fault, avoiding overcurrent fault caused by inrush current upon start. Value description: 0: Flying start is not applied forcibly after automatic fault reset. 1: Flying start is applied forcibly after automatic fault reset.
H3-31	Faults allowing restart after automatic reset	1	0: Whitelist 1: Blacklist	Defines the faults that allow restart after automatic reset. Value description: 0: Whitelist - Only the six sets of parameters contained in the whitelist allow restart after automatic reset. 1: Blacklist - Only the six sets of parameters contained in the blacklist do not allow restart after automatic reset.
H3-34	Specified fault code 1	0.0	0.0 to 255.9	To set fault code 1, which allows restart after automatic fault reset, enter the fault code and subcode, such as 187.1. Note: Enter the code and subcode of the fault, such as 187.1. In this case, when power unit EEPROM junction temperature parameter storage error (E187.1) occurs, whether the drive restarts after reset is determined by the blacklist/whitelist in H3-31.
H3-35	Specified fault code 2	0.0	0.0 to 255.9	Defines the fault code 2 that allows restart after automatic reset.
H3-36	Specified fault code 3	0.0	0.0 to 255.9	Defines the fault code 3 that allows restart after automatic reset.
H3-37	Specified fault code 4	0.0	0.0 to 255.9	Defines the fault code 4 that allows restart after automatic reset.
H3-38	Specified fault code 5	0.0	0.0 to 255.9	Defines the fault code 5 that allows restart after automatic reset.
H3-39	Specified fault code 6	0.0	0.0 to 255.9	Defines the fault code 6 that allows restart after automatic reset.

12.3 Protective Action Against Fault

12.3.1 Setting Actions To Faults

Application scenarios

The fault action indicates the corresponding action taken by the drive after a fault occurs. You can set the fault action according to actual requirements to keep the drive in the corresponding state after the fault occurs.

Function description

11 types of actions can be set to the faults based on degree of severity from high to low: coast-to-stop > stop at maximum capacity > quick stop > decelerate-to-stop > limited operation (operating at limited speed, power, current, and torque) > alarm > prompt > ignore.

When "Ignore" is selected as the protective action against fault, no prompt will be displayed when a fault occurs. Select this option only when necessary.

You can set different fault actions to make the drive active accordingly when a fault occurs, as shown in the following table.

Table 12–4 Descriptions of actions to faults

Action	Description	Related parameters
Coast to stop	After a fault occurs, the output stops and the load coasts to stop based on inertia.	-
Stop with maximum capability	The drive stops the load as quick as possible with maximum output capability upon fault.	The ramp-down time for this stop mode is fixed to 50 ms.
Quick stop	After a fault occurs, the drive stops according to the set quick stop time.	b7-34 [Ramp-down time for quick stop]
Decelerate to stop	After a fault occurs, the drive stops according to the set ramp-down time.	(Take the first set of ramp-up/down time as an example): b7-04 [Ramp 1 ramp-up time] b7-05 [Ramp 1 ramp-down time]
Operating at limited speed	After the fault occurs, the drive continues to run according to the operating mode set by H1-60.	H1-60 [Operating at limited speed] H1-61 [Operating at designated safe operating frequency] H1-62 [Maximum positive frequency limit] H1-63 [Maximum negative frequency limit]
Operating at limited power	After the fault occurs, the drive continues to run, but the power cannot exceed the power limited by H1-64 and H1-65.	H1-64 [Maximum motoring power limit] H1-65 [Maximum regenerative power limit]
Operating at limited current	After the fault occurs, the drive continues to run, but the maximum output current cannot exceed the current limit defined by H1-68.	H1-68 [Maximum current limit]

Action	Description	Related parameters
Operating at limited torque	After the fault occurs, the drive continues to run, but the maximum output torque cannot exceed the torque limit defined by H1-66 and H1-67.	H1-66 [Maximum positive torque limit] H1-67 [Maximum negative torque limit]
Alarm	After a fault occurs, the drive displays an alarm code, without interrupting operation.	-
Prompt	After a fault occurs, the drive displays a prompt code, without interrupting operation.	-
Ignore	This fault is masked.	-

Multiple operation modes and parameters involved are during operation at limited speed. When a fault occurs and the fault action is set to "operating at limited speed", the drive continues to run in the mode defined by H1-60 [Operating at limited speed]. The following six options are available for H1-60.

0: Operating at limited frequency In this mode, the drive continues to run after a fault occurs, but the speed is limited by H1-62 [Maximum positive frequency limit] and H1-63 [Maximum negative frequency limit]. The drive cannot run at a speed higher than the speed limit. H1-62 and H1-63 indicate the frequency reference in percentages. The base value (100%) is determined by A2-04 [Per unit frequency base value].

1: Operating at the operating frequency upon fault In this mode, after a fault occurs, the drive continues to run according to the running frequency upon fault.

2: Operating at the designated safe frequency In this mode, after a fault occurs, the drive continues to run according to H1-61 [Designated safe operating frequency]. H1-61 indicate the frequency reference in percentages. The base value (100%) is determined by A2-04 [Per unit frequency base value].

3: Operating at the set frequency In this mode, the drive continues to run at the set frequency after a fault occurs.

4: Operating at the frequency upper limit in the current direction In this mode, the drive runs at the frequency upper limit in the current direction after a fault occurs.

5: Operating at the frequency lower limit in the current direction In this mode, the drive runs at the lower limit frequency in the current direction after a fault occurs.

The DO terminal configuration can be used. When a fault occurs, the output terminal outputs an active signal.

For example, you can set E1-04 [DO function selection] is to option 2 [Fault output], option 38 [Error output (fault/minor fault/alarm)], option 41 [Fault output (except undervoltage)], or option 43 [Output upon minor fault or alarm].

2: Fault - When the drive stops due to a fault (coast to stop, stop at maximum capability, quick stop, or decelerate to stop), the terminal outputs an active signal.

38: Error (fault/minor fault/alarm)When the AC drive encounters abnormality including a fault/ minor fault/warning, the RO terminal outputs an active signal.

41: Fault (excluding undervoltage) - When the drive encounters an error (fault/minor fault/alarm) other than undervoltage, the terminal outputs an active signal.

43: Minor fault or alarm - When the drive encounters an error (minor fault/alarm), the terminal outputs an active signal.

You can select the protective actions according to the fault action range set for the fault code in H1-00 to H1-18.

When the fault level is "Prompt", the output terminal cannot be configured as the fault output signal.

Related parameters

Table 12–5 Parameters related to operation modes

Param.	Name	Default value	Value range	Description
H1-60	Operation mode for operating at limited speed	1	0: Operating at limited frequency 1: Operating at the operating frequency upon fault 2: Operating at the designated safe frequency 3: Operating at the frequency reference 4: Operating at the frequency upper limit in the current direction 5: Operating at the frequency lower limit in the current direction	Defines the operation mode at limited speed when a minor fault occurs. Value description: 0: Operating at limited frequency - The maximum operating frequency is limited by H1-62 and H1-63. 1: Operating at the operating frequency upon fault - The drive operates at the operating frequency upon fault in limited operation. 2: Operating at the designated safe frequency - The drive operates at the frequency specified by H1-61 in limited operation. 3: Operating at the frequency reference - The drive operates at the set frequency in limited operation. 4: Operating at the frequency upper limit in the current direction - The drive operates at the frequency upper limit in the current direction in limited operation. 5: Operating at the frequency lower limit in the current direction - The drive operates frequency lower limit in the current direction in limited operation.
H1-61	Designated safe operating frequency	0.0%	0.0% to 800.0%	Defines the designated safe operating frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 2, the drive operates at the frequency defined by H1-61 upon a minor fault.
H1-62	Maximum positive frequency limit	100.0%	0.0% to 800.0%	Defines the maximum positive frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 0, the drive operates at the permissible maximum positive frequency upon a minor fault.

Param.	Name	Default value	Value range	Description
H1-63	Maximum negative frequency limit	100.0%	0.0% to 800.0%	Defines the maximum negative frequency in limited operation. Note: If H1-60 (Operating at limited speed) is set to 0, the drive operates at the permissible maximum negative frequency upon a minor fault.
H1-64	Maximum motoring power limit	50.0%	0.0% to 400.0%	Defines the maximum motoring power outputted by the drive in limited operation. Note: Defines the maximum motoring power upon a minor fault.
H1-65	Maximum regenerative power limit	50.0%	0.0% to 400.0%	Defines the maximum regenerative power in limited operation. Note: Defines the maximum regenerative power upon a minor fault.
H1-66	Maximum positive torque limit	50.0%	0.0% to 400.0%	Defines the maximum positive torque in limited operation. Note: Defines the maximum positive torque upon a minor fault.
H1-67	Maximum negative torque limit	50.0%	0.0% to 400.0%	Defines the maximum negative torque in limited operation. Note: Defines the maximum negative torque upon a minor fault.
H1-68	Maximum current limit	50.0%	0.0% to 400.0%	Defines the maximum current in limited operation. Note: Defines the maximum operating current upon a minor fault.

12.3.2 Setting Actions for Fault Codes

Application scenarios

The action for fault codes applies to all the subcodes under this fault code.

Function description

Actions for 76 fault codes can be set through H1-00 [Fault protection action selection 0] to H1-18 [Fault protection action selection 18]. The action for a fault code can be set through the tens, hundreds, and thousands of each parameter. As shown in the following table, the ones, tens, hundreds, and thousands of H1-00 are used to set the actions for overcurrent, overvoltage, pre-charging fault, and undervoltage faults respectively.

Table 12–6 Parameter for setting fault action

Param.	Name	Fault subcode		
H1-00	Protective action selection 0 upon fault	Ones	Overcurrent (E002)	0: Coast to stop
		Tens	Overvoltage (E005)	0: Coast to stop
		Hundreds	Pre-charge fault (E008)	0: Coast to stop
		Thousands	Undervoltage (E009)	0: Coast to stop

Note that not all the fault code can be set with 11 actions. Only fault actions provided in the parameter can be set. Take the ones of H1-00 as an example, the only option for overcurrent fault (E002) is coast-to-stop, which means no other actions can be set.

When the action for the fault code is set, all the subcodes under this master code take the same fault action. You can modify individual fault actions as needed. See details in *"12.3.3 Modifying the Action for an Individual Fault" on page 722*.

For example, if the thousands of H1-03 [Protective action selection 3 upon fault] is set to 3, the protective action for E186 (Power EEPROM fault) is decelerate-to-stop, then decelerate-to-stop applies to all the subcodes under E186, such as E186.1 (Model parameter read/write failure), E186.2 (Power unit parameter error), and E186.3 (Preset model parameters of the main control board inconsistent with the power board).

Related parameters

Table 12–7 Parameters for setting actions for fault codes

Param.	Name	Default value	Value range	Description
H1-00	Protective action selection 0 upon fault	0	Ones: Overcurrent (E002) 0: Coast to stop Tens: Overvoltage (E005) 0: Coast to stop Hundreds: Pre-charge fault (E008) 0: Coast to stop Thousands: Undervoltage (E009) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter are used to set protective actions upon different faults. Value description: Ones: Overcurrent (E002) 0: Coast to stop - When the drive encounters overcurrent, the operating panel displays E002 and the motor coasts to stop. Tens: Overvoltage (E005) 0: Coast to stop - When the drive encounters overvoltage, the operating panel displays E005 and the motor coasts to stop. Hundreds: Pre-charge fault (E008) 0: Coast to stop - When the drive encounters a pre-charge fault, the operating panel displays E008 and the motor coasts to stop. Thousands: Undervoltage (E009) 0: Coast to stop - When the drive encounters undervoltage for some reason, the operating panel displays E009 and the motor coasts to stop. Note: Protective actions for overcurrent, overvoltage, pre-charge fault, and undervoltage set by this parameter cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-01	Protective action selection 1 upon fault	0	Ones: Drive overload (E010) 0: Coast to stop Ones: Motor overload (E011) 0: Coast to stop Hundreds: Input phase loss (E012) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: Output phase loss (E013) 0: Coast to stop	Defines protective actions for different faults. Value description: Ones: Drive overload (E010) 0: Coast to stop - When the drive encounters overload, the operating panel displays E010 and the motor coasts to stop. Ones: Motor overload (E011) 0: Coast to stop - When the drive encounters motor overload, the operating panel displays E011 and the motor coasts to stop. Hundreds: Input phase loss (E012) 0: Coast to stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor coasts to stop. 1: Stop at maximum capability - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor stops at the maximum capability. 2: Quick stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor stops quickly. 3: Decelerate to stop - When the drive encounters phase loss on the input side, the operating panel displays E012 and the motor decelerates to stop. 9: Operating at limited speed - When the drive encounters phase loss on the input side, the operating panel displays L012 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power. When the drive encounters phase loss on the input side, the operating panel displays L012 and the AC drive operates with the power limited to a certain range. 000BH: Operating at limited current. When the drive encounters phase loss on the input side, the operating panel displays L012 and the AC drive operates with the current limited to a certain range. 000CH: Operating at limited torque. When the drive encounters phase loss on the input side, the operating panel displays L012 and the drive operates with the torque limited to a certain range. 13: Alarm - When the drive encounters phase loss on the input side, the operating panel displays A012 and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 14: Prompt - When the drive encounters phase loss on the input side, the operating panel displays N012 and the drive operates normally. 15: Ignore - When the drive encounters phase loss on the input side, the operating panel does not display any fault and the drive operates normally. Thousands: Output phase loss (E013) 0: Coast to stop - When the drive encounters output phase loss, the operating panel displays E013 and the motor coasts to stop. Note: In protective action selection 1, actions for drive overload, motor overload, and output phase loss cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop. If an input phase loss fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-02	Protective action selection 2 upon fault	0	Ones: Module overtemperature (E014) 0: Coast to stop Tens: External fault (E015) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	The ones, tens, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones: Module overtemperature (E014) 0: Coast to stop - When the drive encounters the module overtemperature fault, the operating panel displays E014 and the motor coasts to stop. Tens: External fault (E015) 0: Coast to stop - When the drive encounters an external fault, the operating panel displays E015 and the motor coasts to stop. 1: Stop at maximum capability - When the drive encounters an external fault, the operating panel displays E015 and the motor stops at the maximum capability. 2: Quick stop - When the drive encounters an external fault, the operating panel displays E015 and the motor stops quickly. 3: Decelerate to stop - When the drive encounters an external fault, the operating panel displays E015 and the motor decelerates to stop. 9: Operating at limited speed - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the speed limited to a certain range. 10: Operating at limited power - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the power limited to a certain range. 11: Operating at limited current - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the current limited to a certain range. 12: Operating at limited torque - When the drive encounters an external fault, the operating panel displays L015 and the drive operates with the torque limited to a certain range. 13: Alarm - When the drive encounters an external fault, the operating panel displays A015 and the drive operates normally. (to be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(continued) 14: Prompt - When the drive encounters an external fault, the operating panel displays N015 and the drive operates normally. 15: Ignore - When the drive encounters an external fault, the operating panel does not display any fault and the drive operates normally. Thousands: Current sampling error (E018) 0: Coast to stop - When the drive encounters a current sampling fault, the operating panel displays E018 and the motor coasts to stop. Note: In protective action selection 2, actions for drive overtemperature and current sampling error cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop. If an external fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-03	Protective action selection 3 upon fault	0	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0 to F: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop F: Ignore	The ones, tens, and thousands of this parameter are used to set protective actions for different faults. Value description: Ones: Parameter auto-tuning error (E019) 0000H: Coast to stop - When the drive encounters a parameter auto-tuning fault, the operating panel displays E019 and the motor coasts to stop. Hundreds: EEPROM fault (E021) 0000H: Coast to stop - When the drive encounters the EEPROM fault, the operating panel displays E021 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the EEPROM fault, the operating panel displays E021 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the EEPROM fault, the operating panel displays E021 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the EEPROM fault, the operating panel displays E021 and the motor decelerates to stop. Thousands: Power unit EEPROM fault (E186) 0000H: Coast to stop - When the drive encounters the power unit EEPROM fault, the operating panel displays E186 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the EEPROM fault, the operating panel displays E186 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the EEPROM fault, the operating panel displays E186 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the EEPROM fault, the operating panel displays E186 and the motor decelerates to stop. 000FH: Ignore - When the drive encounters the EEPROM fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 3, action for parameter auto-tuning fault cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop. If an EEPROM fault or power unit EEPROM occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-04	Protective action selection 4 upon fault	0	Ones: Output ground fault (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Cumulative operating time arrival (E026) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: User-defined fault (E027) 0 to F: Same as the hundreds	The ones, tens, and thousands of this parameter indicate actions for different fault. Value description: Ones: Output ground fault (E023) 0000H: Coast to stop - When the drive encounters an output ground fault, the operating panel displays E023 and the motor coasts to stop. Hundreds: Cumulative operating time arrival (E026) 0000H: Coast to stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a cumulative operating time arrival fault, the operating panel displays E026 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a cumulative operating time arrival fault, the operating panel displays L026 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L026 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters a cumulative operating time arrival fault, the operating panel displays L026 and the drive operates with the current limited to a certain range. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) 000CH: Operating at limited torque - When the drive encounters a cumulative operating time arrival fault, the operating panel displays L026 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a cumulative operating time arrival fault, the operating panel displays A026 and the drive operates normally. 000EH: Prompt - When the drive encounters a cumulative operating time arrival, the operating panel displays N026 and the drive operates normally. 000FH: Ignore - When the drive encounters a cumulative operating time arrival fault, the operating panel does not display any fault and the drive operates normally. Thousands: User-defined fault (E027) 0000H: Coast to stop - When the drive encounters a user-defined fault, the operating panel displays E027 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a user-defined fault, the operating panel displays E027 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a user-defined fault, the operating panel displays E027 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a user-defined fault, the operating panel displays E027 and the motor decelerates to stop. 000FH: Ignore - When the drive encounters a user-defined fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 4, action for output ground fault cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop. If an operating time arrival fault or user-defined fault occurs, you can change the protective action to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-05	Fault protection action selection 5	0xDD	Ones: User-defined alarm (E028) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Cumulative power-on time arrival (E029) 0 to F: Same as the ones Hundreds: Three-phase loss (E030) 0 to F: Same as the ones Thousands: PID feedback loss (E031) 0 to F: Same as the ones	The ones, tens, and thousands of this parameter indicate actions for different fault. Value description: Ones: User-defined alarm (E028) 0000H: Coast to stop - When the drive encounters a user-defined alarm, the operating panel displays E028 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a user-defined alarm, the operating panel displays E028 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a user-defined alarm, the operating panel displays E028 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a user-defined alarm, the operating panel displays E028 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a user-defined fault, the operating panel displays L028 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters a user-defined fault, the operating panel displays L028 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters a user-defined fault, the operating panel displays L028 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a user-defined fault, the operating panel displays L028 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a user-defined fault, the operating panel displays A028 and the drive operates normally. 000EH: Prompt - When the drive encounters a user-defined fault, the operating panel displays N028 and the drive operates normally. 000FH: Ignore - When the drive encounters a user-defined alarm, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Tens: Cumulative power-on time arrival (E029) 0000H: Coast to stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor decelerates to stop. 0001H: Stop at maximum capability - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays E029 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays L029 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays A029 and the drive operates normally. 000EH: Prompt - When the drive encounters a cumulative power-on time arrival fault, the operating panel displays N029 and the drive operates normally. 000FH: Ignore - When the drive encounters a cumulative power-on time arrival fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: Three-phase loss (E030) 0000H: Coast to stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters three-phase loss, the operating panel displays E030 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters three-phase loss, the operating panel displays E030 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters three-phase loss, the operating panel displays L030 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters three-phase loss, the operating panel displays A030 and the drive operates normally. 000EH: Prompt - When the drive encounters three-phase loss, the operating panel displays N030 and the drive operates normally. 000FH: Ignore - When the drive encounters three-phase loss, the operating panel does not display any fault and the drive operates normally.

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: PID feedback loss (E031) 0000H: Coast to stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the PID feedback loss fault, the operating panel displays E031 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the PID feedback loss fault, the operating panel displays L031 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the PID feedback loss fault, the operating panel displays A031 and the drive operates normally. 000EH: Prompt - When the drive encounters the PID feedback loss fault, the operating panel displays N031 and the drive operates normally. 000FH: Ignore - When the drive encounters the PID feedback loss fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 5 upon fault, actions for the user-defined alarm, cumulative power-on time arrival, three-phase loss, and PID feedback loss can be changed to enable the drive to act accordingly.

Param.	Name	Default value	Value range	Description
H1-06	Protection action selection 6 upon fault	0x0D0D	Ones: Parameter reset error (E032) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Excessive speed deviation (E042) 0 to F: Same as the ones Thousands: Motor overspeed (E043) 0 to F: Same as the ones	The ones, tens, and thousands of this parameter indicate actions for different fault. Value description: Ones: Parameter reset error (E032) 0000H: Coast to stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a parameter reset fault, the operating panel displays E032 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a parameter reset fault, the operating panel displays L032 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a parameter reset fault, the operating panel displays A032 and the drive operates normally. 000EH: Prompt - When the drive encounters a parameter reset fault, the operating panel displays N032 and the drive operates normally. 000FH: Ignore - When the drive encounters a parameter reset fault, the operating panel does not display any fault and the drive operates normally. Tens: Reserved (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: Excessive speed deviation (E042) 0000H: Coast to stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters excessive speed deviation, the operating panel displays E042 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the AC drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters excessive speed deviation, the operating panel displays L042 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters excessive speed deviation, the operating panel displays A042 and the drive operates normally. 000EH: Prompt - When the drive encounters a parameter reset fault, the operating panel displays N032 and the drive operates normally. 000FH: Ignore - When the drive encounters a parameter reset fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: Motor speed error (E043) 0000H: Coast to stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor overspeed, the operating panel displays E043 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor overspeed, the operating panel displays E043 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor overspeed, the operating panel displays L043 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters motor overspeed, the operating panel displays A043 and the drive operates normally. 000EH: Prompt - When the drive encounters motor overspeed, the operating panel displays N043 and the drive operates normally. 000FH: Ignore - When the drive encounters motor overspeed, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 6 upon fault, actions for fault reset error, excessive speed deviation, and motor speed error can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-07	Protective action selection 7 upon fault	0	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Magnetic pole position auto-tuning error (E051) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Thousands: Magnetic pole position auto-tuning error (E051) 0000H: Coast to stop - When the drive encounters the magnetic pole position auto-tuning fault, the operating panel displays E051 and the motor coasts to stop. Note: In protective action selection 7 upon fault, the action for magnetic pole position auto-tuning fault cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop.
H1-08	Protective action selection 8 upon fault	0	Ones: Reserved 0: Coast to stop Tens: Self-test fault 1 (E056) 0: Coast to stop Hundreds: Self-test fault 2 (E057) 0: Coast to stop Thousands: Self-test fault 3 (E058) 0: Coast to stop	The ones, tens, hundreds, and thousands places of this parameter indicate protective actions for different faults. Value description: Tens: Self-test fault 1 (E056) 0000H: Coast to stop - When the drive encounters self-test fault 1, the operating panel displays E056 and the motor coasts to stop. Hundreds: Self-test fault 2 (E057) 0000H: Coast to stop - When the drive encounters self-test fault 2, the operating panel displays E057 and the motor coasts to stop. Thousands: Self-test fault 3 (E058) 0000H: Coast to stop - When the drive encounters self-test fault 3, the operating panel displays E058 and the motor coasts to stop. Note: In protective action selection 8 upon fault, actions for self-test faults 1, 2, and 3 cannot be changed. When these faults occur, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-09	Protective action selection 9 upon fault	0	Ones: Self-test fault 4 (E059) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Self-test fault 4 (E059) 0000H: Coast to stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops quickly. 0003H: Quick stop - When the drive encounters self-test fault 4, the operating panel displays E059 and the motor stops quickly. 0009H: Operating at limited speed - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters self-test fault 4, the operating panel displays L059 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters self-test fault 4, the operating panel displays A059 and the drive operates normally. 000EH: Prompt - When the drive encounters self-test fault 4, the operating panel displays N059 and the drive operates normally. 000FH: Ignore - When the drive encounters self-test fault 4, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 9 upon fault, the action for self-test fault 4 cannot be changed. When this fault occurs, the drive stops output and the motor coasts to stop.

Param.	Name	Default value	Value range	Description
H1-10	Protective action selection 10 upon fault	0	Ones: Fan fault (E080) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Fan fault (E080) 0000H: Coast to stop When the drive encounters a fan fault, the operating panel displays E080 and the motor coasts to stop. 0001H: Stop at maximum capability When the drive encounters a fan fault, the operating panel displays E080 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters a fan fault, the operating panel displays E080 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters a fan fault, the operating panel displays E080 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters a fan fault, the operating panel displays L080 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters a fan fault, the operating panel displays A080 and the drive operates normally. 000EH: Prompt - When the drive encounters a fan fault, the operating panel displays N080 and the drive operates normally. 000FH: Ignore - When the drive encounters a fan fault, the operating panel does not display any fault and the drive operates normally. Note: In the protective action selection 10 upon fault, the action for fan fault can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-11	Protection action selection 11 upon fault	0xF00	Ones: Reserved 0: Coast to stop Tens: Brake fault (E084) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Hundreds: Sequence fault (E085) 0 to F: Same as the ones Thousands: Motor control error 1 (E093) 0 to F: Same as the ones	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Hundreds: Sequence fault (E085) 0000H: Coast to stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the time sequence fault, the operating panel displays E085 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the time sequence fault, the operating panel displays L085 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the AC drive encounters the time sequence fault, the operating panel displays L085 and the AC drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the time sequence fault, the operating panel displays L085 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the brake fault, the operating panel displays L085 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the time sequence fault, the operating panel displays A085 and the drive operates normally. 000EH: Prompt - When the drive encounters the time sequence fault, the operating panel displays N085 and the drive operates normally. 000FH: Ignore - When the drive encounters the time sequence fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: Motor control error 1 (E093) 0000H: Coast to stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor control error 1, the operating panel displays E093 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor control error 1, the operating panel displays E093 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor control error 1, the operating panel displays L093 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters motor control error 1, the operating panel displays A093 and the drive operates normally. 000EH: Prompt - When the drive encounters motor control error 1, the operating panel displays N093 and the drive operates normally. 000FH: Ignore - When the drive encounters motor control error 1, the operating panel does not display any fault the drive operates normally. Note: In protective action selection 11 upon fault, actions for the sequence fault and motor control error 1 can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-12	Protective action selection 12 upon fault	0xDDDD	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Drive pre-overload (E110) 0 to F: Same as the ones Hundreds: Motor pre-overload (E111) 0 to F: Same as the ones Thousands: Module pre-overtemperature (E114) 0 to F: Same as the ones	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Motor control error 2 (E094) 0000H: Coast to stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters motor control error 2, the operating panel displays E094 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters motor control error 2, the operating panel displays E094 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters motor control error 2, the operating panel displays L094 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters motor control error 2, the operating panel displays A094 and the drive operates normally. 000EH: Prompt - When the drive encounters motor control error 2, the operating panel displays N094 and the drive operates normally. 000FH: Ignore - When the drive encounters motor control error 2, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Tens: Drive pre-overload (E110) 0000H: Coast to stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the drive pre-overload fault, the operating panel displays E110 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the drive pre-overload fault, the operating panel displays L110 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the drive pre-overload fault, the operating panel displays A110 and the drive operates normally. 000EH: Prompt - When the drive encounters the drive pre-overload fault, the operating panel displays N110 and the drive operates normally. 000FH: Ignore - When the drive encounters the drive pre-overload fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: Motor pre-overload (E111) 0000H: Coast to stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the motor pre-overload fault, the operating panel displays E111 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the motor pre-overload fault, the operating panel displays L111 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the motor pre-overload fault, the operating panel displays A111 and the drive operates normally. 000EH: Prompt - When the drive encounters the motor pre-overload fault, the operating panel displays N111 and the drive operates normally. 000FH: Ignore - When the drive encounters the motor pre-overload fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: Module pre-overtemperature (E114) 0000H: Coast to stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the module pre-overtemperature fault, the operating panel displays E114 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the power limited to a certain range. 000BH: Run with module current limited. When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the module pre-overtemperature fault, the operating panel displays L114 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the module pre-overtemperature fault, the operating panel displays A114 and the drive operates normally. 000EH: Prompt - When the drive encounters the module pre-overtemperature fault, the operating panel displays N114 and the drive operates normally. 000FH: Ignore - When the drive encounters the module pre-overtemperature fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 12 upon fault, actions for motor control error 2, drive pre-overload, motor pre-overload, and module pre-overtemperature can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-14	Protective action selection 14 upon fault	0xF	Ones: Reserved 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Brake fault (E150) 0 to F: Same as the ones Hundreds: Reserved 0: Coast to stop Thousands: Automatic fault reset failure (E159) 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Reserved Thousands: Automatic fault reset failure (E159) 0000H: Coast to stop - When the drive encounters an automatic fault reset failure, the operating panel displays E159 and the motor coasts to stop. Note:

Param.	Name	Default value	Value range	Description
H1-15	Protective action selection 15 upon fault	0x0333	Ones: Modbus communication timeout fault (E160) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: CANopen fault (E161) 0 to F: Same as the ones Hundreds: CANlink fault (E162) 0 to F: Same as the ones Thousands: Reserved 0: Coast to stop	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Modbus communication timeout (E160) 0000H: Coast to stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the Modbus communication timeout fault, the operating panel displays E160 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the Modbus communication timeout fault, the operating panel displays L160 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the Modbus communication timeout fault, the operating panel displays A160 and the drive operates normally. 000EH: Prompt - When the drive encounters the Modbus communication timeout fault, the operating panel displays N160 and the drive operates normally. 000FH: Ignore - When the drive encounters the Modbus communication timeout fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Tens: CANopen fault (E161) 0000H: Coast to stop - When the drive encounters the CANopen fault, the operating panel displays E161 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the CANopen fault, the operating panel displays E161 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the CANopen fault, the operating panel displays E161 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the CANopen fault, the operating panel displays E161 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the CANopen fault, the operating panel displays L161 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the CANopen fault, the operating panel displays L161 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the CANopen fault, the operating panel displays L161 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the CANopen fault, the operating panel displays L161 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the CANopen fault, the operating panel displays A161 and the drive operates normally. 000EH: Prompt - When the drive encounters the CANopen fault, the operating panel displays N161 and the drive operates normally. 000FH: Ignore - When the drive encounters the CANopen fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: CANlink fault (E162) 0000H: Coast to stop - When the drive encounters the CANlink fault, the operating panel displays E162 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the CANlink fault, the operating panel displays E162 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the CANlink fault, the operating panel displays E162 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the CANlink fault, the operating panel displays E162 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the CANlink fault, the operating panel displays L162 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the CANlink fault, the operating panel displays L162 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the CANlink fault, the operating panel displays L162 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the CANlink fault, the operating panel displays L162 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the CANlink fault, the operating panel displays A162 and the drive operates normally. 000EH: Prompt - When the drive encounters the CANlink fault, the operating panel displays N162 and the drive operates normally. 000FH: Ignore - When the drive encounters the CANlink fault, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 15 upon fault, actions for Modbus communication timeout, CANopen and CANlink fault can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-16	Protective action selection 16 upon fault	0	Ones: EtherNet/IP fault 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: PROFINET fault (E166) 0 to F: Same as the ones Hundreds: Reserved Thousands: EtherCAT fault 2 (E168) 0: Coast to stop 0 to F: Same as the ones	The ones, tens, hundreds, and thousands of this parameter are used to set protection actions upon different faults. Value description: Ones: EtherNet/IP fault (E165) 0000H: Coast to stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the EtherNet/IP fault, the operating panel displays E165 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the EtherNet/IP fault, the operating panel displays L165 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the EtherNet/IP fault, the operating panel displays A165 and the drive operates normally. 000EH: Prompt - When the drive encounters the EtherNet/IP fault, the operating panel displays N165 and the drive operates normally. 000FH: Ignore - When the drive encounters the EtherNet/IP fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Tens: PROFINET fault (E166) 0000H: Coast to stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the PROFINET fault, the operating panel displays E166 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the PROFINET fault, the operating panel displays L166 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the PROFINET fault, the operating panel displays A166 and the drive operates normally. 000EH: Prompt - When the drive encounters the PROFINET fault, the operating panel displays N166 and the drive operates normally. 000FH: Ignore - When the drive encounters the PROFINET fault, the operating panel does not display any fault and the drive operates normally. Hundreds: Reserved Thousands: Reserved Note: In protective action selection 16 upon fault, actions for EtherNet/IP and PROFINET faults can be changed to make the drive act accordingly.

Param.	Name	Default value	Value range	Description
H1-17	Protective action selection 17 upon fault	0	Ones: Inobus expansion protocol (E170) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Junction temperature fault (E191) 0: Coast to stop Hundreds: Speed tracking fault (E192) 0 to F: Same as the ones 0 to F: Same as the ones Thousands: Undervoltage suppression limit arrival (E193)	The ones, tens, hundreds, and thousands of this parameter indicate protective actions for different faults. Value description: Ones: Inobus protocol fault (E170) 0000H: Coast to stop - When the drive encounter an Inobus protocol fault, the operating panel displays E170, and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the Inobus protocol fault, the operating panel displays E170 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the Inobus protocol fault, the operating panel displays E170 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the Inobus protocol fault, the operating panel displays E170 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the Inobus protocol fault, the operating panel displays L170 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the Inobus protocol fault, the operating panel displays L170 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the Inobus protocol fault, the operating panel displays L170 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the Inobus protocol fault, the operating panel displays L170 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the Inobus protocol fault, the operating panel displays A170 and the drive operates normally. 000EH: Prompt - When the drive encounters the Inobus protocol fault, the operating panel displays N170 and the drive operates normally. 000FH: Ignore - When the drive encounters the Inobus protocol fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Hundreds: Speed tracking fault (E192) 0000H: Coast to stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor coasts to stop. 0001H: Stop at maximum capability - When the drive encounters the flying start fault, the operating panel displays E192 and the motor stops at the maximum capability. 0002H: Quick stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor stops quickly. 0003H: Decelerate to stop - When the drive encounters the flying start fault, the operating panel displays E192 and the motor decelerates to stop. 0009H: Operating at limited speed - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the drive encounters the flying start fault, the operating panel displays L192 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the drive encounters the flying start fault, the operating panel displays A192 and the drive operates normally. 000EH: Prompt - When the drive encounters the flying start fault, the operating panel displays N192 and the drive operates normally. 000FH: Ignore - When the drive encounters the flying start fault, the operating panel does not display any fault and the drive operates normally. (To be continued)

Param.	Name	Default value	Value range	Description
Same as above	Same as above	Same as above	Same as above	(Continued) Thousands: Undervoltage suppression limit arrival (E193) 0000H: Coast to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor coasts to stop. 0001H: Stop at maximum capability - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor stops at the maximum capability. 0002H: Quick stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor stops quickly. 0003H: Decelerate to stop - When the undervoltage suppression limit is reached, the operating panel displays E193 and the motor decelerates to stop. 0009H: Operating at limited speed - When the undervoltage suppression limit is reached, the operating panel displays L193 and the drive operates with the speed limited to a certain range. 000AH: Operating at limited power - When the undervoltage suppression limit is reached, the operating panel displays L193 and the drive operates with the power limited to a certain range. 000BH: Operating at limited current - When the undervoltage suppression limit is reached, the operating panel displays L193 and the drive operates with the current limited to a certain range. 000CH: Operating at limited torque - When the undervoltage suppression limit is reached, the operating panel displays L193 and the drive operates with the torque limited to a certain range. 000DH: Alarm - When the undervoltage suppression limit is reached, the operating panel displays A193 and the drive operates normally. 000EH: Prompt - When the undervoltage suppression limit is reached, the operating panel displays N193 and the drive operates normally. 000FH: Ignore - When the undervoltage suppression limit is reached, the operating panel does not display any fault and the drive operates normally. Note: In protective action selection 17 upon fault, actions for Inobus protocol fault, speed tracking fault, can undervoltage suppression limit arrival can be changed to make the drive act accordingly.

12.3.3 Modifying the Action for an Individual Fault

Application scenarios

This function applies when you need to set the action for an individual subcode. It applies to scenarios where the actions for the fault code and subcode must be different.

Function description

You can set the action for an individual fault through H1-30 [First group of fault code setting] to H1-49 [Tenth group of fault level setting].

H1-30 and H1-31 are used together to set the action for the first fault. H1-30 is used to enter the fault number to be set, and H1-31 is used to select the fault action type to be set. By analogy, there are 20 parameters, that is, the actions for 10 faults can be set separately.

For example, when you set H1-30 to 186.1 and H1-31 to 0x0002 [Quick stop], the action for E186.1 [Model parameter read/write failure] is quick stop.

Table 12–8 Modifying an individual fault action

Param.	Name	Setpoint
H1-30	Setting of the 1st group of fault codes	186.1
H1-31	Setting of the first group of fault level	0x0002 [Quick stop]

Note that the action range for an individual fault must be within that of its fault code. Actions outside the range of the fault code cannot be set.

For example, if the thousands (Power unit EEPROM fault (E186)) of H1-03 [Fault protection action selection 3] can only be set to 0 [Coast to stop], 1 [Stop at maximum capability], 2 [Quick stop], 3 [Decelerate to stop], and F [Ignore], then only one of these five options can be selected as the action for a subcode under E186.

Related parameters

Table 12–9 Parameters for modifying the action for an individual fault

Param.	Name	Default value	Value range	Description
H1-30	Setting of the 1st group of fault codes	0.0	0.0 to 255.9	Defines the 1st group of fault codes whose fault level needs to be edited. Note: Enter the code and subcode of the fault. For example, fill in 187.1 and set H1-31 to 000FH. In this case, E187.1 (Power unit EEPROM junction temperature parameter storage error) is not displayed, but the drive can operate normally.
H1-31	Setting of the first group of fault level	0x000F	0000H: Coast to stop 0001H: Stop at maximum capability 0002H: Quick stop 0003H: Decelerate to stop 0004H to 0008H: Reserved 0009H: Operating at limited speed 000AH: Operating at limited power 000BH: Operating at limited current 000CH: Operating at limited torque 000DH: Alarm 000EH: Prompt 000FH: Ignore	Used to set the level of the first group of fault codes. Value description: 0000H: Coast to stop - When a fault occurs, the drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability - When a fault occurs, the operating panel of the drive displays E and the motor stops at the maximum capability. 0002H: Quick stop - When a fault occurs, the drive displays E and the motor performs quick stop. 0003H: Decelerate to stop - When a fault occurs, the drive displays E and the motor decelerates to stop. 0009H: Operating at limited speed - The drive displays L and continues operating at limited speed. 000AH: Operating at limited power - The drive displays L and continues operating at limited power. 000BH: Operating at limited current - The drive displays L and continues operating at limited current. 000CH: Operating at limited torque - The drive displays L and continues operating at limited torque. 000DH: Alarm - The drive displays alarm A, which does not affect operation. 000EH: Prompt - The drive displays prompt N, which does not affect operation. 000FH: Ignore - This fault is masked by the drive. Note: After fault codes are set, this parameter represents the action against the active fault. The fault level is set through a white list, which lists the allowable fault levels.
H1-32	Setting of the 2nd group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-33	Setting of the 2nd group of fault level	0x000F	Same as H1-31.	Same as H1-31.

Param.	Name	Default value	Value range	Description
H1-34	Setting of 3rd group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-35	Setting of the 3rd group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-36	Setting of the 4th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-37	Setting of the 4th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-38	Setting of 5th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-39	Setting of the 5th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-40	Setting of the 6th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-41	Setting of the 6th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-42	Setting of the 7th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-43	Setting of the 7th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-44	Setting of the 8th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-45	Setting of the 8th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-46	Setting of the 9th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-47	Setting of the 9th group of fault level	0x000F	Same as H1-31.	Same as H1-31.
H1-48	Setting of the 10th group of fault codes	0.0	0.0 to 255.9	Same as H1-30.
H1-49	Setting of the 10th group of fault level	0x000F	Same as H1-31.	Same as H1-31.

12.4 User-defined Faults and Alarms

Application scenarios

The drive supports user-defined faults and alarms. You can select the B connector as the condition for triggering faults and alarms, defining user-defined faults and alarms through parameter interconnection. For details, see *" Parameter Interconnection" on page 779*.

Operating principles

User-defined faults and alarms include two external fault sources, external fault 1 (NO) source and external fault 2 (NC) source.

The source of external fault 1 (NO) is set by H2-00 (0: Inactive; 1: Active). The drive reports E015.1 when H2-00 is set to 1. Alternatively, you can define the conditions for triggering user-defined faults through B connector.

The source of external fault 2 (NC) is set by H2-01 (0: Active; 1: Inactive). The drive reports E015.2 when H2-01 is set to 1. Alternatively, you can define the conditions for triggering user-defined faults through B connector.

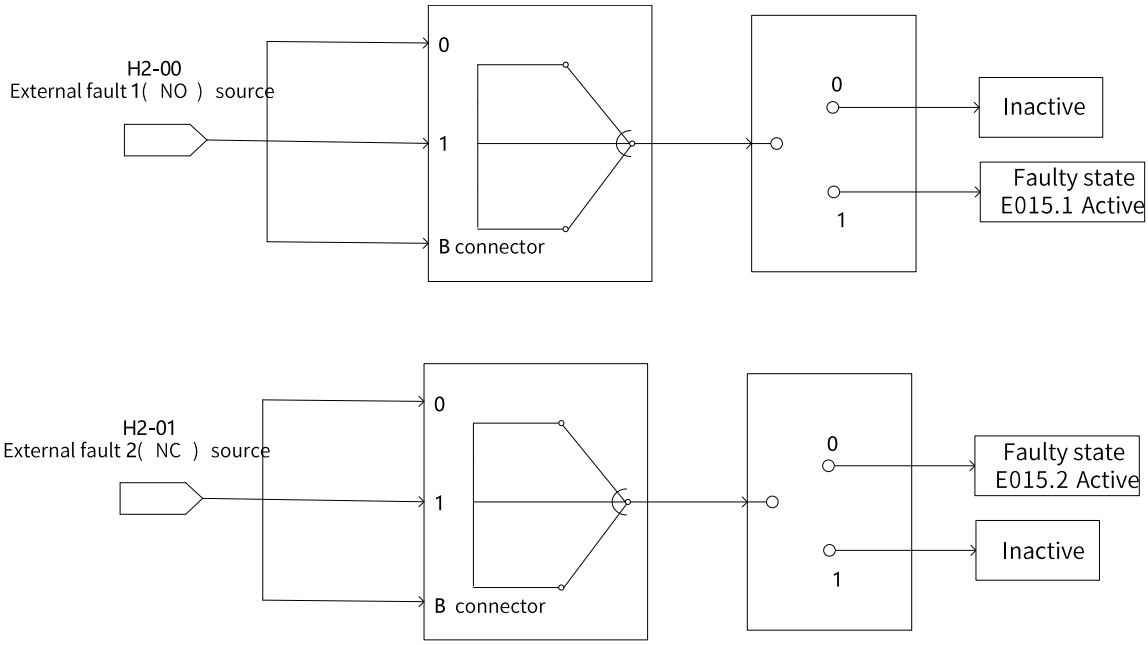


Figure 12-4 External fault diagram

Note that the DI terminal can also be used as the source for triggering these faults. Assign function 11 [External fault NO input] and function 33 [External fault NC input] to the DIs. When the DI is assigned with these functions, the corresponding parameter is read-only. For example, if DI1 is assigned with function 11 [External fault NO input], H2-00 is read-only.

Up to 8 sets of user-defined faults and alarms are available. You can set the source for triggering the 8 sets of user-defined faults through H2-02 [User-defined fault 1 source] to H2-09 [User-defined fault 8 source]. The fault codes are E027.1 to E027.8. You can set the eight sets of user-defined alarms through H2-10 [User-defined alarm 1 source] to H2-17 [User-defined alarm 8 source]. The alarm codes are A28.1 to A28.8.

For example, if you set H2-02 [User-defined fault 1 source] to connector B, and select "L00 [Bit connector 1]" > "L0002 [DI1]" in the dialog box. Then, when DI1 is active, the drive reports E027.1.

Note that if the DI function is set to 44 [User-defined fault 1] or 45 [User-defined fault 2], the source for triggering E027.1 and E027.2 is defined by the DI status.

Related parameters

Table 12–10 Parameters related to user-defined faults and alarms

Param.	Name	Default value	Value range	Description
H2-00	External fault 1 (NO) source	0	0: Inactive 1: Active Other: B connector	Defines the source of external fault 1 (NO). Value description: 0: Inactive - External fault 1 (NO) is inactive, and the drive does not report the fault. 1: Active - External fault 1 (NO) is active, and the drive reports E015.1. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: 1: This parameter defines the source of external fault 1 (NO). When this parameter is set to 1, the drive reports E015.1 upon receiving external fault 1 signal. If external fault 1 does not need to be reported, set this parameter to 0 and reset the fault. 2: After the DI function is set to 11 [External fault NO input], the value of H2-00 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-01	External fault 2 (NC) source	1	0: Inactive 1: Active Other: B connector	Defines the source of external fault 2 (NC). Value description: 0: Inactive - External fault 2 (NC) is inactive and the drive reports E015.2. 1: Inactive - External fault 2 (NC) is active, and the drive does not report the fault. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: 1. This parameter defines the source of external fault 2 (NC). When this parameter is set to 0, the drive reports E015.2 upon receiving external fault 2 signal. If external fault 2 does not need to be reported, set this parameter to 1 and reset the fault. 2. After the DI function is set to 33 [External fault NC input], the value of H2-01 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).

Param.	Name	Default value	Value range	Description
H2-02	Source of user-defined fault 1	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 1. Value description: 0: Inactive - The user-defined fault 1 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 1 is activeand the drive reports E027.1. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 1. When this parameter is set to 1, E027.1 is reported. After the DI function is set to 44 [User-defined fault 1], the value of H2-02 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-03	Source of user-defined fault 2	1	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 2. Value description: 0: Inactive - The user-defined fault 2 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 2 is active and the drive reports E27.2. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 2. E27.2 is reported when it is active. After the DI function is set to 45 [User-defined fault 2], the value of H2-03 is automatically switched to the value of the corresponding DI connector parameter (L0484 to L0490).
H2-04	Source of user-defined fault 3	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 3. Value description: 0: Inactive - The user-defined fault 3 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 3 is active and the drive reports E27.3. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 3. E27.3 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-05	Source of user-defined fault 4	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 4. Value description: 0: Inactive - The user-defined fault 4 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 4 is active and the drive reports E27.4. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 4. E27.4 is reported when it is active.
H2-06	Source of user-defined fault 5	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 5. Value description: 0: Inactive - The user-defined fault 5 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 5 is active and the drive reports E27.5. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 5. E27.5 is reported when it is active.
H2-07	Source of user-defined fault 6	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 6. Value description: 0: Inactive - The user-defined fault 6 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 6 is active and the drive reports E27.6. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 6. E27.6 is reported when it is active.
H2-08	Source of user-defined fault 7	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 7. Value description: 0: Inactive - The user-defined fault 7 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 7 is active and the drive reports E27.7. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 7. E27.7 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-09	Source of user-defined fault 8	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined fault 8. Value description: 0: Inactive - The user-defined fault 8 is inactive, and the drive does not report the fault. 1: Active - The user-defined fault 8 is active and the drive reports E27.8. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined fault 8. E27.8 is reported when it is active.
H2-10	Source of user-defined alarm 1	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 1. Value description: 0: Inactive - The user-defined alarm 1 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 1 is active and the drive reports A28.1. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 1. A028.1 is reported when it is active.
H2-11	Source of user-defined alarm 2	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 2. Value description: 0: Inactive - The user-defined alarm 2 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 2 is active and the drive reports A28.2. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 2. A028.2 is reported when it is active.
H2-12	Source of user-defined alarm 3	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 3. Value description: 0: Inactive - The user-defined alarm 3 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 3 is active and the drive reports A28.3. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 3. A028.3 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-13	Source of user-defined alarm 4	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 4. Value description: 0: Inactive - The user-defined alarm 4 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 4 is activeand the drive reports A28.4. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 4. A028.4 is reported when it is active.
H2-14	Source of user-defined alarm 5	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 5. Value description: 0: Inactive - The user-defined alarm 5 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 5 is active and the drive reports A28.5. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 5. A028.5 is reported when it is active.
H2-15	Source of user-defined alarm 6	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 6. Value description: 0: Inactive - The user-defined alarm 6 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 6 is active and the drive reports A28.6. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 6. A028.6 is reported when it is active.

Param.	Name	Default value	Value range	Description
H2-16	Source of user-defined alarm 7	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 7. Value description: 0: Inactive - The user-defined alarm 7 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 7 is active and the drive reports A28.7. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 7. A028.7 is reported when it is active.
H2-17	Source of user-defined alarm 8	0	0: Inactive 1: Active Other: B connector	Defines the source of user-defined alarm 8. Value description: 0: Inactive - The user-defined alarm 8 is inactive, and the drive does not report the fault. 1: Active - The user-defined alarm 8 is active and the drive reports A28.8. Other: B connector - B connector is used as the condition for triggering faults and alarms. Note: This parameter defines the source of user-defined alarm 8. A028.8 is reported when it is active.

13 Monitoring

Application scenarios

You can set parameters that displayed on the operating panel in the stop and operation states according to actual needs, and switch between them quickly through the shift keys  and  on the operating panel.

Function description

The parameter monitoring function enables you to view the status of the drive through the operating panel. A6-03, A6-04, and A6-05 determine the content displayed on the operating panel and whether free mapping is displayed. A6-07, A6-08, A6-09, and A6-10 determine the content displayed in free mapping.

In the stop or operation state, use the shift keys  and  on the operating panel to switch monitoring parameters.

In the operation state, up to 32 operation status parameters are supported. A6-03 [Parameter 1 displayed on the LED during operation] and A6-04 [Parameter 2 displayed on the LED during operation] determine which parameters are displayed. These two parameters provides 32 optional bits. Parameters corresponding to the bits that set to 1 will be displayed.

In the stop state, 16 stop status parameters are supported. A6-05 [Parameters displayed on the LED at stop] determines whether the corresponding parameter is displayed. The display content corresponding to each parameter bit is shown in the table below.

Table 13–1 Operating panel display in the operation and stop states

Param.	bit	Display	bit	Display
A6-03 Parameter 1 displayed on LED operating panel during operation	bit0	Operating frequency	bit8	DO state
	bit1	Frequency reference	bit9	Reserved
	bit2	Bus voltage	bit10	Reserved
	bit3	Output voltage	bit11	Reserved
	bit4	Output current	bit12	Reserved
	bit5	Output power	bit13	Reserved
	bit6	Output torque	bit14	Load speed display
	bit7	DI state	bit15	PID setting
A6-04 Parameter 2 displayed on LED operating panel during operation	bit0	PID feedback	bit8	Motor speed
	bit1	PLC phase	bit9	Current power-on time
	bit2	Reserved	bit10	Current operating time
	bit3	Operating frequency 2 (Hz)	bit11	Reserved
	bit4	Remaining operating time	bit12	Reference value set through communication
	bit5	Reserved	bit13	Reserved
	bit6	Free mapping 0	bit14	Main frequency X
	bit7	Free mapping 1	bit15	Auxiliary frequency Y
A6-05 Parameter displayed on LED operating panel at stop	bit0	Frequency reference	bit8	Reserved
	bit1	Bus voltage	bit9	PLC phase
	bit2	DI state	bit10	Reserved
	bit3	DO state	bit11	PID setting
	bit4	Reserved	bit12	Reserved
	bit5	Reserved	bit13	Reserved
	bit6	Reserved	bit14	Free mapping 0
	bit7	Reserved	bit15	Free mapping 1

For example, setting A6-05 to 0x003F means bit0 to bit5 are set to 1, and the corresponding parameters will be displayed. You can switch between displayed parameters through shift keys and . For example, in the stop state, the operating panel displays the set frequency. Pressing displays the bus voltage, pressing again displays the DI input status, as shown in the figure below.

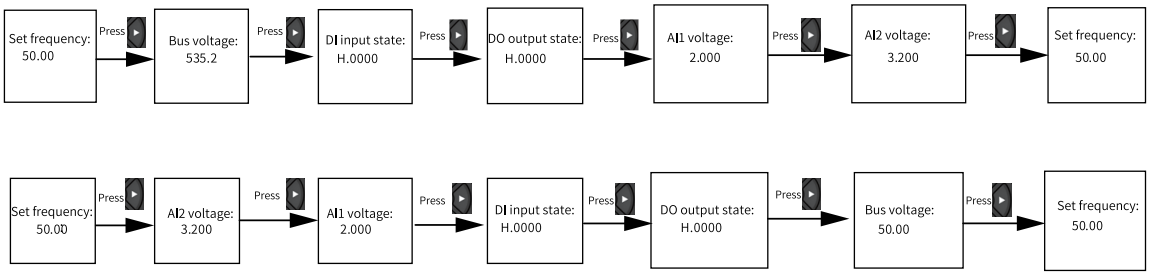


Figure 13-1 Diagram of parameter switchover in the stop state

The drive also supports setting of two free mapping channels. You can select the mapped content through A6-07 [Display address of free mapping 0] and A6-09 [Display address of free mapping 1], and select the unit and decimal point for the mapped content through A6-08 [Display format of free mapping 0] and A6-10 [Display format of free mapping 1].

The free mapping can be set in the operation and stop states through bit6/bit7 of A6-04 [Parameter 2 displayed on LED during operation] and bit14/bit15 of A6-05 [Parameter displayed on LED at stop].

For example, if L1002 [System status word 1] needs to be displayed at stop, do as follows.

(1) Set A6-07 [Display content of free mapping 0], find L10 [Word connector 1] in the drop-down options, and select L1002 [System status word 1], then the content of free mapping 0 is the system status word 1.

(2) Set A6-05 [Parameter displayed on LED at stop] to 0x4033, which means bit0/1/4/5/14 are set to 1. In this case, in the parameters displayed at stop, the last displayed parameter is the content mapped by free mapping 0, which is L1002 [System status word 1].

(3) You can switch between parameters displayed at stop through  and  on the operating panel, as shown below.

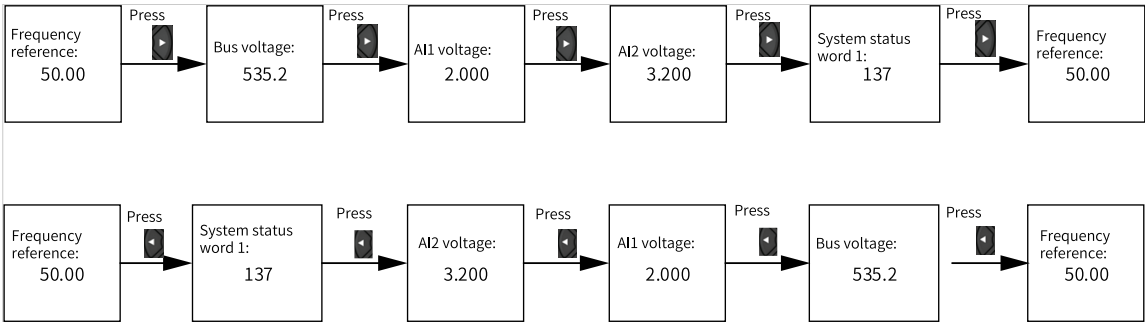


Figure 13-2 Free mapping 1 switchover diagram 1

Note that when setting A6-08 [Display format of free mapping 0] and A6-010 [Display format of free mapping 1], you can set whether the unit and decimal place of the ones and tens are active through the hundreds. When the hundreds is set to 0, the units and decimal places set for the ones and tens are inactive. They are active only when the hundreds is set to 1.

For example, if L1101 [Base value of frequency per-unit value] needs to be 50.0 Hz in the parameters displayed at stop, do as follows.

(1) Set A6-07 [Display content of free mapping 0], find L11 [Word connector 1] in the drop-down options, and select L1101 [Base value of frequency per-unit value], then the content of free mapping 0 is the base value of frequency per-unit value.

(2) Set A6-08 [Display format of free mapping 0] to 0x111, which means the unit is Hz with one decimal place enabled.

(3) Set A6-05 [Parameter displayed on LED at stop] to 0x4033, which means bit0/1/4/5/14 are set to 1. In this case, in the parameters displayed at stop, the last displayed parameter is the content mapped by free mapping 0, which is L1101 [Base value of frequency per-unit value].

(4) You can switch between parameters displayed at stop through  and  on the operating panel.

The detailed operation is shown in the following figure.

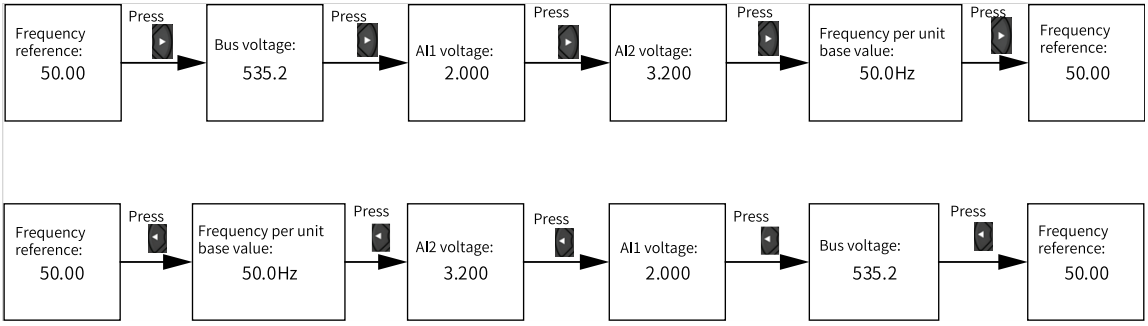


Figure 13-3 Free mapping 0 switchover diagram 2

Related parameters

Table 13–2 Parameters for setting display parameters

Param.	Name	Default value	Value range	Description
A6-03	Parameter 1 displayed on LED operating panel during operation	0x001F	bit0: Operating frequency (Hz) bit1: Set frequency (Hz) bit2: Bus voltage (V) bit3: Output voltage (V) bit4: Output current (A) bit5: Output power (kW) bit6: Output torque (%) bit7: DI input status bit8: DO output status bit9 to bit4: Reserved bit14: Load speed bit15: PID reference bit value: 0: Not displayed 1: Displayed	Defines the content of parameter 1 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel during operation. You can switch parameters through  and  . When this bit is set to 1, the parameter is displayed. When this bit is set to 0, the parameter is not displayed. (Reserved bits are skipped in the LED operating panel.)

Param.	Name	Default value	Value range	Description
A6-04	Parameter 2 displayed on LED operating panel during operation	0x0000	bit0: PID feedback bit1: PLC stage bit2: Reserved bit3: Operating frequency 2 (Hz) bit4: Remaining operating time bit5: Reserved bit6: Free mapping 0 bit7: Free mapping 1 bit8: Motor speed bit9: Current power-on time (min) bit10: Current operating time (min) bit11: Reserved bit12: Reference set through communication bit13: Encoder feedback speed bit14: Main frequency X bit15: Auxiliary frequency Y bit value: 0: Not displayed 1: Displayed	Defines the content of parameter 2 displayed on LED operating panel during operation. Note: Defines the parameters displayed on the LED operating panel during operation. You can switch parameters through the left and right shift keys. When this bit is set to 1, the parameter is displayed. When this bit is set to 0, the parameter is not displayed. (Reserved bits are skipped in the LED operating panel.)

Param.	Name	Default value	Value range	Description
A6-05	Parameter displayed on LED operating panel at stop	0x0033	bit0: Set frequency (Hz) bit1: Bus voltage (V) bit2: DI input status bit3: DO output status bit4 to bit8: Reserved bit9: PLC phase bit10: Reserved bit11: PID reference bit12: Reserved bit13: Reserved bit14: Free mapping 0 bit15: Free mapping 1 bit value: 0: Not displayed 1: Displayed	Defines the contents of parameter displayed on the LED operating panel at stop. Note: Defines the parameters displayed on the LED operating panel with the left and right shift keys pressed down in the stop state. When this bit is set to 1, the parameter is displayed. When this bit is set to 0, the parameter is not displayed. (Reserved bits are skipped in the LED operating panel.)
A6-07	Address displayed by free mapping 0	0	0: Invalid address Other: K connector	Defines the address displayed in free mapping 0. Note: This parameter is associated with free mapping 0 of bit6 in A6-04 and bit14 in A6-05. Set bit6 of A6-04 to 1 to display free mapping 0 on the operating panel during operation, or set bit14 of A6-05 to 1 to display free mapping 0 at stop. The displayed content is the connector value set by A6-07. This parameter is invalid when A6-07 is set to 0.

Param.	Name	Default value	Value range	Description
A6-08	Display format of free mapping 0	0x148	Ones: Unit 0: None 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW A: kW/h B: ℃ Tens: Decimal point 0 to 4: 0 to 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands: Reserved	Defines the format displayed by free mapping 0. Value description: The ones is used to set the display format (unit) of free mapping 0. When free mapping 0 is valid, that is, when the connector value set by A6-07 is valid, if free mapping 0 is selected by A6-04 [Parameter 2 displayed on LED during operation] or A6-05 [Parameter displayed on LED at stop], the parameter is displayed in the unit defined by the ones. The tens is used to set the number of decimal places for free mapping 0, which indicates how many decimal places the content of free mapping 0 is displayed with. The hundreds is used to set whether the unit and decimal place of free mapping 0 are active. When the hundreds is set to 0, the units and decimal places set for the ones and tens are inactive. They are active only when the hundreds is set to 1.
A6-09	Address displayed by free mapping 1	0	0: Invalid address Other: K connector	Defines the address displayed by free mapping 1. Note: This parameter is associated with free mapping 1 of bit7 in A6-04 and bit15 in A6-05. When bit7 in A6-04 is set to 1, the operating panel displays free mapping 0 in the operation state, or when bit15 in A6-05 is set to 1, the operating panel displays free mapping 0 in the stop state, and the displayed content is the connector value set by A6-09. It is inactive when A6-09 is set to 0.

Param.	Name	Default value	Value range	Description
A6-10	Display format of free mapping 1	0x148	Same as A6-08	Defines the display format of free mapping 1. Value description: The ones is used to display the display format (unit) of free mapping 1. When free mapping 0 is valid, that is, when the connector value set by A6-09 is valid, if free mapping 1 is selected in A6-04 [Parameter 2 displayed on LED during operation] or A6-05 [Parameter displayed on LED at stop], the parameter is displayed in the unit defined by the ones. The tens is used to set the number of decimal places for free mapping 1, which indicates how many decimal places the content of free mapping 1 is displayed with. The hundreds is used to set whether the unit and decimal place of free mapping 1 are active. When the hundreds is set to 0, the units and decimal places set for the ones and tens are inactive. They are active only when the hundreds is set to 1.

14 Other Functions

14.1 Parameter Interconnection

14.1.1 Parameter Interconnection

Application scenarios

Parameter interconnection is a flexible method for setting parameters and combining input and output functions, enabling connection between internal functional modules and parameters. It is generally used in control scenarios with complex functions that require multiple modules and different parameters to work together.

Function description

The parameter interconnection system allows certain parameters or modules to read and use other parameters to achieve corresponding control functions.

Connector parameters are read-only parameters that display various states and data of the drive, which can be viewed by users or be read or used by other parameters. When the parameter setting options include the "Other" option, it indicates that this parameter can select a connector as its input value. The "Other" option is divided into the following categories:

Option	Description
Other: B connector	The input value source can be selected as a bit connector (B connector), with values limited to 0 or 1. Connector values include DI inputs, DO outputs, a specific bit of the communication word, a specific bit of the control word and status word, and fault status information. It is located in parameter groups L00 to L09.
Other: K connector	The input value source can be selected as a word connector (K connector). Connector values include the control word, communication word, status word, and internal monitoring parameters of the drive. It is located in parameter groups L10 to L19, L20 to L21, where L20 to L21 are double-word connectors.
Other: F connector	The input value source can be selected as a floating-point connector (F connector). Connector values include per-unit values of drive control-related data such as voltage, current, and power, as well as values received through communication. It is located in parameter groups L22 to L25 and L30 to L33.

There are two ways to set the parameter value source as a connector through parameter interconnection: using the iFA commissioning software or using the operation panel.

When using iFA, first set the parameter value to "Other," then select the connector parameter in the pop-up window. This method allows a clear view of the selected connector parameter, but requires a PC to be connected for commissioning.

When using the operation panel, you can directly set the parameter value to the desired connector number. This method is easy to use, but does not display the meaning of the connector, so you need to understand the connector definitions to set them accurately.

Application instance 1: Achieving parameter interconnection through iFA commissioning software

The following shows how to set the connector parameter as the frequency through iFA commissioning software.

1. As shown in the figure below, open the drop-down list of F0-29 [Main frequency source], and the last option is "Other [F connector]".

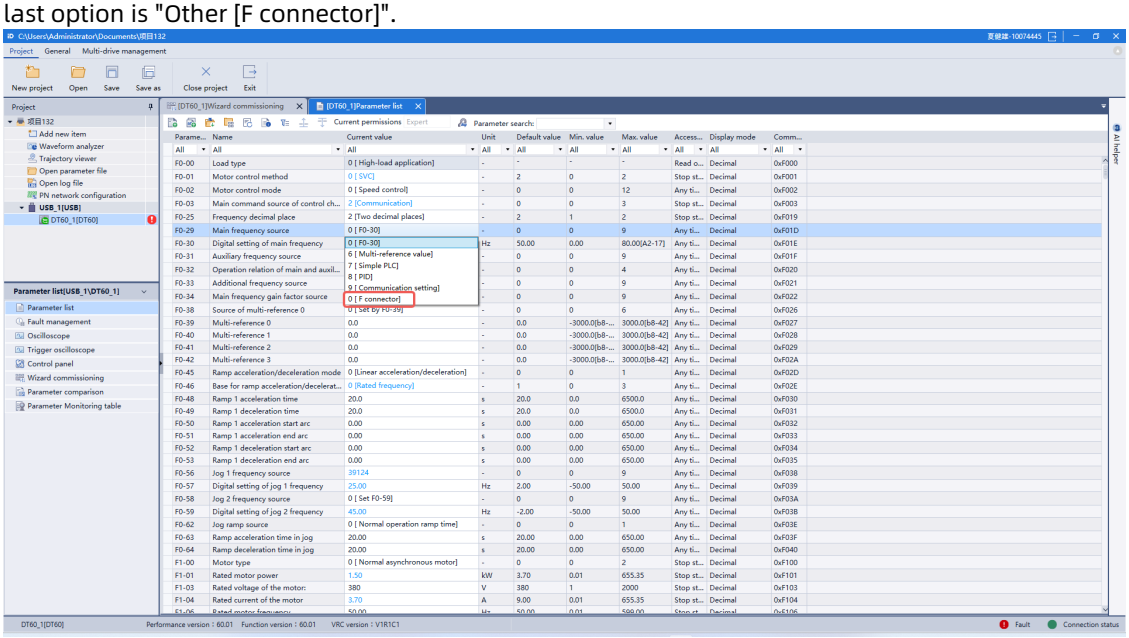


Figure 14-1 Setting the parameter value source

2. Click the "Other [F connector]" option in the drop-down list, and the following page displays. The top section displays parameter information, the left menu shows optional connector groups, and the right side displays the connector parameters available within the current connector group.

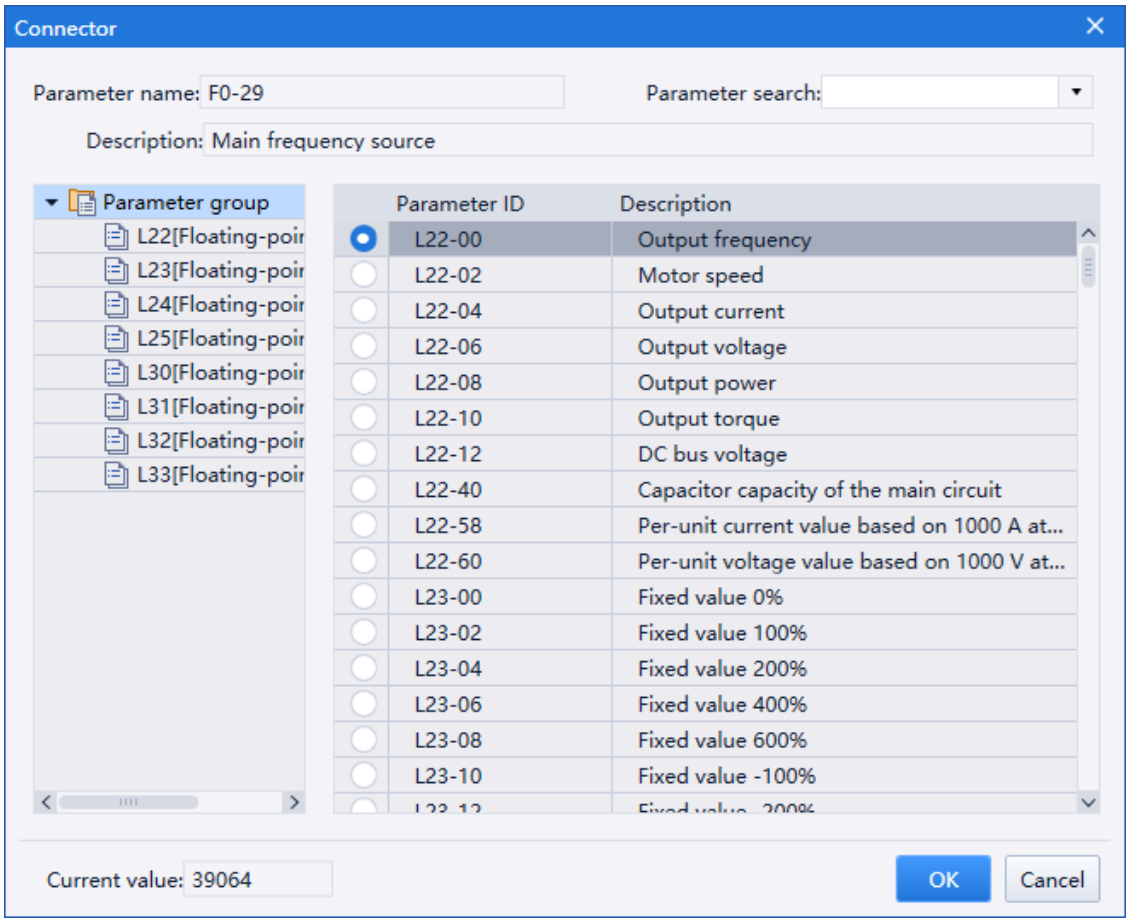


Figure 14-2 Connector selection window

3. Select the connector value to be set. As shown in the figure below, L2352 [Constant setpoint 1 (per-unit)] has been selected.

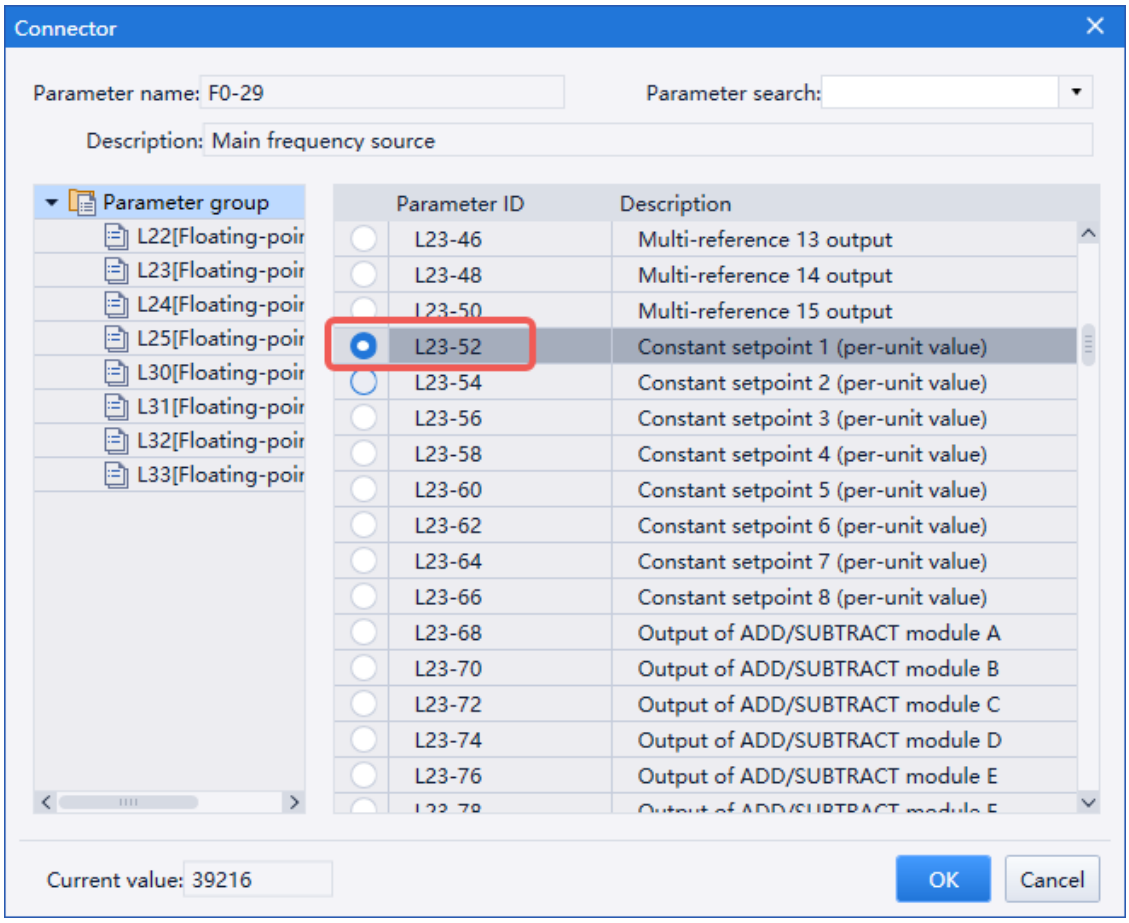


Figure 14-3 Selecting the floating-point connector

4. After selecting the connector, click "OK" to return to the parameter list. F0-29 [Main frequency source] is now set to L2352 [Constant setpoint 1 (per-unit)]. Connector L2352 is the output of the constant value module, meaning that the main frequency of the drive can be modified through o1-00 [Constant setpoint 1 (per-unit)].

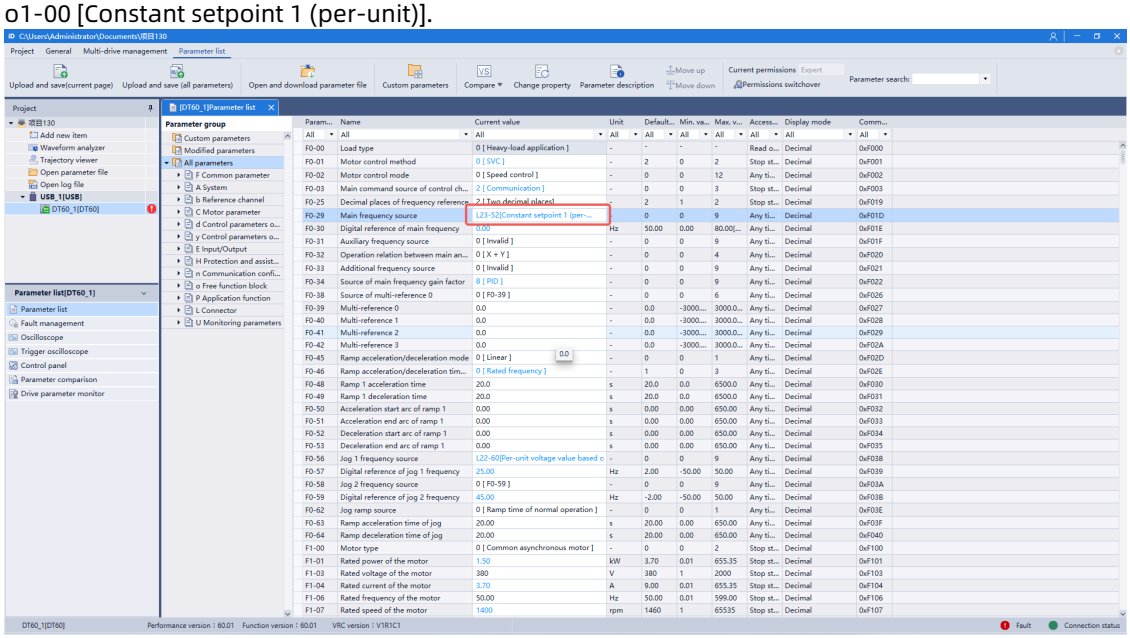
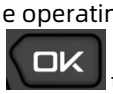


Figure 14-4 Setting result

Application instance 2: Achieving parameter interconnection through operating panel

The following show how to set the connector parameter as the frequency source.

1. On the operating panel, enter the parameter menu and locate F0-29 [Main frequency source].
2. Press  to enter the parameter value setting interface, and use  to change the parameter option.
3. Set the parameter value to connector L2352, then press  to save the parameter value.

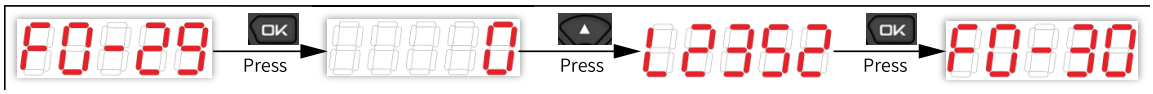


Figure 14-5 Setting the connector parameter through the operating panel

14.1.2 Connector Resource

14.1.2.1 Connector Introduction

Function description

Connectors refer to parameters in group L, which are divided into bit connectors (B connector), word connector system (K connector), and floating-point connectors (F connector).

The word connector system contains word connectors (16 bits, corresponding to groups L10 to L12) and double-word connectors (32 bits, corresponding to group L20).

The double-word connector can represent more valid digits to improve the value precision.

This drive also supports mutual conversion between bit connectors, word connectors, and double-word connectors through free function blocks. See "Free Function Blocks" for details.

Application scenarios

1. You can monitor internal status information of the system through the connector.
2. When used for parameter interconnection, this function serves as signal sources for certain functions, enabling internal resource sharing.
3. When this function is used as inputs for free function blocks, you can perform various mathematical operations to achieve diversified control logic.

14.1.2.2 Bit Connector (B Connector)

Application scenarios

This connector is used to monitor the digital signal status in the system or as a binary signal source for certain functions.

1. Used for monitoring the system state, where only the system digital signal state can be monitored. For example, it can be used to display DI input status, DO output status, a specific bit of the communication word, a specific bit of the control word and status word, and fault activation status information.

2. Used for parameter interconnection. As the system resource pool, for a parameter with the drop-down menu "Other: B connector", the bit connector (B connector) is used as the binary signal source. You can select any bit connector from L00 to L09 as the input of the parameter to implement specific functions (for example, to convert bit connectors to word connectors, see section "Free Function Block" for details).

Function description

The bit connector (B connector) saves information such as the digital signal status in the system, and can be used as the connector signal source for parameters of reference source type. The value of bit connector can only be 0 or 1. Groups L00 to L09 are bit connectors.

Related parameters

Group L00			
Param.	Name	Display range	Description
L0000	Logic 0	0	Constant 0
L0001	Logic 1	1	Constant 1
L0002	DI1	0: DI1 open 1: DI1 closed	Displays the final level state of DI1.
L0003	DI2	0: DI2 open 1: DI2 closed	Displays the final level state of DI2.
L0004	DI3	0: DI3 open 1: DI3 closed	Displays the final level state of DI3.
L0005	DI4	0: DI4 open 1: DI4 closed	Displays the final level state of DI4.
L0006	DI5	0: DI5 open 1: DI5 closed	Displays the final level state of DI5.
L0007	DI6	0: DI6 open 1: DI6 closed	Displays the final level state of DI6.
L0008	DI7	0: DI7 open 1: DI7 closed	Displays the final level state of DI7.
L0009	DI8	0: DI8 open 1: DI8 closed	Displays the final level state of DI8.
L00010	DI9	0: DI9 open 1: DI9 closed	Displays the final level state of DI9.
L00011	DI10	0: DI10 open 1: DI10 closed	Displays the final level state of DI10.
L0012	VDI1	0: VDI1 open 1: VDI1 closed	Displays the final level state of VDI1.
L0013	VDI2	0: VDI2 open 1: VDI2 closed	Displays the final level state of VDI2.
L0014	VDI3	0: VDI3 open 1: VDI3 closed	Displays the final level state of VDI3.
L0015	VDI4	0: VDI4 open 1: VDI4 closed	Displays the final level state of VDI4.
L0016	VDI5	0: VDI5 open 1: VDI5 closed	Displays the final level state of VDI5.

Group L00			
Param.	Name	Display range	Description
L0017	VDI6	0: VDI6 open 1: VDI6 closed	Displays the final level state of VDI6.
L0018	DI1 inversion	0: The inverted value of DI1 is 0. 1: The inverted value of DI1 is 1.	Displays the state after the final output of DI1 is inverted.
L0019	DI2 inversion	0: The inverted value of DI2 is 0. 1: The inverted value of DI2 is 1.	Displays the state after the final output of DI2 is inverted.
L0020	DI3 negation	0: The inverted value of DI3 is 0. 1: The inverted value of DI3 is 1.	Displays the state after the final output of DI3 is inverted.
L0021	DI4 negation	0: The inverted value of DI4 is 0. 1: The inverted value of DI4 is 1.	Displays the state after the final output of DI4 is inverted.
L0022	DI5 negation	0: The inverted value of DI5 is 0. 1: The inverted value of DI5 is 1.	Displays the state after the final output of DI5 is inverted.
L0023	DI6 negation	0: The inverted value of DI6 is 0. 1: The inverted value of DI6 is 1.	Displays the state after the final output of DI6 is inverted.
L0024	DI7 negation	0: The inverted value of DI7 is 0. 1: The inverted value of DI7 is 1.	Displays the state after the final output of DI7 is inverted.
L0025	Opposite to DI8	0: The inverted value of DI8 is 0. 1: The inverted value of DI8 is 1.	Displays the state after the final output of DI8 is inverted.
L0026	DI9 reversal	0: The inverted value of DI9 is 0. 1: The inverted value of DI9 is 1.	Displays the state after the final output of DI9 is inverted.
L0027	DI10 negation	0: The inverted value of DI10 is 0. 1: The inverted value of DI10 is 1.	Displays the state after the final output of DI10 is inverted.
L0028	VDI1 inversion	0: The inverted value of VDI1 is 0. 1: The inverted value of VDI1 is 1.	Displays the state after the final output of VDI1 is inverted.
L0029	VDI2 inversion	0: The inverted value of VDI2 is 0. 1: The inverted value of VDI2 is 1.	Displays the state after the final output of VDI2 is inverted.

Group L00			
Param.	Name	Display range	Description
L0030	VDI3 inversion	0: The inverted value of VDI3 is 0. 1: The inverted value of VDI3 is 1.	Displays the state after the final output of VDI3 is inverted.
L0031	VDI4 inversion	0: The inverted value of VDI4 is 0. 1: The inverted value of VDI4 is 1.	Displays the state after the final output of VDI4 is inverted.
L0032	VDI5 inversion	0: The inverted value of VDI5 is 0. 1: The inverted value of VDI5 is 1.	Displays the state after the final output of VDI5 is inverted.
L0033	VDI6 inversion	0: The inverted value of VDI6 is 0. 1: The inverted value of VDI6 is 1.	Displays the state after the final output of VDI6 is inverted.
L0034	RO	0: No output is generated from RO. 1: RO generates output.	Displays the final output state of relay RO1.
L0035	DO1	0: No output is generated from DO1. 1: DO1 generates output.	Displays the final output state of DO1.
L0036	DO2	0: No output is generated from DO2. 1: DO2 generates output.	Displays the final output state of DO2.
L0037	DO3	0: No output is generated from DO3. 1: DO3 generates output.	Displays the final output state of DO3.
L0038	DO4	0: No output is generated from DO4. 1: DO4 generates output.	Displays the final output state of DO4.
L0039	DO5	0: No output is generated from DO5. 1: DO5 generates output.	Displays the final output state of DO5.
L00340	DO6	0: No output is generated from DO6. 1: DO6 generates output.	Displays the final output state of DO6.
L0044	VDO1	0: No output is generated from VDO1. 1: VDO1 generates output.	Displays the final output state of VDO1.
L0045	VDO2	0: No output is generated from VDO2. 1: VDO2 generates output.	Displays the final output state of VDO2.
L0046	VDO3	0: No output is generated from VDO3. 1: VDO3 generates output.	Displays the final output state of VDO3.

Group L00			
Param.	Name	Display range	Description
L0047	VDO4	0: No output is generated from VDO4. 1: VDO4 generates output.	Displays the final output state of VDO4.
L0048	VDO5	0: No output is generated from VDO5. 1: VDO5 generates output.	Displays the final output state of VDO5.
L0049	VDO6	0: No output is generated from VDO6. 1: VDO6 generates output.	Displays the final output state of VDO6.
L0057	Motor temperature arrival	0: Temperature not reached 1: Temperature reached	Displays whether the motor temperature has reached the value set in E2-74.
L0058	Motor overtemperature fault	0: Invalid 1: Valid	Indicates whether the motor temperature exceeds E2-76.
L0059	Motor overtemperature pre-alarm	0: Invalid 1: Valid	Displays whether the motor temperature reaches the pre-alarm threshold defined by E2-75.

Group L01			
Param.	Name	Display range	Description
L0100	Ready for switch-on	0: Invalid 1: Valid	Displays whether the drive is ready for switch-on.
L0101	Ready to run	0: Invalid 1: Valid	Displays whether the drive is ready to run.
L0102	Operation state	0: Invalid 1: Valid	Displays whether the AC drive is operating.
L0103	Fault activation	0: Invalid 1: Valid	Displays whether the drive is faulty.
L0104	OFF2 (coast to stop) flag	0: Valid 1: Invalid	Displays the current state of the OFF2 (coast to stop) command.
L0105	OFF3 (quick stop) flag	0: Valid 1: Invalid	Displays the current state of the OFF3 (quick stop) command.
L0107	Alarm/Minor fault activation	0: Invalid 1: Valid	Displays whether the drive encounters an alarm or a minor fault.
L0110	Target speed arrival	0: Speed not reached 1: Speed reached	Displays whether the target speed of the drive is reached. When both the operating speed and the actual motor speed are in the range of target speed±P0-51 for a period longer than the time set by P0-52, the output is activated.
L0111	Torque limit arrival	0: Torque/Current not limited 1: Torque/Current limited	Displays whether the torque reaches the set upper and lower limits. The data is valid when the torque is limited.

Group L01			
Param.	Name	Display range	Description
L0112	Positive speed	0: Inactive 1: Active	Displays the direction of the operating speed. This parameter is valid when the operating direction is forward.
L0113	Negative speed	0: Inactive 1: Active	Displays the direction of the operating speed. This parameter is valid when the operating direction is reverse.
L0118	Current control channel	0: Control channel 1 1: Control channel 2	Displays the active control channel.
L0119	Current setting channel	0: Setting channel 1 1: Setting channel 2	Displays the active setting channel.
L0120	Active terminal start/stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	Displays the active terminal start/stop module.
L0121	Terminal control state	0: Inactive 1: Active	Displays whether the command source is terminal control. This parameter is valid when the command source is terminal control.
L0132	Error output	0: No output 1: Error outputted	Displays whether the drive reports faults, minor faults, or alarms.
L0133	Error output (excluding undervoltage fault)	0: No output 1: Error outputted	Defines whether the drive reports faults, minor faults, or alarms (excluding undervoltage faults).
L0134	Fault output	0: Relay invalid upon fault and automatic fault reset 1: Relay valid upon fault and automatic fault reset	Displays whether the relay is valid upon fault and automatic fault reset.
L0135	Stop at fault	0: Inactive 1: Active	Displays whether the stop-at-fault command is valid.
L0136	Normal operation	0: Invalid 1: Valid	Displays whether the drive is in the normal operation state.
L0137	Jog	0: Invalid 1: Valid	Displays whether the drive is in the jog state.
L0138	Decelerate-to-stop state	0: Inactive 1: Valid	Displays whether the drive is in the decelerate-to-stop state.
L0139	Quick stop	0: Inactive 1: Valid	Displays whether the drive is in the quick-stop state.
L0140	Stop-at-maximum-capability state	0: Inactive 1: Valid	Displays whether the drive is in the stop-at-maximum-capability state.
L0156	Reverse run	0: Inactive 1: Valid	Displays whether the drive is operating in the reverse direction.
L0174	Bus voltage state	0: Abnormal 1: Normal	Displays the bus voltage state and the "ready for switch-on" state.

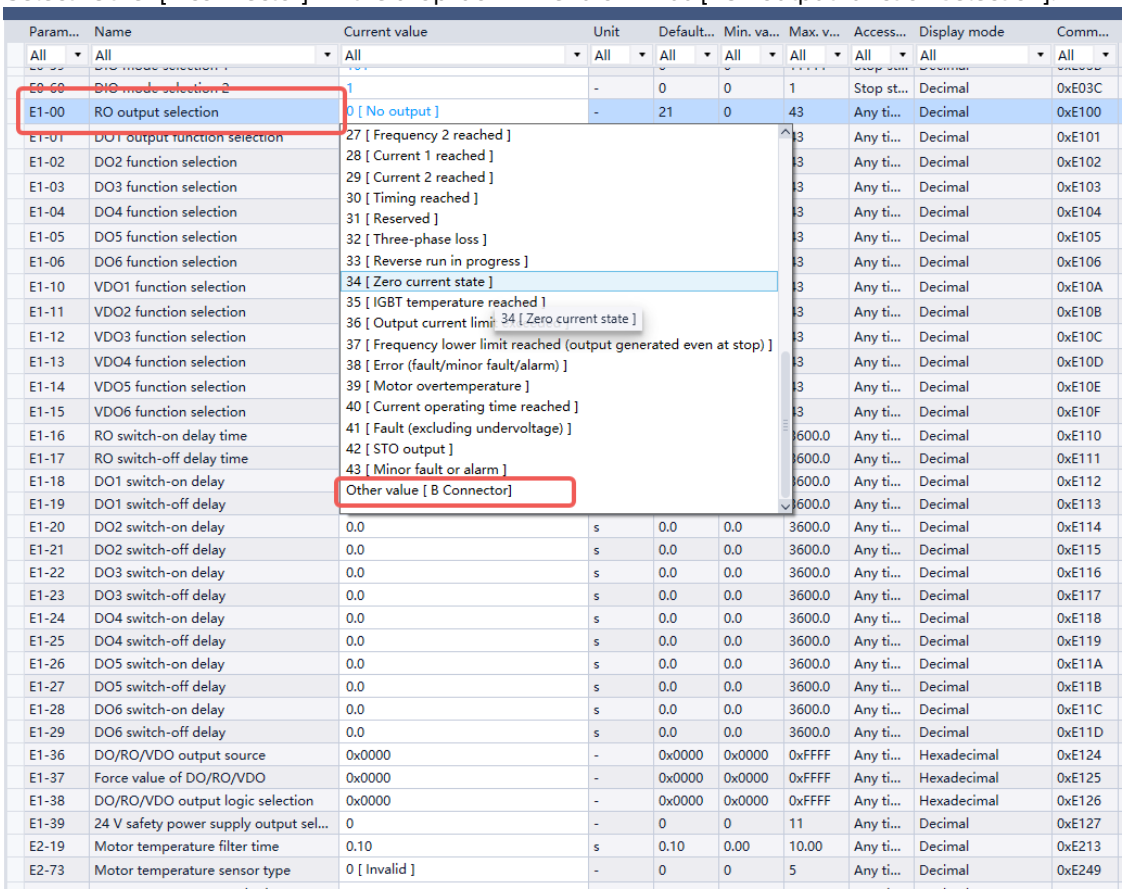
Group L02			
Param.	Name	Display range	Description
L0244	Power-on time arrival	0: Not reached 1: Reached	Displays whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set value (P0-16 and P0-17).
L0245	Operating time arrival	0: Not reached 1: Reached	Displays whether the cumulative operating time (Ad-00 and Ad-01) reaches the set value (P0-18 and P0-19).
L0246	Timed operation arrival	0: Not reached 1: Reached	Displays whether the current operating time reaches the timed operation time (P0-14 and P0-15).
L0247	Current Operating Time Arrival	0: Not reached 1: Reached	Displays whether the current operation time reaches the set time (P0-20).
L0258	Current 1 arrival	0: Not reached 1: Reached	Displays whether the output current reaches the range of current detection level 1.
L0259	Current 2 arrival	0: Not reached 1: Reached	Displays whether the output current reaches the range of current detection level 2.
L0260	Zero current state	0: Inactive 1: Active	Displays whether the drive is in the zero current output state.
L0261	Output Current Limit Violation	0: Inactive 1: Active	Displays whether the output current exceeds the limit.
L0262	Frequency level detection 1	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 1 (FDT1) range.
L0263	Frequency level detection 2	0: Inactive 1: Active	Displays whether the operating frequency reaches the frequency level detection 2 (FDT2) range.
L0264	Frequency arrival	0: Not reached 1: Reached	Displays whether the operating frequency reaches the target frequency.
L0265	Frequency arrival 1	0: Not reached 1: Reached	Displays whether the running frequency reaches detection frequency 1.
L0266	Frequency arrival 2	0: Not reached 1: Reached	Displays whether the running frequency reaches detection frequency 2.

Group L02			
Param.	Name	Display range	Description
L0267	Frequency upper limit arrival	0: Not reached 1: Reached	Displays whether the operating frequency reaches the upper limit. Note: The positive frequency upper limit is determined by C4-10 (Maximum motor frequency), d1-03 (Digital reference of positive frequency upper limit), and d1-05 (Positive frequency upper limit selection), whichever is the minimum. The negative frequency upper limit is similar to the positive frequency upper limit.
L0268	Frequency lower limit arrival (no output at stop)	0: Not reached 1: Reached	Displays whether the operating frequency reaches the lower limit. The connector outputs an active signal when the operating frequency reaches the lower limit. This flag is invalid in the stop state. Note: The frequency lower limit is determined by C4-11 (Minimum motor frequency) and d1-07 (Digital reference of positive frequency lower limit), whichever is higher. The negative frequency lower limit is similar to the positive frequency lower limit.
L0269	Frequency lower limit arrival (output generated even at stop)	0: Not reached 1: Reached	Displays whether the operating frequency reaches the lower limit. The connector outputs an active signal when the operating frequency reaches the lower limit. This flag is active even in the stop state. Note: The frequency lower limit is determined by C4-11 (Minimum motor frequency) and d1-07 (Digital reference of positive frequency lower limit), whichever is higher. The negative frequency lower limit is similar to the positive frequency lower limit.
L0270	Speed comparison arrival 1	0: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 1.
L0271	Speed comparison arrival 2	0: Not reached 1: Reached	Displays whether the motor operating speed reaches the range of speed comparison 2.

Application instance

The following takes E1-00 [RO output function selection] as an example to describe how to select the bit connector (B connector) as the parameter input.

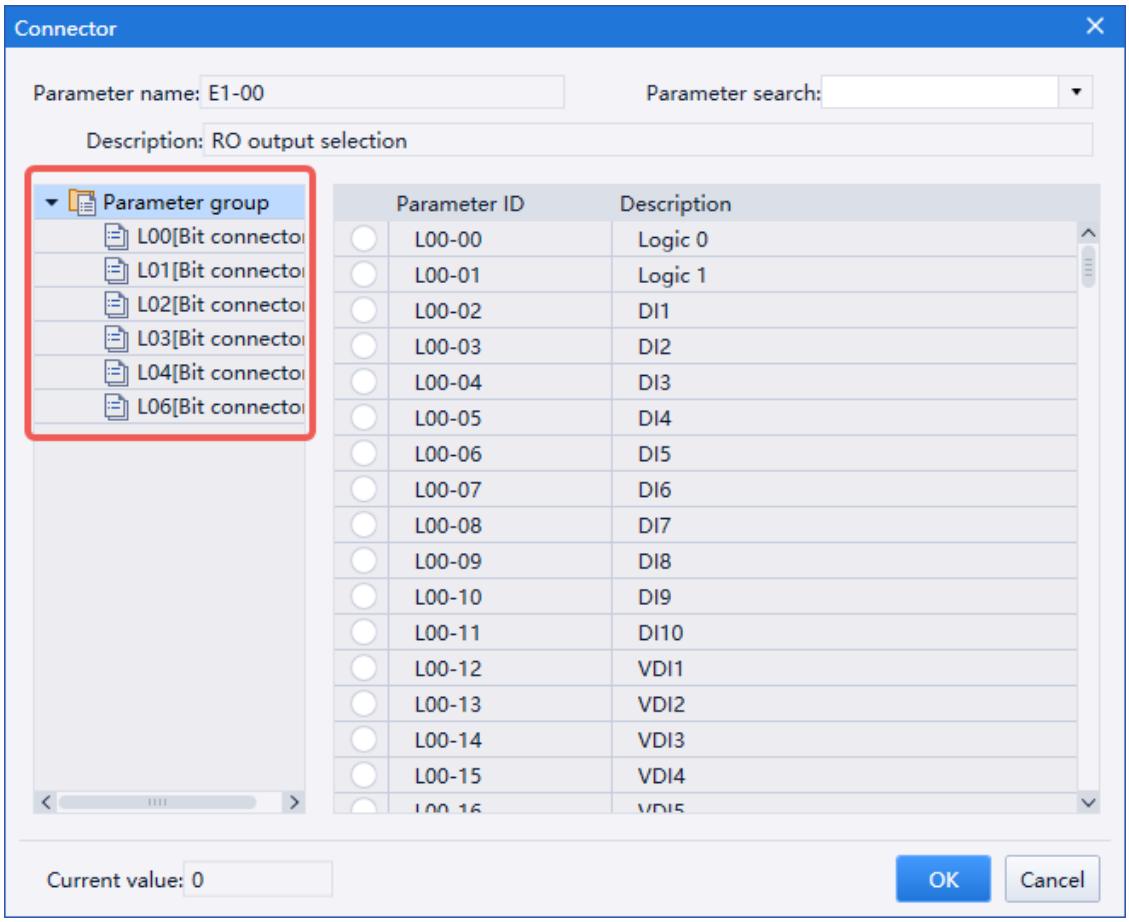
1. Select "Other [B connector]" in the drop-down menu of E1-00 [RO1 output function selection].



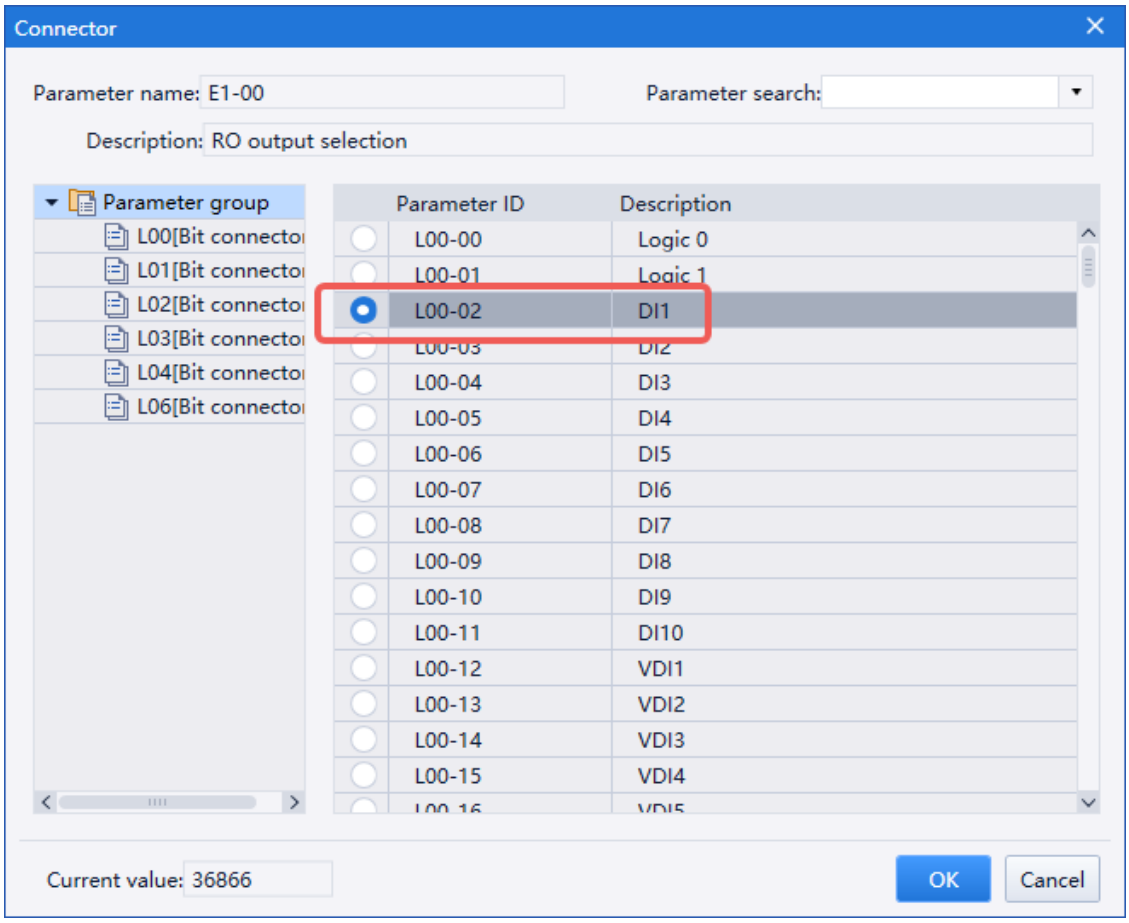
Param...	Name	Current value	Unit	Default...	Min. va...	Max. v...	Access...	Display mode	Comm...
All	All	All	All	All	All	All	All	All	All
E0-60	DIO mode selection 2	1	-	0	0	1	Stop st...	Decimal	0xE03C
E1-00	RO output selection	0 [No output]	-	21	0	43	Any ti...	Decimal	0xE100
E1-01	DO1 output function selection						Any ti...	Decimal	0xE101
E1-02	DO2 function selection						Any ti...	Decimal	0xE102
E1-03	DO3 function selection						Any ti...	Decimal	0xE103
E1-04	DO4 function selection						Any ti...	Decimal	0xE104
E1-05	DO5 function selection						Any ti...	Decimal	0xE105
E1-06	DO6 function selection						Any ti...	Decimal	0xE106
E1-10	VDO1 function selection						Any ti...	Decimal	0xE10A
E1-11	VDO2 function selection						Any ti...	Decimal	0xE10B
E1-12	VDO3 function selection						Any ti...	Decimal	0xE10C
E1-13	VDO4 function selection						Any ti...	Decimal	0xE10D
E1-14	VDO5 function selection						Any ti...	Decimal	0xE10E
E1-15	VDO6 function selection						Any ti...	Decimal	0xE10F
E1-16	RO switch-on delay time						Any ti...	Decimal	0xE110
E1-17	RO switch-off delay time						Any ti...	Decimal	0xE111
E1-18	DO1 switch-on delay						Any ti...	Decimal	0xE112
E1-19	DO1 switch-off delay						Any ti...	Decimal	0xE113
E1-20	DO2 switch-on delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE114
E1-21	DO2 switch-off delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE115
E1-22	DO3 switch-on delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE116
E1-23	DO3 switch-off delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE117
E1-24	DO4 switch-on delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE118
E1-25	DO4 switch-off delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE119
E1-26	DO5 switch-on delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE11A
E1-27	DO5 switch-off delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE11B
E1-28	DO6 switch-on delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE11C
E1-29	DO6 switch-off delay	0.0	s	0.0	0.0	3600.0	Any ti...	Decimal	0xE11D
E1-36	DO/RO/VDO output source	0x0000	-	0x0000	0x0000	0xFFFF	Any ti...	Hexadecimal	0xE124
E1-37	Force value of DO/RO/VDO	0x0000	-	0x0000	0x0000	0xFFFF	Any ti...	Hexadecimal	0xE125
E1-38	DO/RO/VDO output logic selection	0x0000	-	0x0000	0x0000	0xFFFF	Any ti...	Hexadecimal	0xE126
E1-39	24 V safety power supply output sel...	0	-	0	0	11	Any ti...	Decimal	0xE127
E2-19	Motor temperature filter time	0.10	s	0.10	0.00	10.00	Any ti...	Decimal	0xE213
E2-73	Motor temperature sensor type	0 [Invalid]	-	0	0	5	Any ti...	Decimal	0xE249

27 [Frequency 2 reached]
28 [Current 1 reached]
29 [Current 2 reached]
30 [Timing reached]
31 [Reserved]
32 [Three-phase loss]
33 [Reverse run in progress]
34 [Zero current state]
35 [IGBT temperature reached]
36 [Output current limi
34 [Zero current state]
37 [Frequency lower limit reached (output generated even at stop)]
38 [Error (fault/minor fault/alarm)]
39 [Motor overtemperature]
40 [Current operating time reached]
41 [Fault (excluding undervoltage)]
42 [STO output]
43 [Minor fault or alarm]
Other value [B Connector]

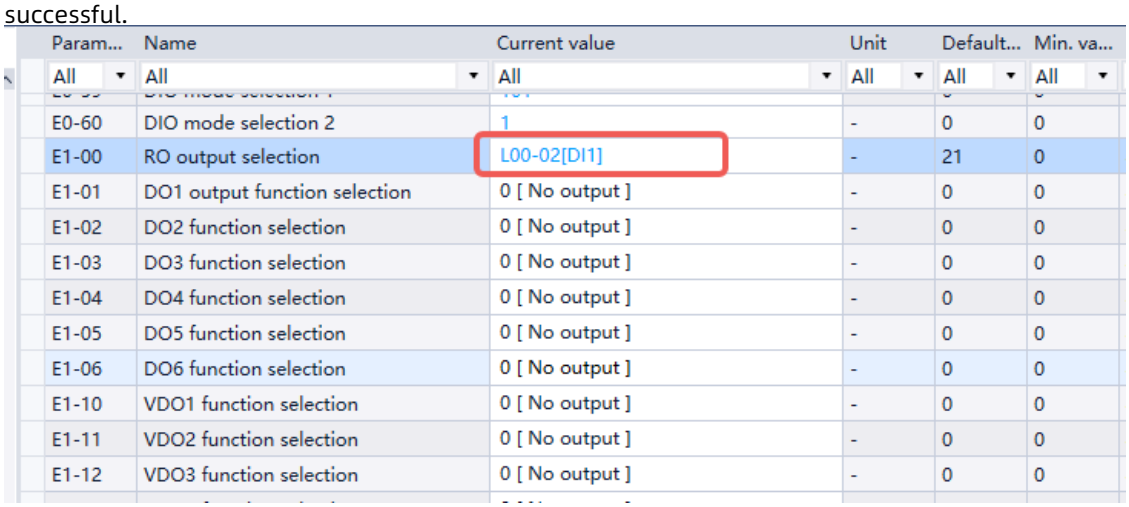
2. After clicking "Other [B connector]", the following dialog box pops up. Click on the left to select the parameter group of the connector (B connector).



3. Click L0002 DI1 and then click "OK".



4. When the current value of E1-00 [RO output function selection] is "L0002 [DI1]", the setting is successful.



Param...	Name	Current value	Unit	Default...	Min. va...
All	All	All	All	All	All
E0-60	DIO mode selection 2	1	-	0	0
E1-00	RO output selection	L00-02[DI1]	-	21	0
E1-01	DO1 output function selection	0 [No output]	-	0	0
E1-02	DO2 function selection	0 [No output]	-	0	0
E1-03	DO3 function selection	0 [No output]	-	0	0
E1-04	DO4 function selection	0 [No output]	-	0	0
E1-05	DO5 function selection	0 [No output]	-	0	0
E1-06	DO6 function selection	0 [No output]	-	0	0
E1-10	VDO1 function selection	0 [No output]	-	0	0
E1-11	VDO2 function selection	0 [No output]	-	0	0
E1-12	VDO3 function selection	0 [No output]	-	0	0

After the above settings are done, if DI1 is closed, L0002 [DI1] is 1 and the RO1 terminal generates output.

14.1.2.3 Word Connector (K Connector)

Application scenarios

This connector is used to monitor the status word in the system or used as a signal source of certain functions.

1. Monitor the system status, during which the status word of a certain function is monitored generally, such as the control word, communication word, status word, and internal monitoring parameter of the drive. For example, you can monitor DI1 to DI10 and VDI1 to VDI6 through L1065.

2. Monitor per-unit values of internal monitoring system. For example, L1101 is the per-unit base value of the frequency.

3. The connector can also be used for parameter interconnection. The status word of a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a word connector from L10 to L19 as the parameter input in the drop-down menu "Other: K connector" to implement a specific function (including using the word connector as the input source, converting it to bit connector or double-word connector, see "Free function block" for details).

Function description

The word connector (K connector) saves information such as analog values, status words, or command words in the system, which is divided into word connector and double-word connector to be used as the connector signal source for source-type parameters. For the word connector, the data type is 16-bit data. Parameter groups L10 to L19 are word connectors.

Related parameters

Group L10			
Param.	Name	Display range	Description
L1000	Current state of the system state machine	0: Initializing 1: Switch-on inhibited 2: Switch-on permitted 3: Operation permission 4: Start 5: Run 6: Stop 7: Self-test 8: Auto-tuning	Displays the current state of the system state machine.
L1001	Switchover command of system state machine	bit0: Start command active bit1: Stop command active bit2: OFF2 (coast to stop) active bit3: OFF3 (quick stop) active bit4: Operation permission active (non-sleep state) bit5: Operation inhibition active bit6: Stop-at-fault active bit7 to bit15: Reserved bit value: 0: Inactive 1: Active	Indicates the active system state machine switchover command. You can click the current value of the parameter to view the command and status indicated by each bit. Value description: bit0: Start command valid - The current start command is valid. bit1: Stop command valid - The current stop command is valid. bit2: OFF2 (coast to stop) active - The OFF2 (coast to stop) command is active, and coast-to-stop is under execution. bit3: OFF3 (quick stop) active - The OFF3 (quick stop) command is active, and quick-stop is under execution. bit4: Operation permission active (non-sleep state) - The drive is allowed to run currently. bit5: Operation inhibition active - The drive is inhibited from running currently. bit6: Stop-at-fault active - The drive stops due to a fault.

Group L10			
Param.	Name	Display range	Description
L1002	System status word 1	bit0: Ready for switch-on bit1: Ready to run bit2: Operating bit3: Fault bit4: OFF2 (coast to stop) state bit5: OFF3 (quick stop) state bit6: Startup lockout bit7: Alarm/Limited operation bit8: No speed deviation bit9: Local/Remote 0: Local 1: Remote bit10: Target speed arrival bit11: Torque limit bit12: Positive speed bit13: Negative speed bit14: Operating (pulsing) bit15: User-defined state 0 bit value: 0: Inactive 1: Active	Displays the value of system status word 1. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Ready for switch-on - The drive passes self-test upon power-on and no fault occurs. bit1: Ready to run - The drive is ready to run. bit2: Operating - The drive is operating. bit3: Fault - The drive stops due to a fault. bit4: OFF2 (coast to stop) state - The OFF2 (coast to stop) command is active, and coast-to-stop is under execution. bit5: OFF3 (quick stop) state - The OFF3 (quick stop) command is active, and quick-stop is under execution. bit6: Startup lockout - The drive is in the startup lockout state. bit7: Alarm/Limited operation - The drive reports Axxx.x (fault) or Lxxx.x (limited operation). bit8: No speed deviation - The deviation between the operating speed and target speed is within the allowable range. bit9:Local/Remote - Displays whether the drive is in the local control mode or remote control mode. bit10: Target speed arrival - Displays whether the set target speed is reached. bit11: Torque limited - Displays whether the torque limit is triggered. bit12: Positive speed - The drive is running in the forward direction. bit13: Negative speed - The drive is operating in the reverse direction. bit14: Running (pulsing) - The drive is operating and generates output. bit15: User-defined state 0 - The drive is in user-defined state 0. Whether this bit is valid depends on P0-59. Main status setting word 1: If P0-59 is 1, bit15 is 1. If P0-59 is 0, bit15 is 0.

Group L10			
Param.	Name	Display range	Description
L1003	System status word 2	bit0: Self-testing bit1: Parameter auto-tuning bit2: Minor fault state bit3: Alarm state bit4: Speed mode bit5: Torque mode bit6: Position control mode (reserved) bit7: RFG enable bit8: RFG operation bit9: Stop at fault bit10: Normal operation bit11: Jogging bit12: Decelerate to stop bit13: Brake (reserved) bit14: Terminal control bit15: User-defined state 1 bit value: 0: Inactive 1: Active	Displays the value of system status word 2. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Self-testing - The drive is in self-test state. bit1: Parameter auto-tuning - The drive is in the process of parameter auto-tuning. bit2: Minor fault state - The drive is in the minor fault state. bit3: Alarm state - The drive reports alarm code Axxx.x. bit4: Speed mode - The motor control mode is speed control. bit5: Torque mode - The motor control mode is torque control. bit6: Position mode (reserved) - The motor control mode is position control. bit7: RFG enable - The RFG module is enabled. bit8: RFG operation - The RFG module is operating. bit9: Stop at fault - The drive stops due to a fault, with Exxx. reported. bit10: Normal operation - The drive is running at the set frequency. bit11: Jogging - The drive is jogging. bit12: Decelerate to stop - The drive is in the decelerate-to-stop state. bit13: Reserved bit14: Terminal control - The current control mode of the drive is terminal control. bit15: User-defined state 1- The drive is in user-defined state 1. Whether this bit is valid depends on the main status setting word 2 of P0-60. When P0-60 is 1, bit15 is set to 1. When P0-60 is 0, bit15 is set to 0.

Group L10			
Param.	Name	Display range	Description
L1004	System status word 3	bit0: Control channel selection 0: Control channel 1 1: Control channel 2 bit1: Setting channel selection 0: Setting channel 1 1: Setting channel 2 bit2: Motor selection bit0 0: Logic 0 1: Logic 1 bit3: Motor selection bit1 0: Logic 0 1: Logic 1 bit4: Error (fault/alarm) 0: No error 1: Error (fault) occurred bit5: EEPROM idle 0: EEPROM idled 1: EEPROM in use bit6: Communication control 0: Inactive 1: Active	Displays the value of system status word 3. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Control channel selection - Displays the active control channel of the drive. bit1: Setting channel selection - Displays the active setting channel. bit2: Motor selection bit0 - Displays the state of motor group selection parameter bit0. bit3: Motor selection bit1 - Displays the state of motor group selection parameter bit1. bit4: Error (fault/alarm) - When bit4 is set to 1, the drive is in the error sate, with fault code Exxx.x or alarm code Axxx.x displayed. bit5: EEPROM idled - EEPROM is in the idle state without read/write tasks. bit6: Communication control - Displays the system communication control status. bit7: Relay action during automatic fault reset - Displays whether the relay acts during automatic fault reset. bit8: IGBT pulsing state - Displays current pulsing state. bit9: System command direction - Displays the system command direction. bit10: IGBT pulsing state with delay - Displays the IGBT pulsing state with delay. bit11: Internal parameter processing flag - Displays the internal parameter processing flag. bit12: Internal voltage state - Displays the internal voltage status. bit14 to bit15: Power board initialization state - Displays whether power board initialization is done.

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	bit7: Relay action during automatic fault reset 0: Relay invalid 1: Relay valid bit8: IGBT pulsing state 0: Stop 1: Valid bit9: System command direction 0: Forward run 1: Reverse bit10: IGBT pulsing state with delay 0: Stop 1: Valid bit11: Internal parameter processing flag 0: Not processed 1: Processing bit12: Internal voltage state 0: Undervoltage or not initialized 1: Normal bit13: Reserved 0: Inactive 1: Active bit14 to bit15: Power board initialization state 0: Not initialized 1: Initializing 2: Initialized 3: Reserved	Same as above

Group L10			
Param.	Name	Display range	Description
L1005	System status word 4	bit0: Operating at zero speed (invalid at stop) bit1: Operating at zero speed (valid at stop) bit2: Frequency level detection 1 bit3: Frequency level detection 2 bit4: Reserved bit5: Simple PLC cycle state 0: Not completed 1: Completed bit6: Reference value set through communication bit7: Reserved bit8: Current 1 arrival bit9: Current 2 arrival bit10: Zero current state bit11: Output current limit violation bit12: Motor overload pre-alarm bit13: Drive overload pre-alarm bit14: Undervoltage bit15: Three-phase loss bit value: 0: Inactive 1: Active	Displays the value of system status word 4. You may click the current value of the parameter to view the system status indicated by each bit. Value description: bit0: Operating at zero speed (invalid at stop) - The drive is operating at zero speed, which is invalid at stop. bit1: Operating at zero speed (active at stop) - The drive is in zero-speed operating state, which is active even at stop. bit2: Frequency level detection 1 - Active when the operating frequency is higher than frequency detection value 1 (FDT1); inactive when the operating frequency is lower than (detection value 1 - detection value 1 x hysteresis value 1). Set FTD1-related parameters through P0-34 to P0-35. bit3: Frequency level detection 2 - Active when the operating frequency is higher than the frequency detection value 2 (FDT2); inactive when the operating frequency is lower than (detection value 2 - detection value 2 x hysteresis value 2). Set FTD2-related parameters through P0-36 to P0-37. bit5: Simple PLC cycle state - Active when the simple PLC module is done executing one cycle of operation. bit6: Reference value set through communication - The parameter is set through communication. bit7: Reserved bit8: Current 1 arrival - Active when the output current of the drive is within (current arrival 1±window of current arrival 1) x rated current range of the motor. Set related parameters through P0-43 to P0-44. bit9: Current 2 arrival - Active when the output current of the drive is within (current arrival 2 ±window of current arrival 2) x rated current range of the motor. Set related parameters through P0-45 to P0-46. bit10: Zero current state - When the output current of the AC drive is lower than or equal to the zero current detection level for a period longer than the zero current detection delay, the bit outputs an active signal. Set current-related parameters through P0-47 to P0-48. (to be continued)

Group L10			
Param.	Name	Display range	Description
Same as above	Same as above	Same as above	(continued) bit11: Output current limit violation - Active when the output current of the drive is higher than the output current limit violation threshold for a period longer than the output current limit violation detection delay. Parameters related to output current limit violation detection are set through P0-49 to P0-50. bit12: Motor overload pre-alarm - The drive reports A111.1 when this bit is active. bit13: Drive overload pre-alarm - The drive reports A110.1 when this bit is active. bit14: Undervoltage - The drive reports E009.1 when this bit is active. bit15: Three-phase loss - The drive reports E030.1 when this bit is active.
L1006	Main status word of the drive	bit0 to bit1: Operation status 0: Initializing 1: Sampling preparation 2: Undervoltage 3: Ready bit2: Hardware information status 0: Not ready 1: Ready bit3: Operation state 0: Stop 1: Valid bit4: Output blocked forcibly at fault 0: Inactive 1: Active bit5: Bus undervoltage state 0: Inactive 1: Active bit6 to bit15: Reserved	Displays the real-time operating status of the drive. You can view the drive status information corresponding to each bit by clicking the current value of the parameter. Value description: bit0 to bit1: Operation state - Displays the power-on initialization state of the drive. bit2: Hardware information status - Displays whether hardware power-on self-test has been passed without faults. bit3: Operation state - Displays the current state of the drive. bit4: Output blocked forcibly at fault - The output of the drive is blocked due to fault. bit5: Bus undervoltage state - The DC bus of the drive is in the undervoltage state.

Group L10			
Param.	Name	Display range	Description
L1044	User-defined command word of control channel 1	bit0: ON_OFF1 (start/stop) state bit1: OFF2 (coast to stop) state bit2: OFF3 (quick stop) state bit0 to bit2: 0: Stop 1: Valid bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Not reset 1: Reset bit5 to bit6: Jog 1 to Jog 2 0: Inactive 1: Active bit7: Speed inversion 0: Not inverted 1: Inverted	Displays the real-time operating status of user-defined command word of control channel 1. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: ON_OFF1 (start/stop) state - Displays the ON_OFF1 (start/stop) state of the user-defined command word of control channel 1. bit1: OFF2 (coast to stop) state - Displays the OFF2 (coast to stop) state of the user-defined command word of control channel 1. bit2: OFF3 (quick stop) state - Displays the OFF3 (quick stop) state of the user-defined command word of control channel 1. bit3: Operation permission - Displays the operation permission state of the user-defined command word of control channel 1. bit4: Reset command - Displays the reset command status of the user-defined command word of control channel 1. bit5: Jog 1 - Displays the jog 1 state of the user-defined command word of control channel 1. bit6: Jog 2 - Displays the jog 2 state of the user-defined command word of control channel 1. bit7: Speed inversion - Displays the speed inversion state of the user-defined command word of control channel 1.
L1045	User-defined command word of control channel 2	Same as L1044	Displays the real-time operating status of user-defined command word of control channel 2. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: ON_OFF1 (start/stop) state - Displays the ON_OFF1 (start/stop) state of the user-defined command word of control channel 2. bit1: OFF2 (coast to stop) state - Displays the OFF2 (coast to stop) state of the user-defined command word of control channel 2. bit2: OFF3 (quick stop) state - Displays the OFF3 (quick stop) state of the user-defined command word of control channel 2. bit3: Operation permission - Displays the operation permission state of the user-defined command word of control channel 2. bit4: Reset command - Displays the reset command status of the user-defined command word of control channel 2. bit5: Jog 2 - Displays the jog 1 state of the user-defined command word of control channel 2. bit6: Jog 2 - Displays the jog 2 state of the user-defined command word of control channel 2. bit7: Speed inversion - Displays the speed inversion state of the user-defined command word of control channel 2.

Group L10			
Param.	Name	Display range	Description
L1046	Auxiliary command word of control channel 1	bit0: OFF2 (coast to stop) state 2 bit1: OFF2 (coast to stop) state 3 bit2: OFF3 (quick stop) state 2 bit0 to bit2: 0: Stop 1: Valid bit3: OFF3 (quick stop) state 3 0: Disable 1: Enable bit4 to bit5: Reset command 2 to Reset command 3 0: Not reset 1: Reset bit6: RFG inhibition bit7: RFG pause bit8: Forced RFG bit6 to bit8: 0: Active 1: Inactive	Displays the real-time operating status of the auxiliary command word of control channel 1. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: OFF2 (coast to stop) state 2 - Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 1. bit1: OFF2 (coast to stop) state 3 - Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 1. bit2: OFF3 (quick stop) state 2 - Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 1. bit3: OFF3 (quick stop) state 3 - Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 1. bit4: Reset command 2 - Displays the reset command 2 status of the auxiliary command word for control channel 1. bit5: Reset command 3 - Displays the reset command 3 status of the auxiliary command word of control channel 1. bit6: RFG inhibition - Displays the RFG inhibition state of the auxiliary command word of control channel 1. bit7: RFG pause - Displays the RFG pause state of the auxiliary command word of control channel 1. bit8: Forced RFG - Displays the forced RFG state of the auxiliary command word of control channel 1.
L1047	Auxiliary command word of control channel 2	Same as L1046	Displays the real-time operating status of the auxiliary command word of control channel 2. You can view the status information corresponding to each bit by clicking the current value of the parameter. bit0: OFF2 (coast to stop) state 2 - Displays the OFF2 (coast to stop) state 2 of the auxiliary command word of control channel 2. bit1: OFF2 (coast to stop) state 3 - Displays the OFF2 (coast to stop) state 3 of the auxiliary command word of control channel 2. bit2: OFF3 (quick stop) state 2 - Displays the OFF3 (quick stop) state 2 of the auxiliary command word of control channel 2. bit3: OFF3 (quick stop) state 3 - Displays the OFF3 (quick stop) state 3 of the auxiliary command word of control channel 2. bit4: Reset command 2 - Displays the reset command 2 state of the auxiliary command word of control channel 2. bit5: Reset command 3 - Displays the reset command 3 state of the auxiliary command word of control channel 2. bit6: RFG inhibition - Displays the RFG inhibition state of the auxiliary command word of control channel 2. bit7: RFG pause - Displays the RFG pause state of the auxiliary command word of control channel 2. bit8: Forced RFG - Displays the forced RFG state of the auxiliary command word of control channel 2.

Group L10			
Param.	Name	Display range	Description
L1050	STO output status word	0x0 to 0xFFFF	Displays the STO state, the input state of dual STOs, and the DO output state. Note: bit0 indicates the STO1 disconnection flag. When the 24 V input of STO1 is disconnected, this bit is set to 1. bit1 indicates the STO2 disconnection flag. When the 24 V input of STO2 is disconnected, this bit is set to 1. bit2 indicates whether the DO of STO is outputted. When both 24 V inputs are disconnected, a DO output signal is generated. In this case, this flag is set to 1. bit3 indicates the STO status flag bit. When both 24 V inputs are disconnected, this flag is set to 1.
L1051	LED control word	bit0: Start bit1: Stop bit2: Jog 1 bit3: Local control bit4: Reset bit5: Jog 2 bit6: Direction switchover bit value: 0: Inactive 1: Active	Displays the control command status of the LED operating panel. You can click current value of the parameter to view the control word status indicated by each bit.

Group L10			
Param.	Name	Display range	Description
L1054	Command channel control word	bit0: ON_OFF1 (start/stop) state bit1: OFF2 (coast to stop) stop bit2: OFF3 (quick stop) state bit0 to bit3: 0: Active 1: Normal bit3: Operation permission 0: Operation inhibited 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly (To be continued)	Displays the input status of the command channel. You can click the current value of the parameter to view the control word status indicated by each bit.
Same as above	Same as above	(Continued) bit7: Fault reset 0: Inactive 1: Active bit8 to bit9: Jog 1 to Jog 2 0: Inactive 1: Active bit10: Remote control (reserved) 0: Inactive 1: Active bit11: Speed inversion 0: Not inverted 1: Inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active	Same as above

Group L10			
Param.	Name	Display range	Description
L1055	Control word set through communication	bit0: ON_OFF1 (start/stop) state bit1: OFF2 (coast to stop) state bit2: OFF3 (quick stop) state bit0 to bit3: 0: Stop 1: Valid bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Not reset 1: Reset bit5 to bit6: Jog 1 to Jog 2 0: Inactive 1: Active bit7: Speed inversion 0: Not inverted 1: Inverted	Displays the input status of the communication control command. You can click the current value of the parameter to view the control word status indicated by each bit.
L1057	Terminal module control word	Same as L1055	Displays the control command status of the terminal control mode. You can view the command status corresponding to the bit by clicking the current value of the parameter.
L1058	Terminal module A input state	bit0: ON_OFF1 (start/stop) state bit1: Reverse run (REV) bit2: Operation permission (enable) bit3: Reset command (reset) bit4: Jog 1 bit5: Jog 2 bit6: Reserved (Rsvd1) bit7: Terminal function input (In1) bit8: Terminal function input (In2) bit9: Terminal function input (In3) bit value: 0: Inactive 1: Active	Displays the control command input state of terminal module A. You can click the current value of the parameter to view the control word status indicated by each bit.
L1059	Terminal module B input state	Same as L1058	Displays the control command input state of terminal module B. You can click the current value of the parameter to view the command status indicated by each bit.

Group L10			
Param.	Name	Display range	Description
L1060	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: User-defined	Displays the external command source.
L1065	DI state	bit0 to bit9: States of DI1 to DI10 bit10 to bit15: States of VDI1 to VDI6 bit value: 0: Low level 1: High level	Displays the final output status of DI and VDI. You can view the DI/VDI status of the bit by clicking the current value of the parameter.
L1068	DO state	bit0: RO state bit1 to bit6: States of DO1 to DO6 bit7 to bit9: FMR reserved bit10 to bit15: States of VDI1 to VDI6 bit value: 0: Low level 1: High level	Displays the final output status of DO and VDO. You can view the DO/VDO status of the bit by clicking the current value of the parameter.

Group L11			
Param.	Name	Display range	Description
L1100	Base value of speed per-unit value	0 rpm to 65535 rpm	Displays the base value of speed per-unit value. Speed per-unit value = Actual speed/Base value
L1101	Base value of frequency per-unit value	0.0 Hz to 6553.5 Hz	Displays the base value of current frequency per-unit value. Frequency per-unit value = Actual frequency/Base value
L1102	Base value of voltage per-unit value	0.0 V to 6553.5 V	Displays the base value of current voltage per-unit value. Voltage per-unit value = Actual voltage/Base value
L1103	Base value of current per-unit value	0.0 A to 6553.5 A	Displays the base value of current per-unit value. Current per-unit value = Actual current/Base value
L1104	Base value of power per-unit value	0.0 kW to 655.35 kW	Displays the base value of power per-unit value. Power per-unit value = Actual power/Base value
L1105	Base value of torque per-unit value	0.00 N·m to 655.35 N·m	Displays the base value of torque per-unit value. Torque per-unit value = Actual torque/Base value
L1106	Base value of DC bus voltage per-unit value	0 V to 65535 V	Displays the base value of DC bus voltage per-unit value. Bus voltage per-unit value = Actual bus voltage/Base value

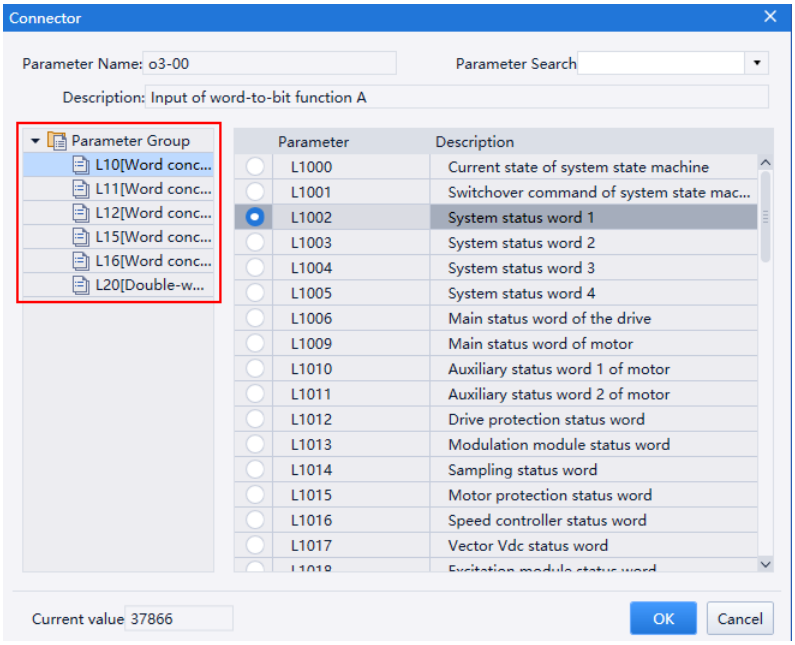
Application instance

The following takes o3-00 [Input of word-to-bit function A] as an example to describe how to select the word connector (K connector) as the parameter input.

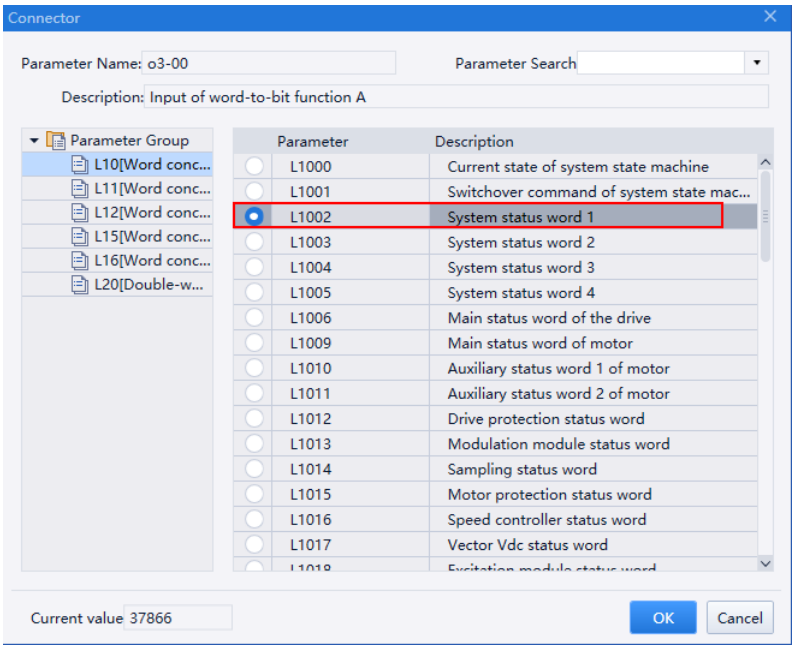
1. Select "Other [K connector]" in the drop-down menu of o3-00 [Input of word-to-bit function A].

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
o3-00	Input of word-to-bit function A	0 [Invalid]	-	0	0	0
o3-01	Input of word-to-bit function B	0 [Invalid]	-	0	0	0
o3-02	Input of word-to-bit function C	others [K Connector]	-	0	0	0
o3-03	Input of word-to-bit function D	0 [Invalid]	-	0	0	0

2. After clicking "Other [K connector]", the following dialog box displays, then click on the left side to select the parameter group of the word connector (K connector).



3. Click L1002 system status word 1, and then click "OK".



4. When the current value of o3-00 [Input of word-to-bit function A] is "L1002 [system status word 1]", the setting is done.

Parameter	Description	Current value	Unit	Factory...	Minim...
o3-00	Input of word-to-bit function A	L1002[System status word 1]	-	0	0
o3-01	Input of word-to-bit function B	0 [Invalid]	-	0	0

After the preceding settings are done, you can convert L1002 [System status word 1] to a bit connector and display the bits in L0304 to L0319.

14.1.2.4 Double-Word Connector (K Connector)

Application scenarios

This connector is used to monitor the status word in the system or used as a signal source of certain functions.

1. Used for system status monitoring, such as the A output of the word-to-double-word module. Compared to double-word connectors and bit connectors (which can read only 1 bit per address) and word connectors (which can read only 16 bits per address), a double-word connector can read more information per address. The double-word connector can represent more valid digits to improve the value precision.

2. When used for parameter interconnection. The status word of a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a word connector from L20 to L21 as the parameter input in the drop-down menu "Other: K connector" to implement a specific function (such as converting double-word connector to bit connector, see section "Free function block" for details).

Function description

The word connector (K connector) saves information such as analog values, status words, or command words in the system, which is divided into word connector and double-word connector to be used as the connector signal source for source-type parameters. The data in double-word connector is of 32-bit double-word type. Parameter groups L20 and L21 are double-word connectors.

Related parameters

Group L20			
Param.	Name	Display range	Description
L2000	Output of word-to-double-word module A	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module A.
L2002	Output of word-to-double-word module B	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module B.
L2004	Output of word-to-double-word module C	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module C.
L2006	Output of word-to-double-word module D	0 to 0xFFFFFFFF	Indicates the output of word-to-double-word module D.

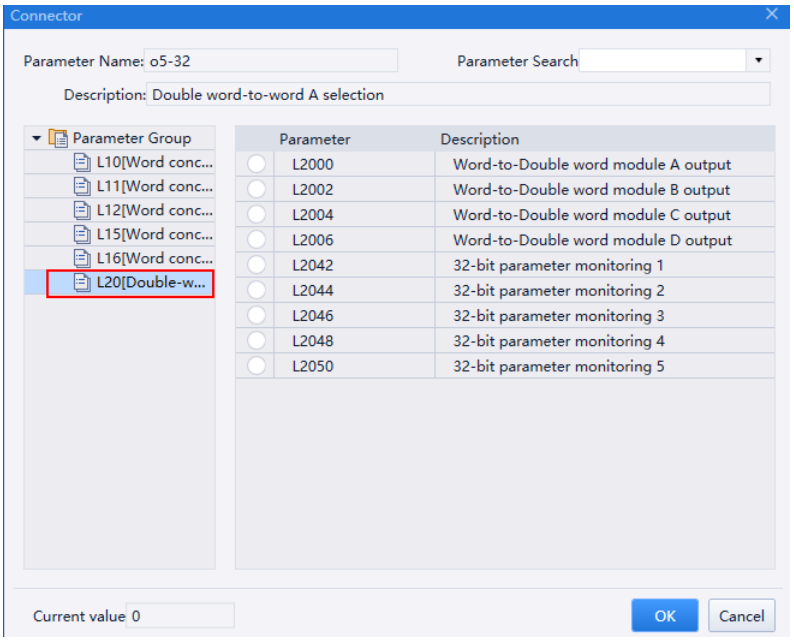
Application instance

The following takes o5-32 [Selection of double-word-to-word module A] as an example to describe how to select the double-word connector (K connector) as the parameter input.

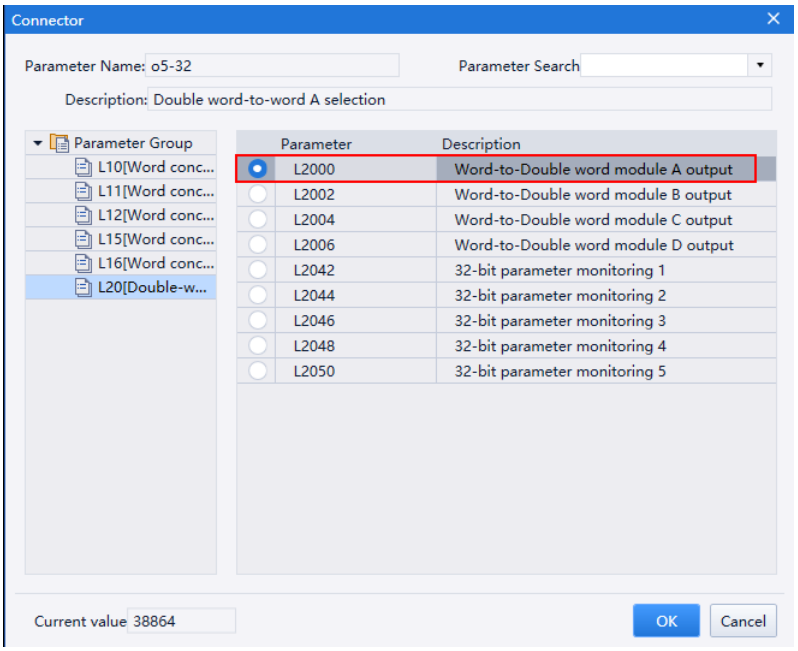
1. Select "Other [K connector]" in the drop-down menu of o5-32 [Selection of double-word-to-word module A].

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
o5-15	High bit of base value of word-to-d...	0	-	0	0	65535
o5-32	Double word-to-word A selection	0 [Disable]	-	0	0	0
o5-33	Low bit of the base value of double...	0 [Disable]	-	0	0	65535
o5-34	High bit of base value of double wor...	others [K Connector]	-	0	0	65535
o5-35	Double word-to-word B selection	0 [Disable]	-	0	0	0

2. After clicking "Other [K connector]", the following dialog box displays, then click on the left to select the parameter group of the double-word connector (K connector).



3. Click "L2000 word-to-double-word module A output", then click "OK".



4. When the value of o5-32 [Selection of double-word-to-word module A] changes to "L2000 word-to-double-word module A", the setting is done successfully.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
o5-15	High bit of base value of word-to-d...	0	-	0	0	65535
o5-32	Double word-to-word A selection	L2000[Word-to-Double word module...	-	0	0	0
o5-33	Low bit of the base value of double...	0	-	0	0	65535

After the above settings are done, L2000 can be converted to a word connector and displayed in L1212 and L1213.

14.1.2.5 Floating-Point Connector (F Connector)

Application scenarios

This connector is used to monitor floating-point type data in the system or act as a signal source for certain functions.

1. It can be used to monitor the operation data of the system, including floating-point variables in the system, which are generally related to system operations such as output frequency and motor speed.

2. It can be used for parameter interconnection. The data related to a function module of the drive is used as the signal source input. As the resource pool of the system, you can select a floating-point connector from L24 to L39 as the input of the parameter with the drop-down menu "Other: F connector".

Function description

The floating-point connector (F connector) saves information such as analog values in the system and can be used as the connector signal source for parameters of the floating-point source type. The data type in the floating-point connector is 32-bit single-precision floating-point type. Parameter groups L22 to L39 are floating-point connectors.

Related parameters

Group L22			
Param.	Name	Value range	Description
L2200	Output frequency	-8 to +8	Displays the output frequency.
L2202	Motor speed	-8 to +8	Displays the motor speed.
L2204	Output current	-8 to +8	Displays the output current.
L2206	Output voltage	-8 to +8	Displays the output voltage.
L2208	Output power	-8 to +8	Displays the output power.
L2210	Output torque	-8 to +8	Displays the output torque.
L2258	Per-unit current value based on 1000 A at maximum	-8 to +8	Displays the per-unit current value based on 1000 A at maximum.
L2260	Per-unit voltage value based on 1000 V at maximum	-8 to +8	Displays the per-unit voltage value based on 1000 V at maximum.

Group L23			
Param.	Name	Value range	Description
L2318	Multi-reference selection output	-8 to +8	Displays the output corresponding to the selected multi-reference value.
L2320	Output corresponding to multi-reference 0	-8 to +8	Displays the output corresponding to multi-reference 0.
L2322	Multi-reference 1 output	-8 to +8	Displays the output corresponding to multi-reference 1.

Group L23			
Param.	Name	Value range	Description
L2324	Multi-reference 2 output	-8 to +8	Displays the output corresponding to multi-reference 2.
L2326	Multi-reference 3 output	-8 to +8	Displays the output corresponding to multi-reference 3.
L2328	Multi-reference 4 output	-8 to +8	Displays the output corresponding to multi-reference 4.
L2330	Multi-reference 5 output	-8 to +8	Displays the output corresponding to multi-reference 5.
L2332	Multi-reference 6 output	-8 to +8	Displays the output corresponding to multi-reference 6.
L2334	Multi-reference 7 output	-8 to +8	Displays the output corresponding to multi-reference 7.
L2336	Multi-reference 8 output	-8 to +8	Displays the output corresponding to multi-reference 8.
L2338	Multi-reference 9 output	-8 to +8	Displays the output corresponding to multi-reference 9.
L2340	Multi-reference 10 output	-8 to +8	Displays the output corresponding to multi-reference 10.
L2342	Multi-reference 11 output	-8 to +8	Displays the output corresponding to multi-reference 11.
L2344	Multi-reference 12 output	-8 to +8	Displays the output corresponding to multi-reference 12.
L2346	Multi-reference 13 output	-8 to +8	Displays the output corresponding to multi-reference 13.
L2348	Multi-reference 14 output	-8 to +8	Displays the output corresponding to multi-reference 14.
L2350	Multi-reference 15 output	-8 to +8	Displays the output corresponding to multi-reference 15.

Group L24			
Param.	Name	Value range	Description
L2452	Digital reference of motorized potentiometer forced value	-8 to +8	Displays the forced value of motorized potentiometer.
L2454	Reset value of motorized potentiometer	-8 to +8	Displays the reset value of motorized potentiometer.
L2456	Maximum value of motorized potentiometer	-8 to +8	Displays the maximum value of motorized potentiometer.
L2458	Minimum value of motorized potentiometer	-8 to +8	Displays the minimum value of motorized potentiometer.
L2460	Initial value of motorized potentiometer	-8 to +8	Displays the initial value of motorized potentiometer.
L2462	Process operation value of motorized potentiometer	-8 to +8	Displays the process operation value of motorized potentiometer.

Group L24			
Param.	Name	Value range	Description
L2464	Final output value of motorized potentiometer	-8 to +8	Displays the final output value of the motorized potentiometer.
L2466	General PID output	-8 to +8	Displays the total output of the general PID.
L2468	General PID error	-8 to +8	Displays the error input of the general PID.
L2470	General PID reference	-8 to +8	Displays the reference input of the general PID.
L2472	General PID feedback	-8 to +8	Displays the feedback input of the general PID.
L2474	General PID proportional output	-8 to +8	Displays the proportional output of the general PID.
L2476	General PID integral output	-8 to +8	Displays the integral term output of the general PID.
L2478	General PID derivative output	-8 to +8	Displays the derivative term output of the general PID.
L2480	General PID inversion cutoff output	-8 to +8	Displays the maximum output upon PID inversion cutoff.
L2482	Per-unit value of simple PLC step	-8 to +8	Displays the per-unit value of simple PLC step.

Group L30			
Param.	Name	Value range	Description
L3000	Actual motor speed	-8 to +8	Displays the actual motor speed. Note: The value of this parameter is the encoder speed in the FVC mode, motor observation speed in the SVC mode, and synchronous frequency before slip compensation in the V/f mode.
L3002	Final motor speed reference	-8 to +8	Displays the final motor speed reference. Note: This parameter indicates the speed after the final output of RFG.
L3006	Target frequency	-8 to +8	Displays the target frequency.
L3008	Operating frequency	-8 to +8	Defines the real-time frequency output of the drive, which is also the motor control target frequency.
L3016	Jog 1 frequency	-8 to +8	Defines jog 1 frequency of the active setting channel, which is obtained based on settings of the jog 1 frequency source and jog 1 frequency reference.
L3018	Jog 2 frequency	-8 to +8	Defines jog 2 frequency of the active setting channel, which is obtained based on settings of the jog 2 frequency source and jog 2 frequency reference.
L3046	RFG reference input	-8 to +8	Displays the frequency set by the input RFG.
L3052	RFG calculation output	-8 to +8	Displays the frequency after RFG calculation.
L3054	RFG acceleration	-8 to +8	Displays RFG acceleration value.

Group L30			
Param.	Name	Value range	Description
L3058	Offset of frequency adjusted by UP/DOWN key	-8 to +8	Displays the offset frequency adjusted by UP/DOWN keys on the operating panel or DIs functioning as UP/DOWN keys.
L3060	Upper limit of frequency adjusted by UP/DOWN key	-8 to +8	Displays the UP/DOWN upper limit.
L3062	Lower limit of frequency adjusted by UP/DOWN key	-8 to +8	Displays the UP/DOWN lower limit.
L3064	Speed reference set through communication	-8 to +8	Displays the per-unit value of the speed reference set through communication.
L3066	Communication (0x1000H)	-8 to +8	Displays the reference set through communication.
L3068	Maximum positive frequency	-8 to +8	Displays the active maximum positive frequency.
L3070	Minimum positive frequency	-8 to +8	Displays the active minimum positive frequency.
L3072	Maximum negative frequency	-8 to +8	Displays the active maximum negative frequency.
L3074	Minimum negative frequency	-8 to +8	Displays the active minimum negative frequency.

Group L31			
Param.	Name	Value range	Description
L3100	Torque reference	-8 to +8	Displays the torque reference. Note: The torque reference is obtained after the torque is multiplied by the torque gain factor and processed with the maximum and minimum torque limits.
L3112	Maximum positive torque	-8 to +8	During operation without torque limit, the maximum positive torque is the smaller value between digital reference of positive torque upper limit and the positive torque upper limit. During operation with torque limited, the maximum positive torque is the smaller value among the digital reference of positive torque upper limit, positive torque upper limit selection, and the maximum positive torque limit.
L3114	Maximum negative torque	-8 to +8	During operation without torque limit, the maximum negative torque is the higher value between inverted digital reference of negative torque upper limit and absolute value of negative torque upper limit. During operation with torque limited, the maximum negative torque is the higher value among the inverted digital reference of negative torque upper limit, negative torque upper limit selection, and the absolute value of maximum negative torque limit.

Group L31			
Param.	Name	Value range	Description
L3120	Target voltage in V/f decoupled mode	-8 to +8	In the non-operational state or when the V/f decoupled mode is not enabled, the target voltage in the V/f decoupled mode is 0. In the operational state and when the V/f decoupled mode is enabled, the target voltage in the V/f decoupled mode is the value outputted after digital reference of voltage in the V/f decoupled mode is processed with the voltage upper limit in the V/f decoupled mode.
L3122	Voltage output in V/f decoupled mode	-8 to +8	In the non-operational state, the voltage output in the V/f decoupled mode is 0. In the operational state, the voltage output in the V/f decoupled mode is the voltage processed with voltage ramp-up/down in the V/f decoupled mode.

Group L32			
Param.	Name	Value range	Description
L3208	Cumulative drive overload value	-8 to +8	Displays the cumulative value of drive overload. Note: Defines the cumulative value of drive overload. When the value 100% is reached, the drive reports overload fault.
L3210	Cumulative motor overload value	-8 to +8	Displays the cumulative value of motor overload. Note: Defines the cumulative value of motor overload. When the value 100% is reached, the motor reports overload fault.
L3212	Synchronous frequency	-8 to +8	Displays the synchronous frequency.
L3228	Phase U current	-8 to +8	Displays the phase U current.
L3230	Phase V current	-8 to +8	Displays the phase V current.
L3232	Phase W current	-8 to +8	Displays the phase W current.
L3234	Output current amplitude	-8 to +8	Displays the amplitude of the output current.
L3238	Output voltage amplitude	-8 to +8	Displays the amplitude of the output voltage.
L3248	Bus voltage of the drive	-8 to +8	Displays the bus voltage of the drive.

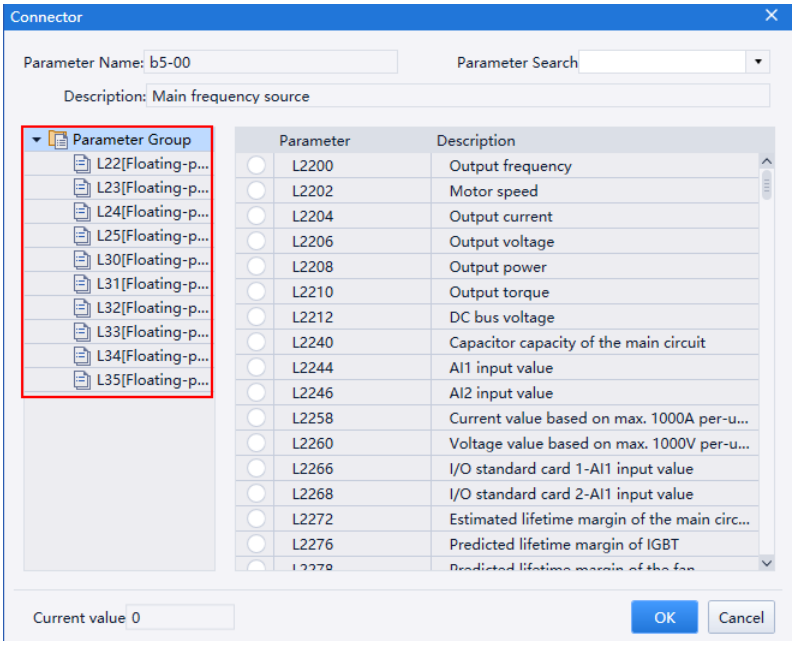
Application instance

Take b5-00 [Main frequency source] as an example to describe how to select the floating-point connector (F connector) as the parameter input.

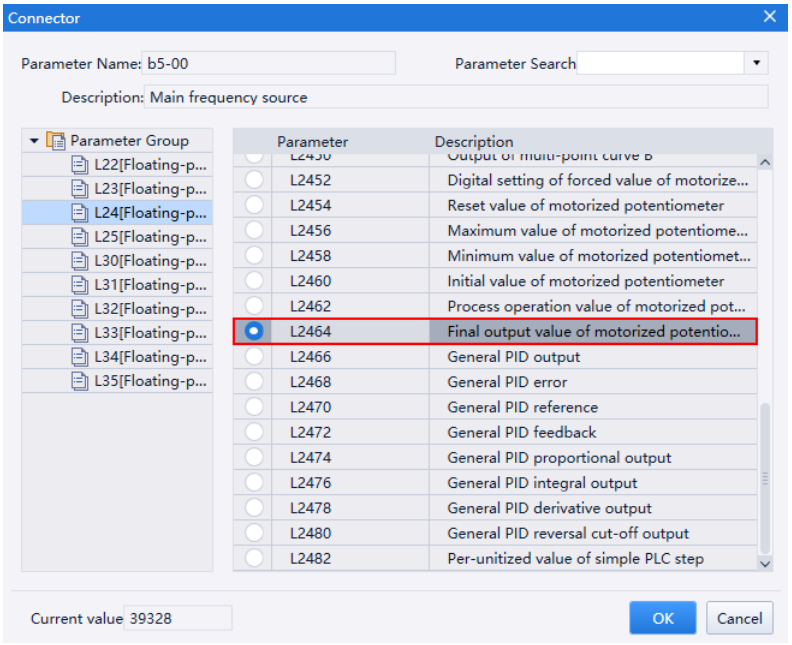
1. Select "Others [F connector]" from the drop-down menu of b5-00 [Main frequency source].

Parameter	Description	Current value	Unit	Factory...	Minim...
b5-00	Main frequency source	0 [b5-01]	-	0	0
b5-01	Digital setting of main frequency	0 [b5-01]	Hz	50	0
b5-02	Auxiliary frequency source	2 [AI1]	-	0	0
b5-03	Operation relation of main and auxil...	3 [AI2]	-	0	0
b5-04	Additional frequency source	5 [HDI pulse reference (valid for MD63	-	0	0
b5-05	Main frequency gain coefficient sour...	6 [Multi-reference]	-	0	0
b5-06	Auxiliary frequency gain coefficient s...	7 [Simple PLC]	-	0	0
b5-07	Jog 1 frequency source	8 [PID]	-	0	0
b5-08	Digital setting of jog 1 frequency	9 [Communication]	Hz	2	-50
b5-09	Jog 2 frequency source	others [F Connector]	-	0	0
b5-10	Digital setting of jog 2 frequency		Hz	-2	-50
b5-11	Frequency ramp change	0 [Inhibited]	-	0	0

2. After clicking "Others [F connector]", the following dialog box pops up. You can click on the left to select the parameter group of the floating-point connector (F connector).



3. Click the final output value of L2464 motorized potentiometer and click "OK".



4. When the current value of b5-00 [Main frequency source] is "L2464 final output value of the motorized potentiometer", the setting is done.

Parameter	Description	Current value	Unit	Factory...	Minim...
b5-00	Main frequency source	L2464[Final output value of motorize...	-	0	0
b5-01	Digital setting of main frequency	50.00	Hz	50	0

After the above settings are done, the motorized potentiometer can be used as the main frequency source.

14.2 Parameter Access Level

14.2.1 Parameter Access Level

Application scenario

The drive provides different levels of parameter access permissions, with each level assigned with access to different parameters. The higher the level, the more parameters can be accessed. You can switch access level as needed.

The standard access level is set by default, which displays basic function parameters, excluding parameters for extended functions. To access parameters for extended functions, you can change the current system parameter access level to extended level.

The standard access level includes commonly used parameters of the drive, which can meet the basic function commissioning requirements. For complex and extended function commissioning scenarios, you can the current system parameter access level to extended level.

Function description

The access levels are divided into standard, extended, expert, and manufacturer, with each level assigned with access to different parameters. These levels correspond to numbers 0 to 3 in sequence, where a higher number indicates a higher level and more accessible parameters.

High access levels include low access levels, with lower-level parameters being subset of higher-level parameters.

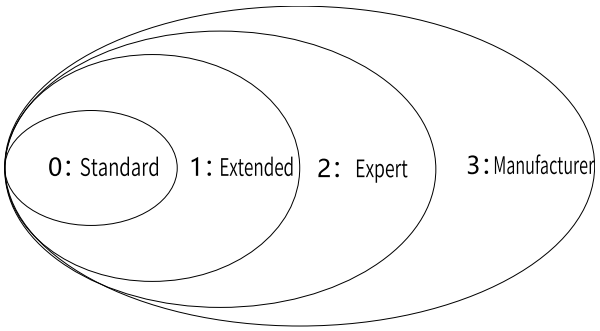


Figure 14-6 Relationship of parameter access levels from low to high

See the table below for descriptions and applicable scopes of different parameter access levels:

Table 14–1 Description of parameter access level

Access level	Description	Description	Applicable scenario
0	Standard	Covers most commonly used functions of the drive. The standard level is recommended when advanced application functions or complex process needs are not needed.	Default parameter access level, which mainly includes commonly used parameters of the drive to meet the basic function commissioning requirements of the drive.
1	Extended	Extended beyond common functions to include advanced application functions and complex processes, such as user-defined parameters, VDI, VDO, and free function blocks.	Added with extended function parameters to the standard parameters to meet specific functional requirements.
2	Expert	Added with more complex motor performance tuning parameters to the extended parameters.	Access to the expert level is password-protected. Expert level is added with complex motor performance tuning parameters to the extended parameters, which is intended only for professional commissioning personnel.
3	Manufacturer	Password-protected for use by Inovance only.	Allows access to all parameters, which is intended only for after-sales maintenance personnel of Inovance.

Note

1. Parameters in the standard level and extended level can meet most commissioning requirements.
2. Parameters in expert level are not covered by the user guide. These parameters can be set only by professionals. If you need to adjust expert parameters, contact Inovance.
3. Parameters in manufacture level are not covered by the user guide. These parameters can be set only by the maintenance personnel of Inovance.

Related parameters

Param.	Name	Default value	Value range	Description
A0-10	Current system parameter access level	0	0: Standard 1: Extended 2: Expert 3: Manufacturer	Displays the parameter access level of current system. Value description: 0: Standard (Default) - Only standard-level parameters are accessible. Parameters of other levels cannot be accessed. Most commonly-used parameters are available at the standard level to meet the needs of most commissioning scenarios. 1: Extended - Parameters at the extended level and standard level can be accessed. Extended-level parameters are related to specific functional requirements or process needs. 2: Expert - Parameters at the expert level, extended level, and expert level can be accessed. The expert level is password-protected and intended for professional commissioning personnel only. 3: Manufacturer - All parameters can be accessed. The manufacturer level is password-protected and intended for use by Inovance only.
A0-11	Parameter access level	0	0: Standard 1: Extended 2: Expert	Defines the system parameter level. Value description: 0: Standard - The standard level can be accessed. 1: Expansion - The extended level can be accessed. 2: Expert - The expert level can be accessed. Note: If the expert password (A0-14) is locked, you cannot switch to expert level directly.

Param.	Name	Default value	Value range	Description
A0-14	Expert password status display	0	0: Expert password invalid (expert password is not set) 1: Expert password locked (expert password is activated and locked) 2: Expert password unlocked (expert password is activated and unlocked)	Displays the current expert password status. Value description: 0: Expert password invalid (expert password is not set) - The expert password is set to 0. That is, no expert password is set. In this case, you can switch to the expert level directly through A0-11. 1: Expert password locked (expert password is activated and locked) - The expert password is set, and the expert-level parameters are locked. You need to enter the correct expert password to switch to the expert level through A0-11. 2: Expert password unlocked (expert password is activated and unlocked) - The expert password has been set and the correct expert password is entered. You can switch to the expert level directly through A0-11. Note: This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
A0-15	Expert password input	0	0 to 65535	Used to input the expert password. Note: If the data entered through A0-15 is consistent with that defined by A0-16, you can unlock the expert-level parameters. This parameter is an extended parameter, which can be displayed only when the parameter access level (A0-10) is "Extended" or higher.
A0-16	Expert password setting	0	0 to 65535	Defines the expert password. If this parameter is set to 0, the expert password is invalid. If this parameter is set to a non-zero value, the expert password is valid. Note: If the expert password is set, you need to enter the correct expert password through A0-15 before switching to the expert-level parameter through A0-11. If the password entered is incorrect, you cannot enter the expert level. This parameter is an expert parameter, which can be displayed only when the parameter access level (A0-10) is "Expert" or higher.

14.2.2 Switching Parameter Access Level

The parameter access level of the drive is set to "Standard level" by default. During use, you may switch to other parameter access levels as needed. The current parameter access level of the drive is displayed in A0-10 [Current system parameter access level].

The method for switching parameter access levels is shown in the figure below.

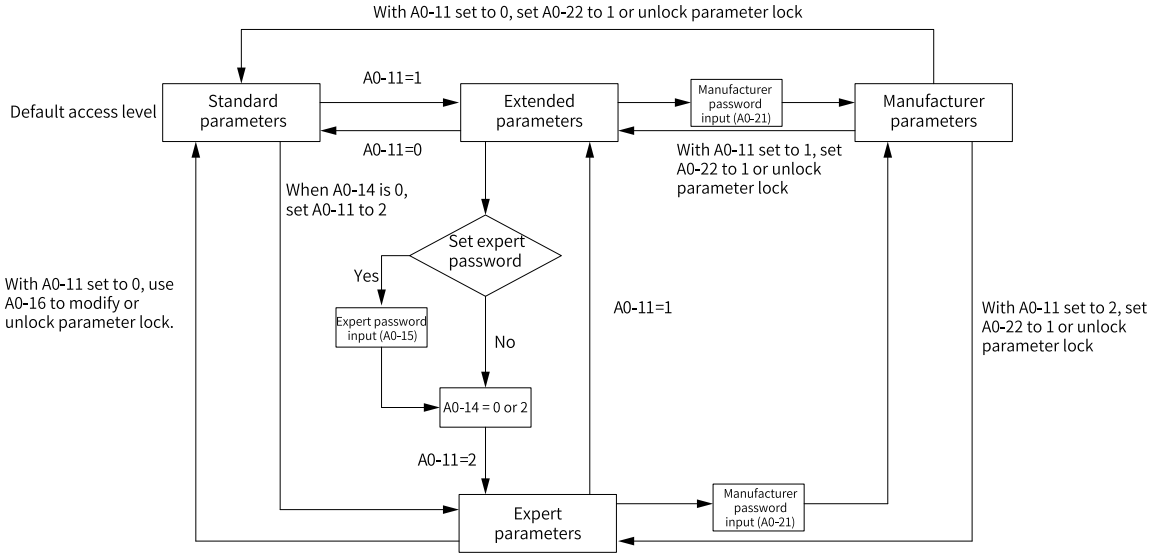


Figure 14-7 Parameter access level switchover

The following rules apply when switching parameter access levels:

1. You can switch between standard parameters and extended parameters through A0-11 [Parameter access level setting] directly.
   When A0-11 [Parameter access level setting] is set to 0 [Standard], the parameter access level is "Standard".

   When A0-11 [Parameter access level setting] is set to 1 [Extended], the parameter access level is "Extended".

2. Expert parameters
   When A0-14 [Expert password status display] is set to 0 [Expert password invalid] or 2 [Expert password unlocked], you can set A0-11 [Parameter access level setting] to 2 [Expert] to switch to expert parameters directly. At this point, the standard, extended, and expert parameters can be switched freely.

   When A0-14 [Expert password status display] is set to 1 [Expert password locked], set A0-11 [Parameter access level setting] to 1 [Extended] to switch to extended parameters first, then enter the set expert password to A0-15 [Expert password input]. After unlocking, A0-14 [Expert password status display] is set to 2 [Expert password unlocked]. At this point, you can switch to expert parameters by setting A0-11 [Parameter access level setting] to 2 [Expert].

3. There are three methods to exit expert parameters:
   Method 1: Modify the expert password in A0-16 [Expert password setting].

   Method 2: Set A0-11 [Parameter access level setting] to 0 [Standard] or 1 [Extended] to switch to standard or extended parameters.

   Method 3: The default expert password is 0. After you enter the expert parameter level after the set expert password is active, wait for one hour to allow the expert password unlock hold time elapses, at which point the expert level is exited automatically.

Switching from standard parameters to extended parameters

1. Check that A0-10 [Current system parameter access level] is set to 0 [Standard] in the default state.
2. Change the value of A0-11 [Parameter access level setting] to 1 [Extended].
3. Check that A0-10 [Current system parameter access level] is set to 1 [Extended], indicating that the system has switched from standard parameters to extended parameters.

Switching from standard parameters to expert parameters

- If A0-14 [Expert password status display] is set to 0 [Expert password invalid] or 2 [Expert password unlocked],
  You can set A0-11 [Parameter access level setting] to 2 [Expert] to switch to expert parameters directly.
- If A0-14 [Expert password status display] is set to 1 [Expert password locked],
  1. You can set A0-11 [Parameter access level setting] to 1 [Extended] to switch to extended parameters first.
  2. Enter the set expert password in A0-15 [Expert password input]. After unlocking, A0-14 [Expert password status display] is set to 2 [Expert password unlocked].
  3. Set A0-11 [Parameter access level setting] to 2 [Expert] to switch from standard parameters to expert parameters.

14.3 User-Defined Parameter Group

14.3.1 User-defined Parameter Group

Application scenario

You can group commonly used parameters scattered in different parameter groups into a single user-defined parameter group for easy access and commissioning.

Function description

Parameters (AE-00 to AE-31) in group AE are user-defined, consisting of a continuous set of parameters with consecutive communication addresses. You can set common parameters as user-defined parameters, with a maximum of 32 user-defined parameters allowed. You only need to enter the common parameter address to the user-defined parameter group. Accessing and modifying the mapped parameters in the user-defined parameter group is equivalent to accessing and modifying the common parameters in different parameter groups.

As shown below, scattered common parameters are consolidated into the user-defined parameter group for easy management.

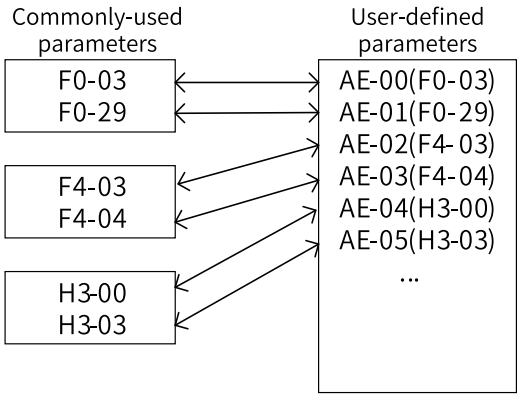


Figure 14-8 Mapping relationship between common parameters and user-defined parameter group

Related parameters

Param.	Name	Default value	Value range	Description
A0-72	User-defined parameter display mode	111	Ones: 0: Mask user mode 1: Show user mode Tens: 0: Mask calibration mode 1: Show calibration mode Hundreds: 0: Mask error menu 1: Show error menu	Used to determine whether the user-defined parameter group, user-modified parameter group, and error menu are displayed on the operating panel through the ones, tens, and hundreds.
AE-00	User parameter 0	F0-00	0x0000 to 0xFFFF	Defines user-defined parameters. AE-00 to AE-31 support setting of up to 32 user-defined parameters. Note: This group of parameters are user-defined. You can select desired parameters from all parameters and consolidate them into the AE group as user-defined parameters for easy management. You can switch to the -USER menu by holding the Back key down.
AE-01	User parameter 1	Same as AE-00	Same as AE-00	Same as AE-00
AE-02	User parameter 2	Same as AE-00	Same as AE-00	Same as AE-00
AE-03	User parameter 3	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default value	Value range	Description
AE-04	User parameter 4	Same as AE-00	Same as AE-00	Same as AE-00
AE-05	User parameter 5	Same as AE-00	Same as AE-00	Same as AE-00
AE-06	User parameter 6	Same as AE-00	Same as AE-00	Same as AE-00
AE-07	User parameter 7	Same as AE-00	Same as AE-00	Same as AE-00
AE-08	User parameter 8	Same as AE-00	Same as AE-00	Same as AE-00
AE-09	User parameter 9	Same as AE-00	Same as AE-00	Same as AE-00
AE-10	User parameter 10	Same as AE-00	Same as AE-00	Same as AE-00
AE-11	User parameter 11	Same as AE-00	Same as AE-00	Same as AE-00
AE-12	User parameter 12	Same as AE-00	Same as AE-00	Same as AE-00
AE-13	User parameter 13	Same as AE-00	Same as AE-00	Same as AE-00
AE-14	User parameter 14	Same as AE-00	Same as AE-00	Same as AE-00
AE-15	User parameter 15	Same as AE-00	Same as AE-00	Same as AE-00
AE-16	User parameter 16	Same as AE-00	Same as AE-00	Same as AE-00
AE-17	User parameter 17	Same as AE-00	Same as AE-00	Same as AE-00
AE-18	User parameter 18	Same as AE-00	Same as AE-00	Same as AE-00
AE-19	User parameter 19	Same as AE-00	Same as AE-00	Same as AE-00
AE-20	User parameter 20	Same as AE-00	Same as AE-00	Same as AE-00
AE-21	User parameter 21	Same as AE-00	Same as AE-00	Same as AE-00
AE-22	User parameter 22	Same as AE-00	Same as AE-00	Same as AE-00
AE-23	User parameter 23	Same as AE-00	Same as AE-00	Same as AE-00
AE-24	User parameter 24	Same as AE-00	Same as AE-00	Same as AE-00
AE-25	User parameter 25	Same as AE-00	Same as AE-00	Same as AE-00
AE-26	User parameter 26	Same as AE-00	Same as AE-00	Same as AE-00
AE-27	User parameter 27	Same as AE-00	Same as AE-00	Same as AE-00
AE-28	User parameter 28	Same as AE-00	Same as AE-00	Same as AE-00

Param.	Name	Default value	Value range	Description
AE-29	User parameter 29	Same as AE-00	Same as AE-00	Same as AE-00
AE-30	User parameter 30	Same as AE-00	Same as AE-00	Same as AE-00
AE-31	User parameter 31	Same as AE-00	Same as AE-00	Same as AE-00

14.3.2 Address Mapping

As shown in the following table, the parameter address for group AE is 0x2F00 to 0x2F1F. This address is used to establish mapping relationship. You can write the parameter address to this address directly to establish the mapping relationship. 0xAE00 to 0xAE1F are user parameter access addresses. After mapping relationship is established, these addresses are used to access common parameters. Reading from or writing to these addresses is equivalent to reading from or writing to the mapped parameters.

Table 14–2 Parameter address relationship in group AE

Param.	Function	Parameter address (establishing mapping relationship)	User parameter access address
AE-00	User parameter 0	0x2F00	0xAE00
AE-01	User parameter 1	0x2F01	0xAE01
AE-02	User parameter 2	0x2F02	0xAE02
AE-03	User parameter 3	0x2F03	0xAE03
AE-04	User parameter 4	0x2F04	0xAE04
AE-05	User parameter 5	0x2F05	0xAE05
AE-06	User parameter 6	0x2F06	0xAE06
AE-07	User parameter 7	0x2F07	0xAE07
AE-08	User parameter 8	0x2F08	0xAE08
AE-09	User parameter 9	0x2F09	0xAE09
AE-10	User parameter 10	0x2F0A	0xAE0A
AE-11	User parameter 11	0x2F0B	0xAE0B
AE-12	User parameter 12	0x2F0C	0xAE0C
AE-13	User parameter 13	0x2F0D	0xAE0D
AE-14	User parameter 14	0x2F0E	0xAE0E
AE-15	User parameter 15	0x2F0F	0xAE0F
AE-16	User parameter 16	0x2F10	0xAE10
AE-17	User parameter 17	0x2F11	0xAE11
AE-18	User parameter 18	0x2F12	0xAE12
AE-19	User parameter 19	0x2F13	0xAE13
AE-20	User parameter 20	0x2F14	0xAE14
AE-21	User parameter 21	0x2F15	0xAE15
AE-22	User parameter 22	0x2F16	0xAE16
AE-23	User parameter 23	0x2F17	0xAE17
AE-24	User parameter 24	0x2F18	0xAE18
AE-25	User parameter 25	0x2F19	0xAE19

Param.	Function	Parameter address (establishing mapping relationship)	User parameter access address
AE-26	User parameter 26	0x2F1A	0xAE1A
AE-27	User parameter 27	0x2F1B	0xAE1B
AE-28	User parameter 28	0x2F1C	0xAE1C
AE-29	User parameter 29	0x2F1D	0xAE1D
AE-30	User parameter 30	0x2F1E	0xAE1E
AE-31	User parameter 31	0x2F1F	0xAE1F

14.3.3 Establishing Mapping Relationship

Enter the address of common parameters to parameters in group AE (AE-00 to AE-31) to set the mapping relationship. The default value of AE-00 to AE-31 is 0xF000, indicating no parameter is mapped.

The mapping relationship can be established through the operating panel, iFA commissioning software, or communication.

You can enter the parameter address to be mapped to parameters AE-00...AE-31 through the operating panel/iFA software or through communication to establish the mapping relationship.

After the mapping relationship is established, scattered common parameters can be grouped into a single user-defined parameter group, which are directly displayed in the user menu. Additionally, reading and writing addresses 0xAE00 to 0xAE1F via communication is equivalent to reading and writing the addresses of common parameters.

Application instance 1: Configuring the mapping relationship between common parameters and user-defined parameter group through the operating panel

Establish the mapping relationship between AE-00 [User parameter 0] and F0-03 [Main command source of control channel 1] through the operating panel.

1. On the operating panel, locate the secondary menu for parameters in group AE. See details in section *"6.1 Operating Panel"*.
2. After locating AE-00, press 

to enter AE-00 mapping configuration, where the default display is uF0.00.
3. Press  again to adjust the mapped parameter. Press  three times consecutively to adjust it to uF0.03.
4. Press 

to complete mapping. In this case, the operating panel displays AE-01.

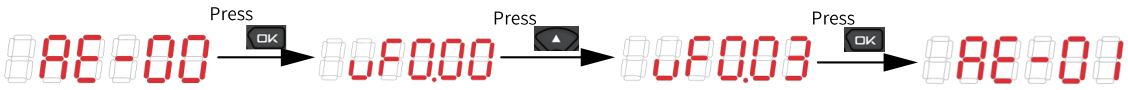
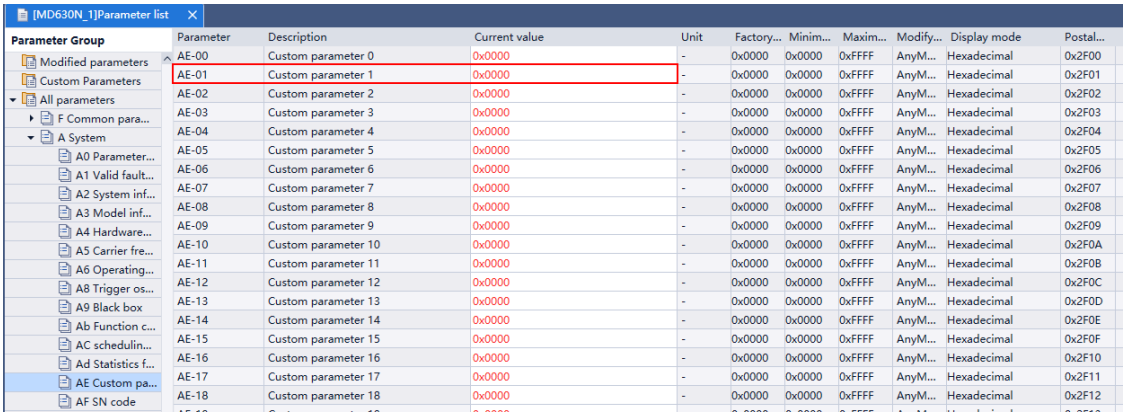


Figure 14-9 Configuring mapping relationship through the operating panel

Application instance 2: Configuring the mapping relationship between common parameters and user-defined parameter group through iFA software

Establish the mapping relationship between AE-01 [User parameter 1] and F0-29 [Main frequency source] through the iFA software.

1. In the iFA software, locate AE-01 in group AE, as shown in the figure below.



2. Enter 0xF01D to AE-01 and press Enter to complete mapping configuration, as shown in the figure below.

Parameter	Description	Current value	Unit	Factory...	Minim...	Maxim...
AE-00	Custom parameter 0	0x0000	-	0x0000	0x0000	0xFFFF
AE-01	Custom parameter 1	0xF01D	-	0x0000	0x0000	0xFFFF
AE-02	Custom parameter 2	0x0000	-	0x0000	0x0000	0xFFFF
AE-03	Custom parameter 3	0x0000	-	0x0000	0x0000	0xFFFF

Figure 14-10 Configuring mapping relationship through iFA software

Application instance 3: Configuring the mapping relationship between common parameters and user-defined parameter group through communication

Establish the mapping relationship between AE-02 [User parameter 2] and F4-03 [DI1 terminal function selection] through communication.

1. Write 0xF403 (F4-03 parameter address) to address 0x2F02 (AE-02 parameter address) to establish the mapping relationship.
2. Read the value at address 0xAE02 (user parameter access address of AE-02), and the value of F4-03 is returned.
3. Write 2 to address 0xAE02 (user parameter access address of AE-02), and the value 2 is written to F4-03.

Precautions

These user-defined parameters are displayed differently on the operating panel and the commissioning software. The operating panel displays the selected parameter name and the commissioning software displays the corresponding communication address.

For example, when the operating panel displays AE-00 [User-defined parameter 0] = uF0.03, the user-defined parameter 0 is F0-03 [Main command source of control channel 1]. On the commissioning software, the value of AE-00 corresponds to the communication address 0xF003 of F0-03 [Main command source of control channel 1].

14.3.4 QUICK Menu

The QUICK Menu on the operating panel includes four modes: Base (base) mode, User User-defined (user) mode, User Changed (-C-) mode, and Fault (-Err-) mode.

- Base (base) mode: Displays all parameters such as F0, F1..., A0...
- User User-defined (user) mode: Displays parameters mapped in group AE (namely common parameters). For example, mapped parameters such as F0-03, F0-29, and F4-03 are displayed in the user (User User-defined) mode. In this mode, you can view and modify the values of the mapped parameters.
- User Changed (-C-) mode: Displays parameters that have been changed, which are parameters with values different from default ones.
- Fault (-Err-) mode: Displays current fault information of the drive.

The following figure shows switchover among these four modes.

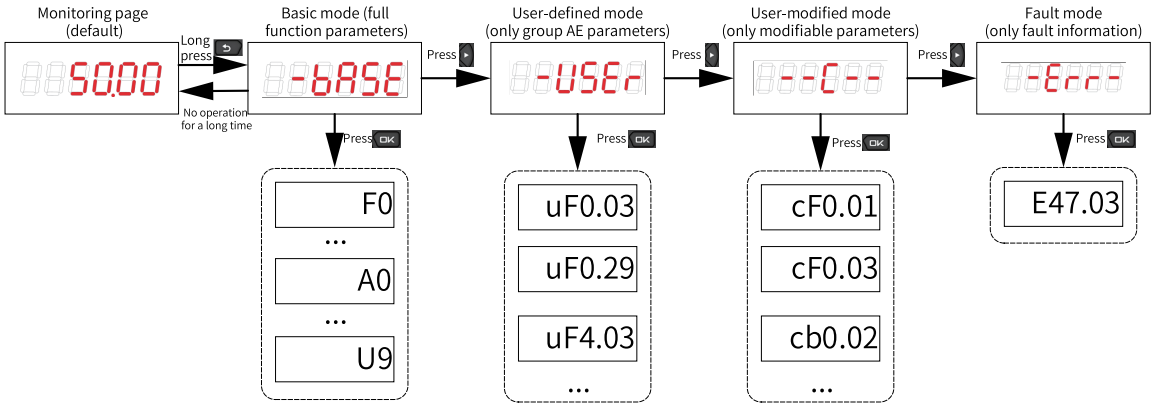


Figure 14-11 QUICK menu mode switchover

Application example: Modifying mapped parameters in user mode

You can view and set the values of the mapped parameters through the user mode in the QUICK menu of the operating panel. As shown in the following figure, you can enter user mode from the default monitoring screen, then access and set the mapped parameters in user mode.

Prerequisites

The mapping relationship from AE-00 to F0-03 and from AE-01 to F0-29 has been established.

Procedure

1. On the default monitoring page, hold down  to enter the QUICK menu.
2. After entering the QUICK menu, the default mode is base mode. Press  to select user mode.
3. When the operating panel displays "-user", press  to enter user mode, where the first mapped parameter in group AE is displayed, which is uF0.03 (F0-03).
4. Keep pressing  to select the second mapped parameter in group AE, which is uF0.29 (F0-29).

5. When "uF0.29" is displayed, press OK to access the current value of F0-29 (such as the value 3).
6. Keep pressing ▼ to modify the value of F0-29 (such as the value 2).
7. Press OK to save the value of F0-29.

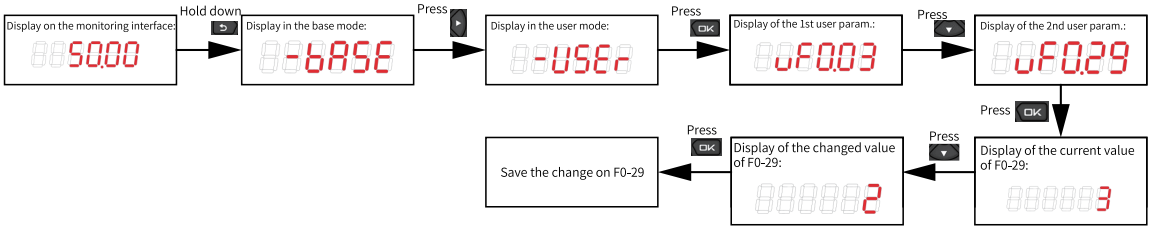


Figure 14-12 Example for entering user mode

The default value of AE-00 to AE-31 is 0xF000 (displayed as uF0.00 on the operating panel). In this case, only F0-00 is displayed in user mode.

14.4 Parameter Protection

14.4.1 Parameter Lock

14.4.1.1 Introduction To Parameter Lock

Application scenario

This product provides the parameter lock function, which can be used to lock all drive parameters after commissioning is done. In the locked state, no parameters can be viewed, copied, or downloaded, which means you can only view the monitoring parameters in the monitoring page of the operating panel and the user-defined parameter group in the user menu.

After commissioning is done on site, you can lock parameters to prevent parameters from be viewed by unauthorized personnel.

Function description

The parameter lock function is disabled by default. If you need to enable the parameter lock function, it is recommended to activate it only after all commissioning work is done to avoid frequent unlock during commissioning.

The mapped parameters in the user-defined parameter group are not locked by the parameter lock, so the parameter lock function can be used together with the user-defined parameter group, which means the user-defined parameter group can be used as an interface parameter group that contains monitoring parameters or non-critical commissioning parameters for simple monitoring and commissioning in the parameter lock state.

You can enable the parameter lock function through A0-31 [Parameter lock setting]. After the parameter lock password is set, a password is required for accessing parameters, preventing parameters from being viewed by unauthorized personnel.

The procedure for using the parameter lock is as follows.

- By default, the parameter lock password is inactive, and all users can access the parameters. After the parameter lock password is set through A0-31 [Parameter lock setting], the parameter menu of the drive is locked immediately.
- After the parameter menu is locked, it can only be unlocked by entering the correct password. After unlocking, A0-30 [Parameter lock status] displays the value 2 [Parameter lock unlocked], and parameters can be modified normally. After the parameter menu remains unlocked for a duration equal to the time set in A0-32 [Hold time of unlock state], the parameter menu is locked again automatically.
- After setting the parameter lock password and unlocking, in addition to waiting for the unlock hold time to expire, you can also set A0-33 [Lock parameter lock immediately] to 1 [Lock] to activate the parameter lock function.
- When A0-30 [Parameter lock status] is set to 0 [Parameter lock inactive], the settings on A0-33 [Lock parameter lock immediately] and A0-32 [Hold time of unlock state] are inactive, and a lock on the parameter menu will not be triggered.

Related parameters

Param.	Name	Default value	Value range	Description
A0-30	Parameter Lock Status	0	0: Inactive (parameter lock not set) 1: Locked (parameter lock setting activated, and locked) 2: Unlocked (parameter lock setting activated, and unlocked)	Displays the parameter lock status. Value description: 0: Inactive (parameter lock not set) - A0-31 [Parameter lock setting] is set to 0, which means the parameter lock is inactive. 1: Locked (parameter lock setting activated, and locked) - Parameter lock is set through A0-31 [Parameter lock setting], and the parameter lock is in the locked state. You need to enter the correct parameter lock to unlock it. 2: Unlocked (parameter lock setting activated, and unlocked) - Parameter lock is set through A0-31 [Parameter lock setting]. You need to enter the correct parameter lock to lock it. Note: 1 .If A0-31 [Parameter lock setting] is set to a non-zero value, the parameter lock is active. 2 .When the parameter lock is in the locked state, you need to enter a correct password to access the parameter list normally.
A0-31	Parameter lock setting	-	0 to 65535	Used to set the parameter lock. The setpoint 0 indicates the parameter lock is inactive, and the setpoint 1 indicates the parameter lock is active. Note: 1 .If A0-31 [Parameter lock setting] is set to a non-zero value, the parameter lock is active. 2 .When the parameter lock is in the locked state, you need to enter a correct password to access the parameter list normally.

Param.	Name	Default value	Value range	Description
A0-32	Hold time of unlock state	3600	60 to 65535s	Defines the duration for unlock state of the parameter lock. The timing starts when a correct password is entered and ends when the hold time elapses, at which point the parameter lock is locked automatically. Note: 1 .This parameter is active when the parameter lock is active (A0-31 is not 0). 2 .The parameter lock is automatically locked after the unlock time exceeds the hold time. In this case, you need to enter the correct parameter lock again to unlock the parameter.
A0-33	Lock parameter lock immediately	0	0: Not applied 1: Lock	Defines whether to lock the parameter lock manually. Value description: 0: Not apply - This function is inactive. 1: Lock - The parameter lock is locked. Note: 1 .This parameter is active when the parameter lock is active (A0-31 is not 0). 2 .When this parameter is set to 1, the parameter lock is locked immediately before the time defined by A0-32 elapses. You need to enter the correct parameter lock to unlock it. 3 .This parameter is set to 0 automatically after the parameter lock is locked.

Precautions

Keep the password properly for enabling the parameter lock function. An incorrect password prevents you from accessing parameters locked.

14.4.1.2 Setting the Password for Locking Parameters

It is recommended to set the parameter lock password after parameters are commissioned properly. This is to prevent frequent unlock of the parameter lock during commissioning.

The procedure for setting parameter lock is as follows.

1. Check that the drive commissioning is done.
2. Check that A0-30 [Parameter lock status] is set to 0 [Parameter lock deactivated (parameter lock not set)].
3. Record the password to be set, and enter it to A0-31 [Parameter lock setting].

After preceding settings are done, the parameter lock is activated. After the parameter lock is activated, a password prompt appears when you try to access parameters. Namely:

For the operating panel, you need to enter the password when access parameters in the base mode or -C– (User-changed) mode under the QUICK menu. For the iFA software, you need to enter the password when enter the parameter list.

14.4.1.3 Access To User-Defined Parameter Group with Parameter Locked

User-defined parameters (AE-00 to AE-31) and drive fault information are not affected by the parameter lock, which means even with a set parameter lock, you can still access user-defined parameters (AE-00 to AE-31) and drive fault information.

The parameter lock is generally used together with user-defined parameters during operation.

Prerequisites

The drive has done commissioning and ready to enter the operation state.

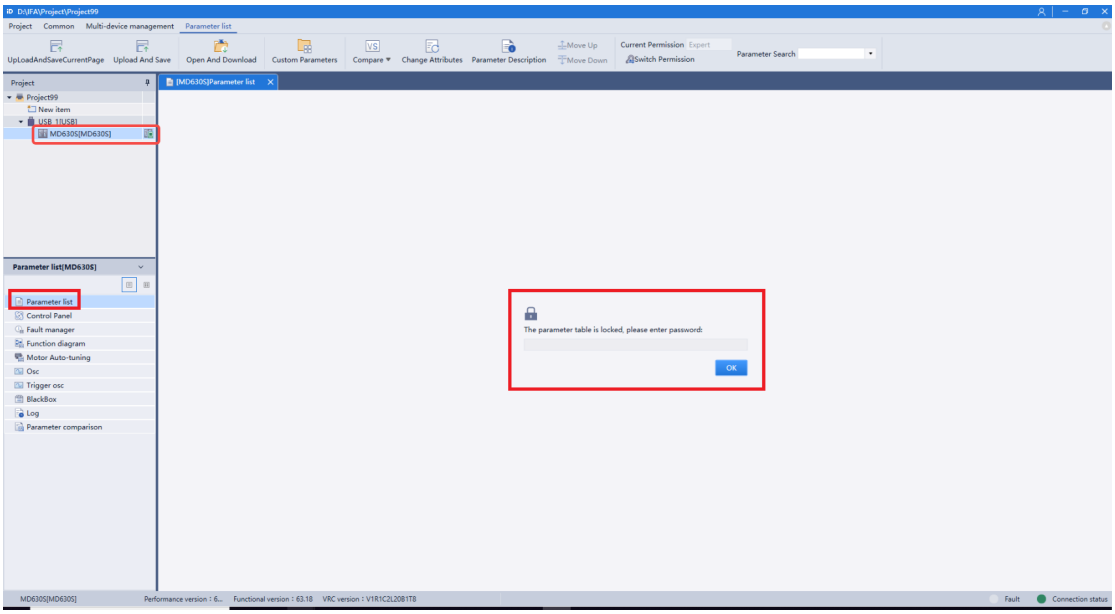
Procedure

1. Establish a mapping relationship between common parameters and user-defined parameters (AE-00 to AE-31).
   Open parameters in group AE, enter uF0.30 to AE-00 [User parameter 0], uF0.48 to AE-01 [User parameter 1], uF0.49 to AE-02 [User parameter 2], uF0.49 to AE-03 [User parameter 3], uU0.26 to AE-04 [User parameter 4], and uU0.61 to AE-05 [User parameter 5]. In this way, F0-30 [Digital reference of main frequency], F0-48 [Ramp-up time of ramp 1], F0-49 [Ramp-down time of ramp 1], U0-26 [Current operating time], and U0-61 [Drive status 1] to parameters in group AE. See section "User-Defined Parameter Groups" for details.
2. Check that A0-30 [Parameter lock status] is set to 0 [Parameter lock deactivated (parameter lock not set)].
3. Adjust A0-32 [Hold time of unlock state].
4. Enter the password to A0-31 [Parameter lock setting]. After entering the password, the parameters are locked and cannot be accessed normally (except for parameters in user-defined parameter groups).
5. Switch the operating panel to the user mode under the QUICK menu. Under the parameter lock condition, F0-30 [Digital reference of main frequency], F0-48 [Ramp-up time of ramp 1], F0-49 [Ramp-down time of ramp 1], U0-26 [Current operating time], and U0-61 [Drive status 1] can be accessed through the user-defined parameter group.

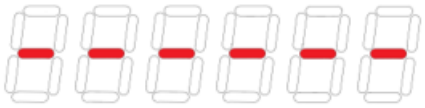
14.4.1.4 Unlocking Parameter Lock

Parameters cannot be accessed when the parameter lock is locked. Do as follows to unlock parameters.

- For iFA debugging software, click the "Parameter list" option, enter the set parameter lock password in the dialog box, and click "OK" to unlock.



- For the operating panel, switch to the base mode or -C- (User-changed) mode under the QUICK menu, enter the parameter lock password in the displayed "----", and click OK to unlock.



14.4.1.5 Modifying the Parameter Lock Password

When the parameter lock is unlocked, enter a different password in A0-31 [Parameter lock setting] to modify the password.

Note

The parameter lock is automatically locked after the password is modified.

14.4.1.6 Deactivating Parameter Lock

1. Set A0-31 [Parameter lock setting] to 0 in the unlock state.
2. The parameter lock function is deactivated when you set A0-30 [Parameter lock state] to 0 [Parameter lock inactive (parameter lock not set)].
   After the parameter lock is deactivated, access to parameters is not limited by the parameter lock.

14.4.1.7 Re-lock

Application scenarios

- The drive needs to be commissioned again (the user-defined parameter group cannot meet the commissioning requirements).
- The drive parameters need to be copied in batches.

Procedure

1. Check that the commissioning/copy operations are done.
2. Set A0-33 [Immediately lock parameter lock] to 1 [Lock] to immediately lock the parameter lock.

After preceding settings are done, the parameter lock is activated. After the parameter lock is activated, a password prompt appears when you try to access parameters. Namely:

For the operating panel, you need to enter the password when access parameters in the base mode or -C- (User-changed) mode under the QUICK menu. For the iFA software, you need to enter the password when enter the parameter list.

14.4.1.8 Non-lockable Functions

After the parameter lock is locked, the following functions are not affected.

For the operation panel:

1. The monitoring page is not affected.
2. All keys on the operating panel are not affected.
3. The user mode under the QUICK menu is not affected.
4. The Err menu is not affected.

For the iFA commissioning software:

1. The oscilloscope function is not affected.
2. The control panel function is not affected.
3. The fault management function is not affected.
4. The function of the function diagram is not affected.

14.4.2 Parameter Write Protection

Application scenarios

This function is used to prevent commissioning parameters from being modified inadvertently. After the write protection is enabled, all the drive parameters cannot be modified except those permitted for modification by the software.

Function description

Set the parameter write protection function through A0-44 [Parameter write protection enable]. When A0-44 [Parameter write protection enable] is set to 1 [Enable], the protection is activated. In this case, all the drive parameters cannot be modified except those permitted for modification by the software.

The following parameters can still be modified after parameter write protection is enabled.

Param.	Name	Description
A0-44	Parameter write protection	Used to set the parameter write protection function.
A0-11	Parameter access level	Defines the system parameter level. Value description: 0: Standard - The standard level can be accessed. 1: Expansion - The extended level can be accessed. 2: Expert - The expert level can be accessed. Note: If the expert password (A0-14) is locked, you cannot switch to expert level directly.
A0-15	Expert password input	Used to input the expert password. Note: If the data entered through A0-15 is consistent with that defined by A0-16, you can unlock the expert-level parameters.
A0-21	Manufacturer password input	Used to enter the manufacturer password. Note: After the correct manufacturer password is entered through A0-21, the manufacturer password is unlocked and the system automatically switches to the manufacturer level. A0-10 displays the manufacturer.

Param.	Name	Description
A0-22	Exit manufacturer level immediately	Defines whether to exit the manufacturer level immediately. Value description: 0: Not apply - This function is inactive. 1: Exit - The drive exits manufacturer level and switches to the level set by A0-11. Note: Automatic clear is performed after the manufacturer level is exited.
A0-33	Lock parameter lock immediately	Defines whether to lock the parameter lock manually. Value description: 0: Not apply - This function is inactive. 1: Lock - The parameter lock is locked. Note: 1. This parameter is active when the parameter lock is active (A0-31 is not 0). 2. When this parameter is set to 1, the parameter lock is locked immediately before the time defined by A0-32 elapses. You need to enter the correct parameter lock to unlock it. 3. This parameter is set to 0 automatically after the parameter lock is locked.

Unlike the parameter lock function, after enabling parameter write protection, you can still view the parameter menu and modify the parameter access level to check the drive parameter information.

Related parameters

Param.	Name	Default value	Value range	Description
A0-44	Parameter write protection	0	0: Disable 1: Enable	Defines whether the write protection of the drive parameters is enabled. After the parameter write protection is enabled, the drive parameters cannot be changed. 0: Disable - The parameter write protection is disabled. 1: Enable - Parameter-write protection is enabled. The drive parameters cannot be changed. Note: A0-11, A0-15, A0-33, and A3-00 are not controlled by A0-44.

14.5 Restoring Default Parameter Settings

You can restore designated parameters to default values through A0-00 [Parameter initialization]. After the operation is done, A0-00 [Parameter initialization] will be automatically reset to 0 [Not applied].

14.5.1 Restoring Default Parameters (Excluding Motor Parameters)

Application scenario

This function applies when motor parameters have been set, or when the motor parameters do not need to be reset for parameter initialization.

Function description

Set A0-00 [Parameter initialization] to 1 [Restoring default parameters (excluding motor parameters)] to restore the drive parameters (excluding motor parameters) to default values.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

14.5.2 Restoring Default Parameters (Including Motor Parameters)

Application scenario

This function applies when motor parameters have not been set, or when the motor parameters need to be reset for parameter initialization.

Function description

Set A0-00 [Parameter initialization] to 3 [Restoring default parameters (including motor parameters)] to restore the drive parameters (including motor parameters) to default values.

Note

- The parameters related to the power module model are restored to the default values of the model instead of the factory values.
- Do not clear log parameters.

14.5.3 Backing Up Current User Parameters

Application scenario

This function is used to back up the set parameters to the local drive.

Function description

Set A0-00 [Parameter initialization] to 4 [Back up current user parameters] to back up the parameters with default values changed by the user.

Note

Same as A0-39 (User backup) when it is set to 400.

14.5.4 Restoring Backup Parameters

Application scenario

This function is used to restore backup parameters in the drive.

Function description

Set A0-00 [Parameter initialization] to 501 [Restoring backup parameters] to restore parameters backed up by setting A0-00 to 4.

Note

Same as A0-38 (Backup parameter restore) when it is set to 500.

14.5.5 Clearing Log Information

Function description

Set A0-00 [Parameter initialization] to 2 [Clear log information] to clear the log parameters.

Note

- The parameters Ad-00 to Ad-17 are record parameters.
- The parameters in groups H6 to Hb of historical fault records are record parameters.
- P1-05 to P1-07 are record parameters in the simple PLC function.

14.5.6 Clearing Fault Information

Function description

Set A0-00 [Parameter Initialization] to 5 [Clear fault information] to clear the historical fault log parameters saved in groups H6 to Hb.

14.5.7 Restoring Default Parameters (Including Motor Parameters) and Clear Log Information

Application scenario

This function applies when motor parameters have not been set, or when the motor parameters need to be reset, and log parameters need to be cleared for parameter initialization.

Function description

Set A0-00 [Parameter initialization] to 503 [Restoring default parameters (including motor parameters) and clear log information] to restore the drive parameters (including motor parameters) to default values and clear the log information.

Note

The parameters related to the model are restored to the default values of the model instead of the factory values.

14.6 Clearing Log

14.6.1 Clearing Fault Log

Application scenarios

Parameter groups H6 to Hb of the drive is used to save fault log. After the current fault of the drive is rectified and reset, the fault log can be cleared through this function.

Function description

Set A0-00 [Parameter initialization] to 5 [Clear fault information], then execute parameter initialization to clear the fault log saved in parameter groups H6 to Hb.

Alternatively, set A0-00 [Parameter initialization] to 2 [Clear records] to clear fault log, but other logs such as cumulative operating time, cumulative power-on time, and cumulative power consumption will also be cleared together. Therefore, it is not recommended to clear the fault log by setting A0-00 to 2.

Related parameters

Param.	Name	Default value	Value range	Description
A0-00	Parameter initializa-tion	0	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: No action 1: Most of the function parameters are restored to default values, except manufacturer parameters, motor parameters, and log information. 2: Clear the fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption. 3: Most of the function parameters are restored to default values, except manufacturer parameters and log information. 4: The current parameter setpoints are backed up, which functions in the same way as the setpoint 400 of A0-39. 5: Clear the fault log information in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which functions in the same way as the setpoint 500 of A0-38. 503: Most of the function parameters are restored to default values, except manufacturer parameters. Manufacturer parameters include model parameters and manufacturer-calibrated parameters. Records include the fault log, cumulative operating time, and cumulative power-on time. Note: After parameters are restored to default values, this parameter is automatically restored to 0.

14.6.2 Clearing Log Information

Application scenarios

Records such as the cumulative operating time and cumulative power consumption will not be automatically reset after the drive is restarted. You can clear the log through this function.

Function description

Set A0-00 [Parameter initialization] to 2 [Clear log information], then execute parameter initialization to clear information including fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption.

Related parameters

Param.	Name	Default value	Value range	Description
A0-00	Parameter initialization	0	0: Not applied 1: Restore default parameters (excluding motor parameters) 2: Clear log information 3: Restore default parameters (including motor parameters) 4: Back up current user parameters 5: Clear fault log 501: Restore backup parameters 503: Restore default parameters (including motor parameters) and clear log information	0: No action 1: Most of the function parameters are restored to default values, except manufacturer parameters, motor parameters, and log information. 2: Clear the fault log, cumulative operating time, cumulative power-on time, and cumulative power consumption. 3: Most of the function parameters are restored to default values, except manufacturer parameters and log information. 4: The current parameter setpoints are backed up, which functions in the same way as the setpoint 400 of A0-39. 5: Clear the fault log information in groups H6 to Hb. 501: Parameters backed up by setting A0-00 to 4 are restored, which functions in the same way as the setpoint 500 of A0-38. 503: Most of the function parameters are restored to default values, except manufacturer parameters. Manufacturer parameters include model parameters and manufacturer-calibrated parameters. Records include the fault log, cumulative operating time, and cumulative power-on time. Note: After parameters are restored to default values, this parameter is automatically restored to 0.

14.7 SD Card Parameter Copy Timeout

Application scenarios

This function is mainly used in scenarios where a new drive is replaced after the original drive fails, which significantly reduces parameter tuning work.

Function description

The SD card parameter copy function is divided into four sub-functions: parameter reading, parameter writing, fault protection, and status monitoring:

(1) Parameter reading: Configuration parameters of the drive are read to the SD card to be saved, with the operating panel displaying "-rEAd" during parameter reading.

(2) Parameter writing: Configuration parameters saved in the SD card are written to the drive, with the operating panel displaying "-COPy" during parameter writing.

(3) Fault protection: If a fault (such as SD card disconnected/damaged/disturbed during copy) occurs during parameter copy, E178.1 (Parameter copy failure)/E178.2 (Parameter copy timeout) can be reported.

(4) Status monitoring: The SD card parameter copy state is displayed by U2-15.

Related parameters

Param.	Name	Default value	Value range	Description
A0-12	SD card parameter copy	0	Ones: Copy action selection 0: Idle 1: Read parameters (from the drive to SD card) 2: Write parameters (from SD card to the drive) Tens: Parameter copy index 0 to 9: 1st to 10th parameter set	① Used to trigger parameter copy: The ones is used to select the copy action and the tens is used to select which set of parameters to copy. ② After parameter copy is done, A0-12 is automatically cleared.
A0-13	SD card parameter copy mode	1	1: Copy all parameters (including motor parameters) 2: Copy some parameters (excluding motor parameters)	Used to set the SD card parameter copy mode (whether to copy motor parameters).
A0-29	SD card parameter copy timeout period	180s	0s to 65535s	Used to set the SD card parameter copying timeout period. If the parameter copy time exceeds this setpoint, the SD card parameter copy timeout fault E178.2 can be triggered.
U2-15	Parameter copy status of SD card	1	1: Idle 2: Parameter copy in progress 3: Parameter copied successfully 4: Failed to copy parameters	Displays the parameter copy status of the SD card.

Precautions

(1) Parameter copy is not allowed during operation. It can only be performed when the drive is stopped.

(2) During parameter copy, the local panel displays “-rEAd” or “-COPy” and cannot switch to other screens. Operation is also inhibited during this period.

(3) Some parameters are classified as "model parameters". These parameters are directly related to the specific hardware model configuration, physical characteristics, and core hardware information of the drive. Therefore, these parameters are not copied,
which include: Fd-00, n1-02 (Commissioning address), A0-00 (Parameter initialization), A0-37 (Backup clear), A0-38 (Backup recovery), A0-39 (User backup), A3-00 to A3-05 (Model, load, power, current, voltage, maximum current), A3-11 to A3-14 (Voltage/Current sampling calibration), A3-17/

A3-18 (Oversampling mode/delay), A3-30 (Transistor voltage drop), A3-31 to A3-46 (Dead zone parameters), A3-52/A3-53/A3-54 (Protection thresholds), A3-55 to A3-58 (Undervoltage/ Overvoltage thresholds), A3-59 (Protection command word), A3-65/A3-66 (Phase loss detection), A4-00/A4-02 (Braking unit parameters), AC-20 (Carrier frequency switchover threshold), and AF-00 to AF-63 (Serial number).

14.8 Modified Parameter List

Application scenarios

When parameters modified during function commissioning need to be modified again, you can locate the modified parameters through this list to improve the commissioning efficiency.

When parameters are modified inadvertently, you can locate the modified parameters through this list to restore these parameters.

Function description

The modified parameter list consolidates modified parameters from different groups into the same menu level. You can access this list through the operating panel or iFA commissioning software.

Application instance 1: Accessing the list through operating panel

You can view the list through the QUICK menu of the operating panel. For detailed information on the operation panel, see *"6.1 List of Commissioning Tools" on page 103*. For details on the QUICK menu, see *"14.3.1 User-defined Parameter Group" on page 784*.

The basic steps to access the list through the operating panel are shown in the figure below.

1. Hold down the  on the default monitoring page to enter the QUICK menu.
2. After entering the QUICK menu, the default mode is basic mode (-bASE). Press  to switch to user-change mode.
3. When the operation panel displays "–C–", press  to enter the user-change mode, where the first modified parameter cF1.01 (F1-01) will be displayed.
4. Keep pressing  to view the second modified parameter cF1.04 (F1-04).
5. When "cF1.04" is displayed, press  to access F1-04, where the parameter value shown in the figure is 6.70.
6. Press  or  to modify the value of F1-04 to 6.85.
7. Press  to save the modified value of F0-29.

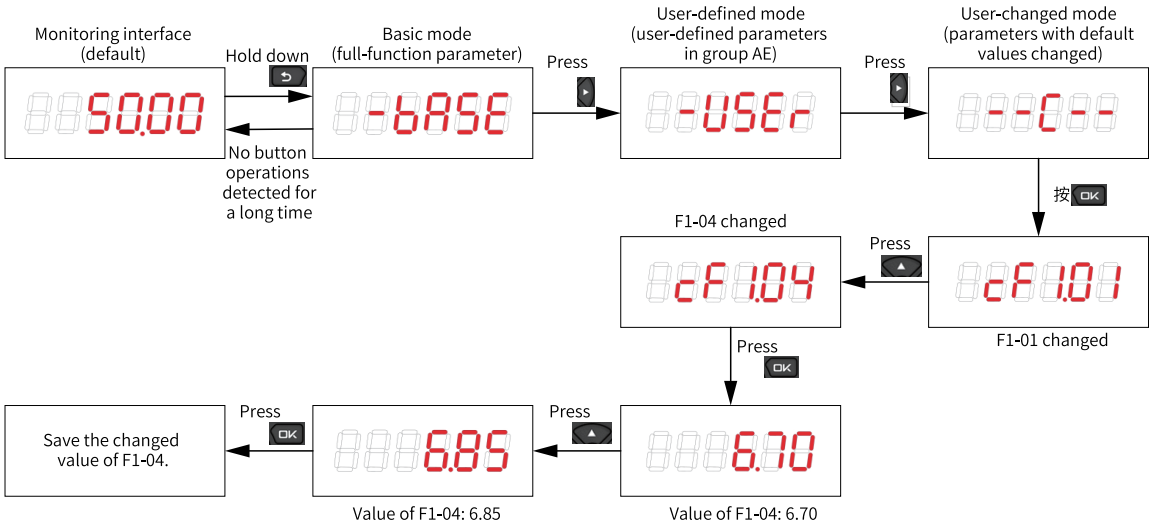


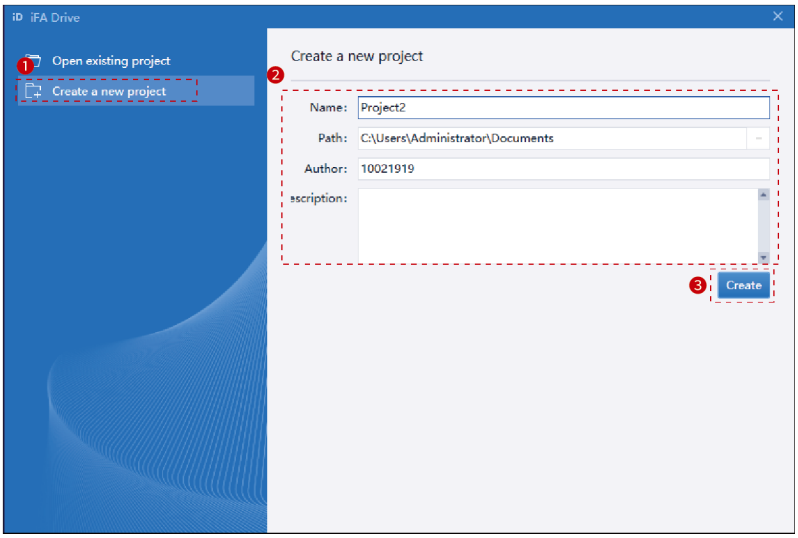
Figure 14-13 Accessing the list through operating panel

Application instance 2: Accessing the list of modified parameters through iFA commissioning software

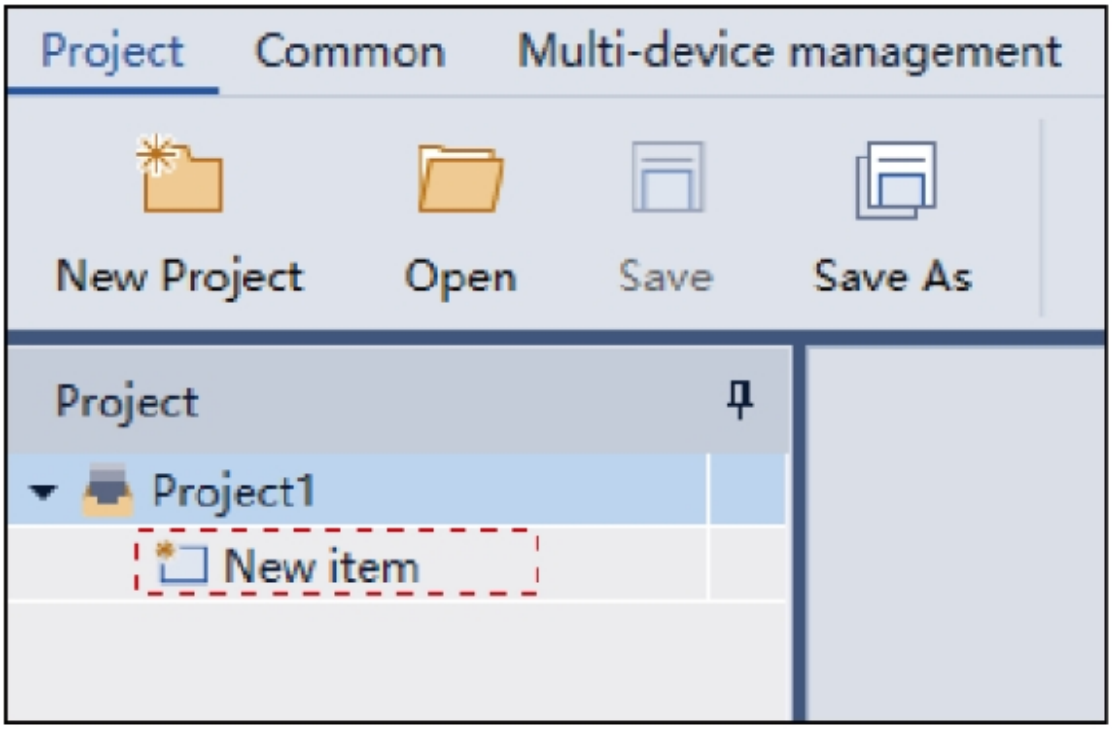
The iFA commissioning software can also synchronize and display the modified parameters of the drive. For detailed information on the iFA commissioning software functions, see *" iFA Commissioning Software" on page 120*.

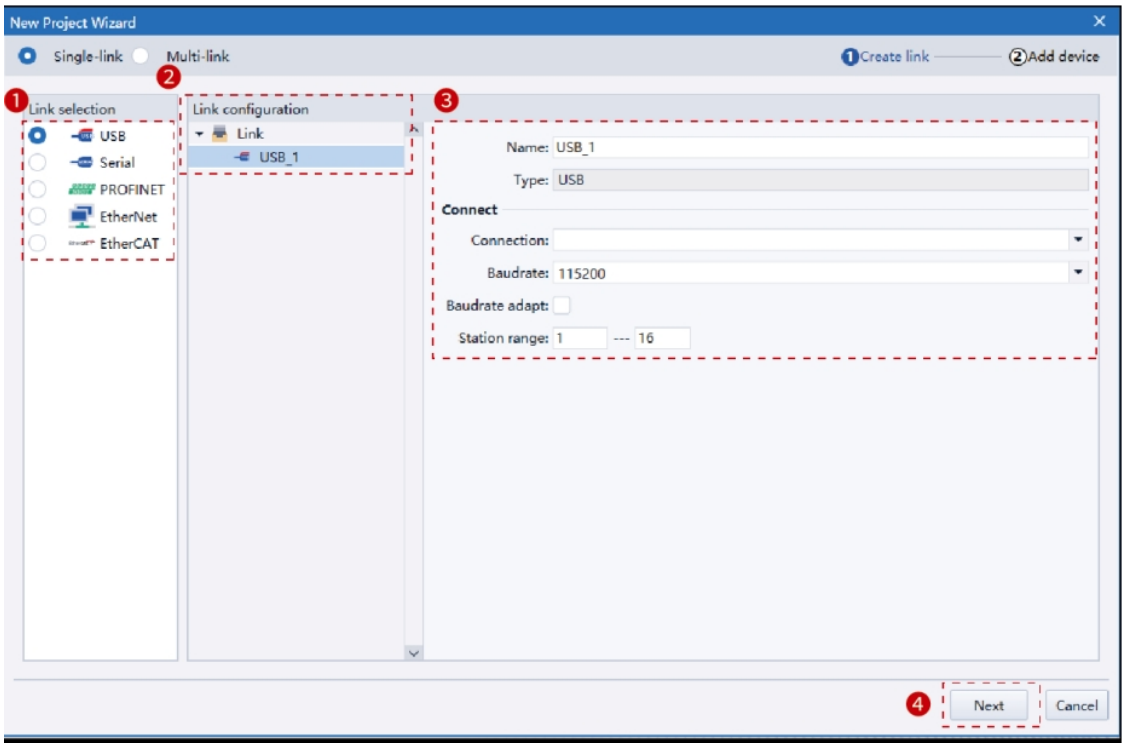
The basic steps to access the list of modified parameters through iFA commissioning software are as follows:

1. Open the iFA commissioning software, enter the project information, and click "Create" to create a new project.

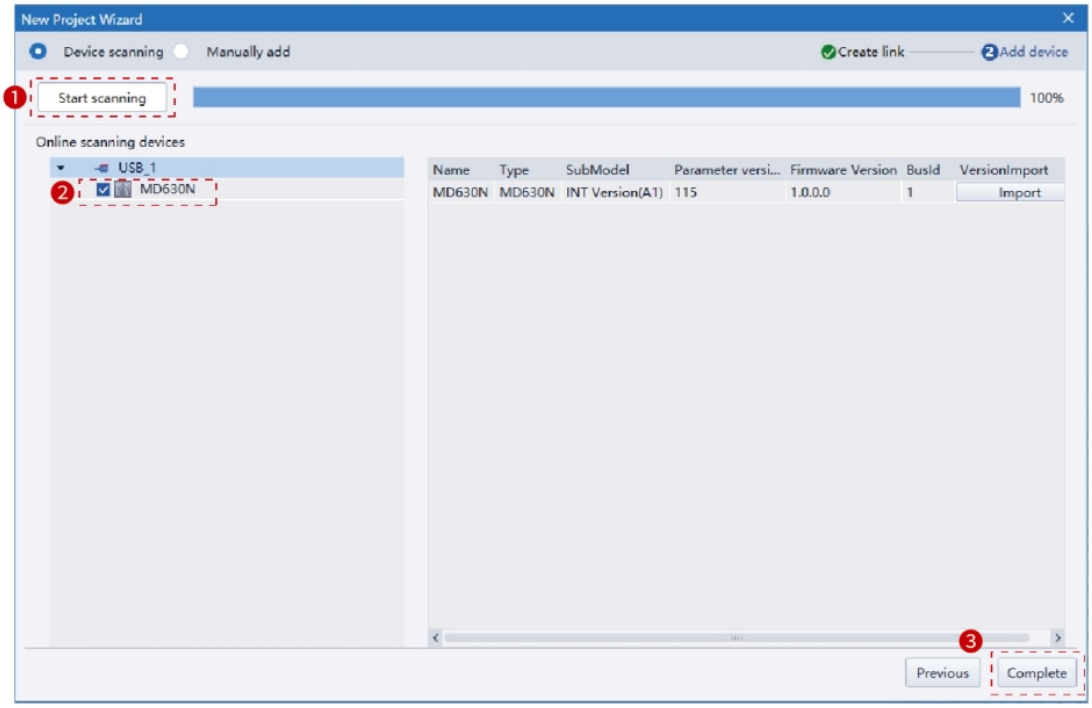


2. After entering the main page, click on the left side to add new items. In the wizard page displayed, enter information such as baud rate and station number, then click "Next".

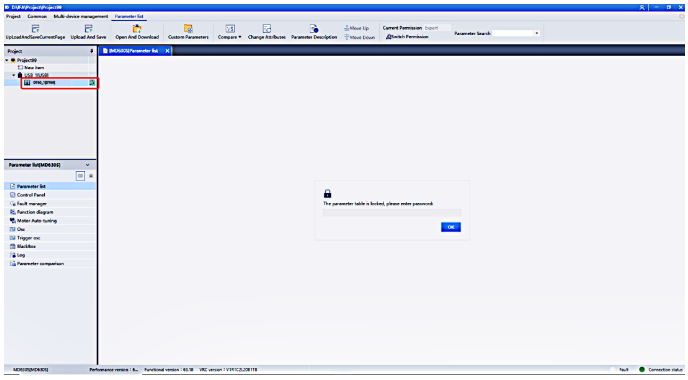


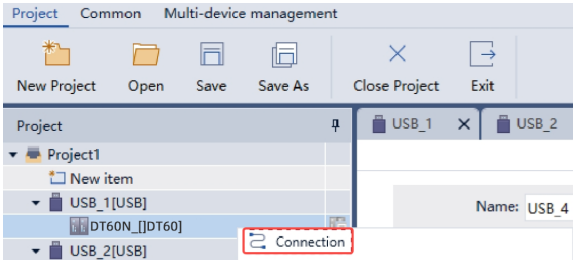


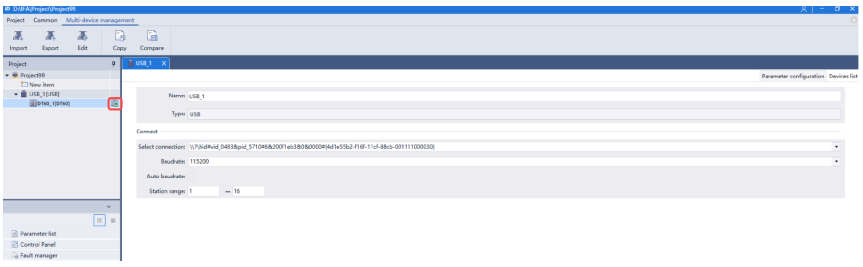
3. First, click "Start scanning" on the new page to scan for devices. After the connected device information is displayed, click "Done" to return to the main page.



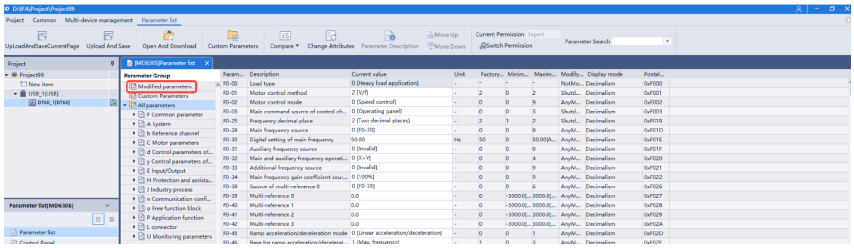
4. Right-click on the device name on the left side of the main page, which is DT60 her, and select "Connect device" in the pop-up menu. A green mark displayed besides the device name indicates this device has been connected successfully.



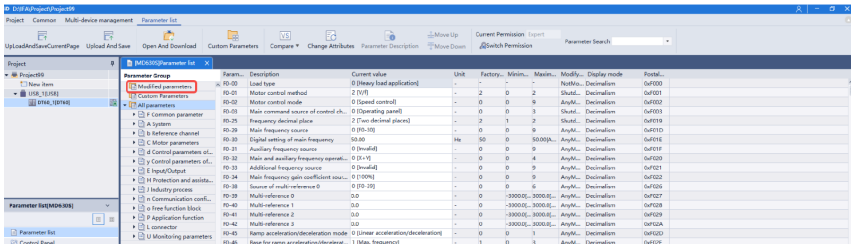


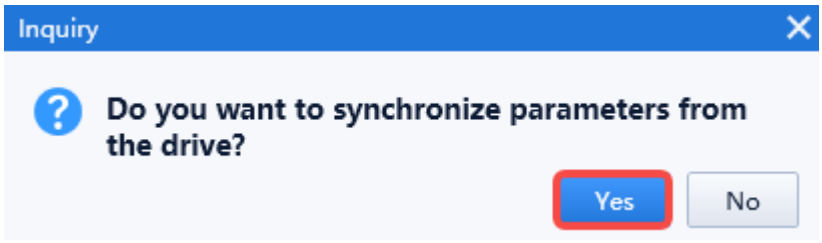


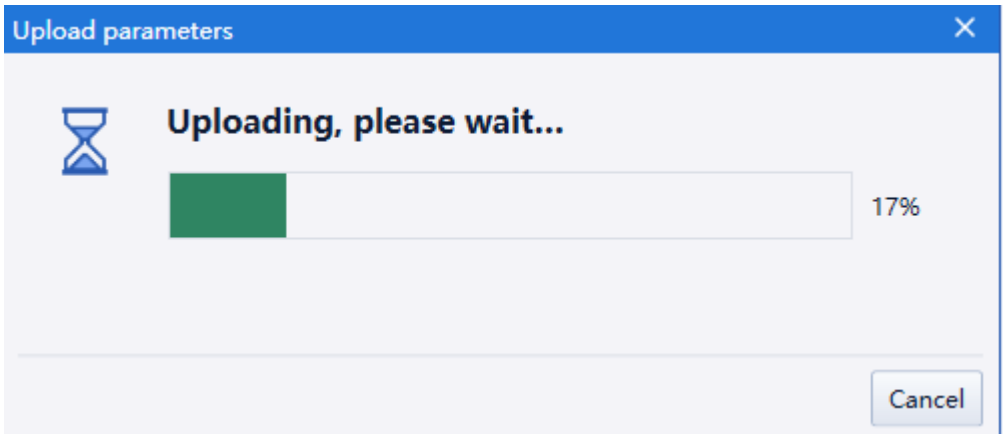
5. Next, click the parameter list on the left side to display parameters of the drive. Parameter groups are displayed on the right side.



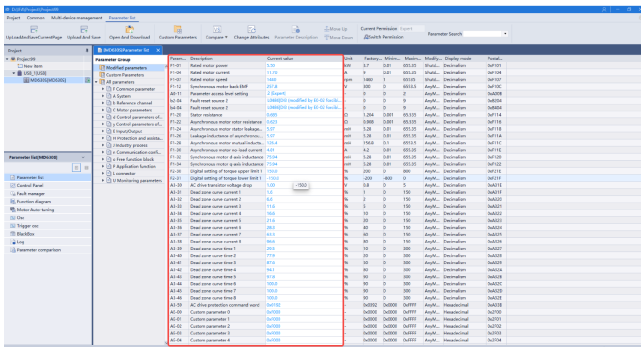
6. Click the modified parameters at the top of the parameter groups on the right side of the page. In the pop-up menu, click "Yes." Then the message "Uploading, please wait" is displayed, indicating that the modified parameters are being synchronized.







7. After synchronization is done, the modified parameters are displayed as follows. You can scroll up and down to view all the parameters, or click the current value input box of a parameter to modify it.



15 Parameters

15.1 Parameter Groups

15.1.1 Introduction To Parameter Groups

Application scenarios

Parameters are grouped based on functions for easy parameter management and setup. To achieve a specific function, locate the parameter group based on the function needed.

Function description

Parameters are displayed in three-level menus.

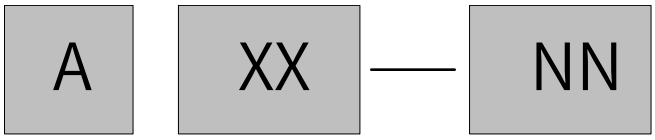


Figure 15-1 Parameter display

- The letter A indicates the level-1 menu, which is represented by one letter and corresponds to a group of complete functions. For example, group A corresponds to the system functions and group b corresponds to the command channel.
- The letter B indicates the level-2 menu, which is represented by one or two digits. The first and second level menus are combined to represent a specific group of functions. For example, group A0 is related to parameter management, and group A2 is related to system information.
- NN indicates the level-3 menu, which is represented by a 2-digit number, corresponding to a certain parameter when combined with level-1 and level-2 menus. For example, A0-00 is a system initialization parameter.
- Level-2 and level-3 menus are usually connected through the separator "-".

Parameter group

The parameter menu is divided by function category, such as system, motor parameters, reference channels, input/output, and communication configuration. Each group is further divided into different level-2 parameter groups based on specific functions.

The following table lists the parameter categories. Group F contains all the commonly-used parameters for easy commissioning.

Level-1 group name	Description	Level-2 group name	Description	Remarks
F	Common parameter	F0	Basic parameter setting	Basic motor commissioning parameters
		F1	Basic parameters of motor 1	Basic parameters of motor 1
		F2	Control parameters of motor 1	Basic control parameters of motor 1
		F4	I/O Parameters	Basic I/O setting parameters
		Fd	Basic communication parameters	Basic communication configuration parameters
A	System	A0	Parameter management	User parameters and device initialization parameters
		A1	Active faults and alarms	Active fault and alarm parameters
		A2	System information	Current system information storage parameters
		A3	Model information	AC drive model parameters
		A4	Hardware configuration	Fan and braking unit parameters
		A5	Carrier frequency and pulse generation configuration	Carrier frequency and pulse generation parameters
		A6	Operating panel and display	Operating panel parameters
		A8	Triggered Oscilloscope	Trigger oscilloscope function parameters
		Ab	Commissioning function	Internal commissioning function parameters
		AC	Scheduling configuration	Software scheduling time display parameters
		Ad	Statistics function	Statistics function parameters
		AE	User-defined parameters	User-defined parameters
		AF	SN code	SN code information display parameters
b	Reference channel	b0	Reference command configuration	Reference configuration parameters of the drive
		b1	Main command word of control channel 1	Reference configuration parameters of drive channel 1
		b2	Auxiliary command word of control channel 1	Auxiliary reference configuration parameters of channel 1
		b3	Main command word of control channel 2	Reference configuration parameters of channel 2
		b4	Auxiliary command word of control channel 2	Auxiliary reference configuration parameters of channel 2
		b5	Setting channel 1	Configuration parameters of setting channel 1
		b6	Setting channel 2	Configuration parameters of setting channel 2
		b7	Ramp (acceleration/ deceleration) setting	Ramp-up/down parameters of the drive
		b8	Multi-reference	Multi-reference value of the drive frequency
		b9	Terminal start/stop module	Parameters for start/stop through terminals

Level-1 group name	Description	Level-2 group name	Description	Remarks
C	Motor parameters	C2	Auto-tuning and self-test	Perform motor parameter auto-tuning.
		C4	Basic parameters of motor 1	Basic parameters of motor 1
		C5	Expansion parameters of motor 1	Expansion parameters of motor 1
		C7	Basic parameters of motor 2	Basic parameters of motor 2
		C8	Expansion parameters of motor 2	Expansion parameter of motor 2
		CA	Basic parameters of motor 3	Basic parameters of motor 3
		Cb	Expansion parameters of motor 3	Expansion parameters of motor 3
		Cd	Basic parameters of motor 4	Basic parameters of motor 4
		CE	Expansion parameters of motor 4	Expansion parameters of motor 4
d	Control parameters of motor 1/2	d0	Basic control of motor 1	Basic control parameters of motor 1
		d1	Limit and protection of motor 1	Limit and protection parameters of motor 1
		d2	Motor 1 - V/f control	Motor 1 - V/f control parameters
		d3	Speed control of motor 1	Speed control parameters of motor 1
		d4	Current control of motor 1	Current control parameters of motor 1
		d5	Motor 1 excitation control	Excitation control parameters of motor 1
		d6	Model of motor 1	Model parameters of motor 1
		d7	Control optimization of motor 1	Control optimization parameters of motor 1
		d8	Basic control of motor 2	Basic control parameters of motor 2
		d9	Limit and protection of motor 2	Limit and protection parameters of motor 2
		dA	Motor 2 - V/f control	Motor 2 - V/f control parameters
		db	Speed control of motor 2	Speed control parameters of motor 2
		dC	Current control of motor 2	Current control parameters of motor 2
		dd	Excitation control of motor 2	Excitation control parameters of motor 2
		dE	Model of motor 2	Model parameters of motor 2
		dF	Control optimization of motor 2	Control optimization parameters of motor 2

Level-1 group name	Description	Level-2 group name	Description	Remarks
y	Control parameters of motor 3/ 4	y0	Basic control of motor 3	Basic control parameters of motor 3
		y1	Limit and protection of motor 3	Limit and protection parameters of motor 3
		y2	Motor 3 - V/f control	Motor 3 - V/f control parameters
		y3	Speed control of motor 3	Speed control parameters of motor 3
		y4	Current control of motor 3	Current control parameters of motor 3
		y5	Motor 3 excitation control	Excitation control parameters of motor 3
		y6	Model of motor 3	Model parameters of motor 3
		y7	Control optimization of motor 3	Control optimization parameters of motor 3
		y8	Basic control of motor 4	Basic control parameters of motor 4
		y9	Limit and protection of motor 4	Limit and protection parameters of motor 4
		yA	Motor 4 - V/f control	Motor 4 - V/f control parameters
		yb	Speed control of motor 4	Speed control parameters of motor 4
		yC	Current control of motor 4	Current control parameters of motor 4
		yd	Motor 4 excitation control	Excitation control parameters of motor 4
		yE	Model of motor 4	Model parameters of motor 4
		yF	Control optimization of motor 4	Control optimization parameters of motor 4
E	Input/ Output	E0	DI	Input terminal parameters
		E1	DO/RO	Output terminal parameters
		EE	Input/Output calibration parameters - User	Input/Output calibration parameters - User
H	Protection and assistance	H1	Fault level setting	Fault level setting parameters of the drive
		H2	User-defined fault	User-defined fault setting parameters of the drive
		H3	Automatic fault reset/ restart	Fault reset and restart parameters of the drive
		H6	Historical fault log 1	Information of fault 1
		H7	Historical fault log 2	Information of fault 2
		H8	Historical fault log 3	Information of fault 3
		H9	Historical fault log 4	Information of fault 4
		HA	Historical fault log 5	Information of fault 5
		Hb	Historical fault log 6	Information of fault 6
n	Communi-cation configura-tion	n0	General communication configuration	General communication parameters
		n1	Commissioning communication	Function commissioning parameters
		n2	Modbus communication	Modbus communication parameters
		n3	CAN communication	CAN communication parameters
		n5	EtherNet/IP parameter	EtherNet/IP communication parameters
		n6	PROFINET parameter	PROFINET communication parameters
		nd	CiA 402 parameter	CiA 402 communication parameters
		nE	Process data address mapping	Mapping address setting parameters

Level-1 group name	Description	Level-2 group name	Description	Remarks
o	Free function block	o1	Constant setpoint	Constant setpoint module parameters
		o2	Multi-point curve	Multi-point curve module parameters
		o3	Word-to-bit module	Word-to-bit module parameters
		o5	Data conversion module	Data conversion module parameters
		o6	Logic operation 1	Logic operation module setting 1
		o7	Logic operation 2	Logic operation module setting 2
		o8	Arithmetic operation 1	Arithmetic operation module setting 1
		o9	Arithmetic operation 2	Arithmetic operation module setting 2
		oA	Switch selection function	Switch selection function module parameters
		ob	Control function 1	Control function module setting 1
		oC	Control function 2	Control function module setting 2
P	Application function	P0	Auxiliary functions	Auxiliary function parameters of the drive
		P1	Simple PLC	Simple PLC parameters
		P2	Process PID	Design PID parameters of the drive
		P3	Motorized potentiometer	Motorized potentiometer parameters
L	Connector	L00	Bit connector 1	Bit connector 1
		L01	Bit connector 2	Bit connector 2
		L02	Bit connector 3	Bit connector 3
		L03	Bit connector 4	Bit connector 4
		L04	Bit connector 5	Bit connector 5
		L06	Bit connector 7	Bit connector 7
		L10	Word connector 1	Word connector 1
		L11	Word connector 2	Word connector 2
		L12	Word connector 3	Word connector 3
		L20	Double-word connector 1	Double-word connector 1
		L22	Floating-point connector 1	Floating-point connector 1
		L23	Floating-point connector 2	Floating-point connector 2
		L24	Floating-point connector 1	Floating-point connector 1
		L25	Floating-point connector 2	Floating-point connector 2
		L30	Floating-point connector 9	Floating-point connector 9
		L31	Floating-point connector 10	Floating-point connector 10
		L33	Floating-point connector 12	Floating-point connector 12
U	Common monitoring	U0	Monitoring parameter 0	Monitoring parameter 0
		U1	Monitoring parameter 1	Monitoring parameter 1
		U2	Monitoring parameter 2	Monitoring parameter 2
		U3	Monitoring parameter 3	Monitoring parameter 3
		U4	Monitoring parameter 4	Monitoring parameter 4
		U6	Monitoring parameter 6	Monitoring parameter 6

15.1.2 Common Parameter Groups

Application scenarios

The drive supports common parameter group (Group F), which is combined by the common parameters from other groups. You can quickly configure common functions through parameters in group F.

Function description

As shown in the figure above, all parameters in Group F are mapped from common function parameters in other groups. In this user guide, parameters that have been mapped to group F are indicated with the mapped parameter in group F. Mapping parameters and mapped parameters in group F are equivalent in terms of function.

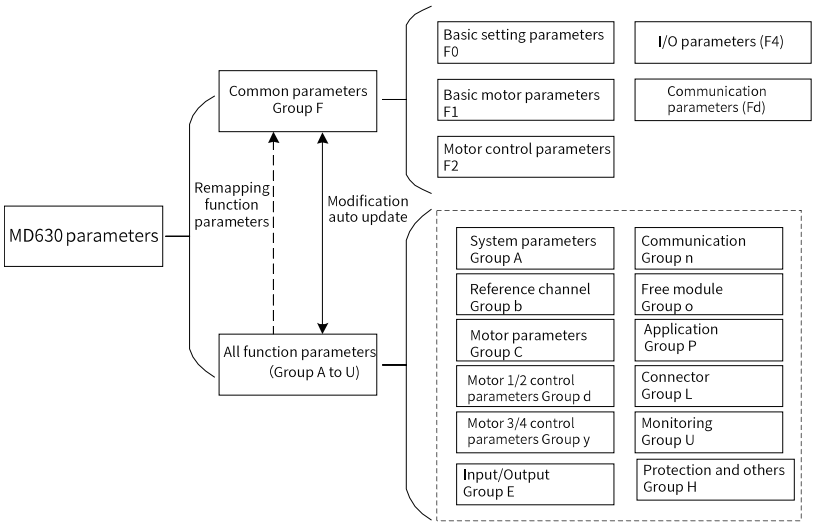


Figure 15-2 Parameter group diagram

Precautions

1. Operation commands can be set through two control channels. In group F, common parameters for operation commands in channel 1 (default channel) are provided.
2. Frequency/Torque references can be set through two setting channels. In group F, common parameters for frequency/torque references in channel 1 (default channel) are provided.
3. Multiple sets of motor parameters can be set. In group F, parameters related to motor 1 are provided.

15.2 Parameter List

See *"DT60 Series Distributed AC Drive Parameter Guide"* for detailed parameter description.

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-00	0xF000	Load type	0: High-load application 1: Low-load application	0	-	Read only
F0-01	0xF001	Motor control method	0: SVC 2: V/f	2	-	At stop
F0-02	0xF002	Motor control mode	0: Speed Control 1: Torque Control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8 : DI6 9: DI7 10 : DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
F0-03	0xF003	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: User-defined	0	-	At stop
F0-25	0xF019	Decimal places of frequency reference	1: One decimal place 2: Two decimal places	2	-	At stop
F0-29	0xF01D	Main frequency source	0: F0-30 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F0-30	0xF01E	Digital reference of main frequency	0.00 to A2-17	50.00	Hz	Real time
F0-31	0xF01F	Auxiliary frequency source	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F0-32	0xF020	Calculation relationship between main and auxiliary references	0: Main+Auxiliary Main - Auxiliary 2: Max. (|main|, |auxiliary) 3: Min. (|main|, |auxiliary|) 4: Main x Auxiliary	0	-	Real time
F0-33	0xF021	Additional frequency source	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-34	0xF022	Source of main frequency gain coefficient	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F0-38	0xF026	Source of multi-reference 0	0: F0-39 5: PID 6: b5-01/b-01 Other: F connector	0	-	Real time
F0-39	0xF027	Multi-reference 0	b8-42 to b8-43	0.0	-	Real time
F0-40	0xF028	Multi-reference 1	b8-42 to b8-43	0.0	-	Real time
F0-41	0xF029	Multi-reference 2	b8-42 to b8-43	0.0	-	Real time
F0-42	0xF02A	Multi-reference 3	b8-42 to b8-43	0.0	-	Real time
F0-45	0xF02D	Ramp-up/down mode	0: Linear ramp-up/down 1: S-curve ramp-up/down	0	-	Real time
F0-46	0xF02E	Ramp-up/down time base	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	1	-	Real time
F0-48	0xF030	Ramp-up time of ramp 1	0.0 to 6500.0	20.0	s	Real time
F0-49	0xF031	Ramp-down time of ramp 1	0.0 to 6500.0	20.0	s	Real time
F0-50	0xF032	Ramp-up start arc of ramp 1	0.00 to 650.00	0.00	s	Real time
F0-51	0xF033	Ramp-up end arc of ramp 1	0.00 to 650.00	0.00	s	Real time
F0-52	0xF034	Ramp-down start arc of ramp 1	0.00 to 650.00	0.00	s	Real time
F0-53	0xF035	Ramp-down end arc of ramp 1	0.00 to 650.00	0.00	s	Real time
F0-56	0xF038	Source of jog frequency 1	0: F0-57 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F0-57	0xF039	Digital reference of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F0-58	0xF03A	Source of jog frequency 2	0: F0-59 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F0-59	0xF03B	Digital reference of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real time
F0-62	0xF03E	Jog ramp source	0: Ramp time during normal operation 1: Ramp time during jogging	0	-	Real time
F0-63	0xF03F	Ramp-up time in jog	0.00 to 650.00	20.00	s	Real time
F0-64	0xF040	Ramp-down time in jog	0.00 to 650.00	20.00	s	Real time
F1-00	0xF100	Motor type	0: Regular asynchronous motor 2: Permanent magnet synchronous motor	0	-	At stop
F1-01	0xF101	Rated power of the motor	0.01 to 655.35	3.70	kW	At stop
F1-03	0xF103	Rated voltage of the motor	1 to 2000	380	V	At stop
F1-04	0xF104	Rated current of the motor	0.01 to 655.35	9.00	A	At stop
F1-06	0xF106	Rated frequency of the motor	0.01 to 599.00	50.00	Hz	At stop
F1-07	0xF107	Rated speed of the motor	1 to 65535	1460	rpm	At stop
F1-10	0xF10A	Maximum frequency of the motor	F1-06 to 599.00	50.00	Hz	At stop
F1-11	0xF10B	Minimum frequency of the motor	0.00 to F1-06	0.00	Hz	At stop
F1-12	0xF10C	Back EMF of synchronous motor	0.0 to 6553.5	300.0	V	Real time
F1-13	0xF10D	Maximum motor current	0.0 to 1000.0	1000.0	%	Real time
F1-14	0xF10E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop
F1-15	0xF10F	Number of effective motor pole pairs	0 to 128	0	-	Read only
F1-20	0xF114	Stator resistance	0.001 to 65.535	1.204	Ω	Real time
F1-22	0xF116	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real time
F1-24	0xF118	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F1-26	0xF11A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
F1-28	0xF11C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real time
F1-30	0xF11E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
F1-32	0xF120	d-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real time
F1-34	0xF122	q-axis inductance of synchronous motor	0.01 to 655.35	5.28	mH	Real time
F1-48	0xF130	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
F1-49	0xF131	Electromechanical time constant	0.01 to 655.35	1.00	s	Read only
F1-68	0xF144	Selective grounding	0: Ungrounded 1: Grounded	1	-	At stop
F1-69	0xF145	Motor parameter auto-tuning mode	0: No operation 1: Static partial parameter auto-tuning of asynchronous motor 2: Dynamic parameter auto-tuning of asynchronous motor 3: Static complete parameter auto-tuning of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic parameter auto-tuning of permanent magnet motor 13: Static partial parameter auto-tuning of permanent magnet motor UV gain deviation auto-tuning	0	-	At stop
F2-02	0xF202	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real time
F2-03	0xF203	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real time
F2-04	0xF204	Zero speed switchover frequency	0.0 to d3-09	1.0	%	Real time
F2-05	0xF205	Zero speed Kp calibration coefficient	0.0 to 1000.0	100.0	%	Real time
F2-06	0xF206	Zero speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
F2-07	0xF207	Low speed switchover frequency	0.0 to d3-12	10.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-08	0xF208	Low speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
F2-09	0xF209	Low speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
F2-10	0xF20A	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real time
F2-11	0xF20B	High speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
F2-12	0xF20C	High speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
F2-14	0xF20E	Motor direction selection	0: Default 1: Inverted direction	0	-	At stop
F2-15	0xF20F	Startup mode	0: Direct start 1: Flying start	0	-	At stop
F2-16	0xF210	Speed tracking mode	0: Starting from the frequency at stop 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	4	-	Real time
F2-17	0xF211	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	-	Real time
F2-20	0xF214	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
F2-21	0xF215	Negative speed selection	Same as F2-20	1	-	Real time
F2-22	0xF216	Digital reference of positive frequency upper limit 1	F2-26 to 800.0	800.0	%	At stop
F2-23	0xF217	Digital reference of negative frequency upper limit 1	-800.0 to F2-27	-800.0	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-24	0xF218	Source of positive frequency upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F2-25	0xF219	Source of negative frequency upper limit 2	0: 800% 1: Inverted value of F2-24 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
F2-26	0xF21A	Digital reference of positive frequency lower limit 1	0.0 to F2-22	0.0	%	At stop
F2-27	0xF21B	Digital reference of negative frequency lower limit 1	F2-23 to 0.0	0.0	%	At stop
F2-30	0xF21E	Digital reference of torque upper limit 1	0.0 to 800.0	150.0	%	Real time
F2-31	0xF21F	Digital reference of torque lower limit 1	-800.0 to 0.0	-150.0	%	Real time
F2-32	0xF220	Source of torque upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
F2-33	0xF221	Source of torque lower limit 2	0: 800% 1: Inverted value of F2-32 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
F2-36	0xF224	Over-excitation gain (V/f)	0 to 200	90	%	Real time
F2-37	0xF225	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
F2-38	0xF226	Overcurrent suppression threshold	80 to 300	200	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F2-39	0xF227	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression in vector control 0: Disable 1: Enable bit2 to bit15: Reserved	0x0	-	Real time
F2-40	0xF228	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real time
F2-43	0xF22B	Response to undervoltage	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real time
F2-44	0xF22C	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real time
F2-48	0xF230	Overmodulation coefficient	0.0 to 110.0	103.0	%	Real time
F2-50	0xF232	Carrier frequency reference	0.8 to 20.0	4.0	kHz	Real time
F2-51	0xF233	Effective carrier frequency	0.8 to 20.0	4.0	kHz	Read only
F4-00	0xF400	Terminal start/stop module A/B selection	0: Module A 1: Module B Other: B connector	0	-	At stop
F4-01	0xF401	Mode of terminal start/stop module A	0: Disable 1: IN1 for start 2: IN1 for start; IN2 for direction 3: IN1 for forward start; IN2 for reverse start 4: IN1P (rising edge) for start; IN2 for stop 5: IN1P (rising edge) for start; IN2 for stop; IN3 for direction 6: IN1P (rising edge) for forward start; IN2P (rising edge) for reverse start; IN3 for stop	3	-	At stop
F4-02	0xF402	Mode of terminal start/stop module B	Same as F4-01	3	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-03	0xF403	DI1 function selection	0: No function 1: Terminal control IN1 2: Terminal control IN2 3: Terminal control IN3 4: Jog 1 5: Jog 2 6: Used as UP key for frequency adjustment 7: Used as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: Normally open (NO) input of external fault 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Terminal 1 for acceleration/deceleration selection 17: Terminal 2 for acceleration/deceleration selection 18: Reserved 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Reserved 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC state reset 24 to 28: Reserved 29: Torque control inhibited 30: Reserved 31: Reserved 32: Immediate DC braking 33: Normally closed (NC) input of external fault 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 37: Reserved 38: PID integral paurse 39: Reserved 40: Reserved 41: Motor selection terminal 1 42: Reserved 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control selection 47: Emergency stop 48: Reserved 49: Decelerate to DC braking To be continued	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-03	0xF403	DI1 function selection	Continued 50: Clear current operating time 51: Positive limit 52: Negative limit 53 to 63: Reserved 64: Jog 1 via terminal B 65: Jog 2 via terminal B 66: Forced local control 67: Forced terminal control 68: Forced communication control 69: Forced user-defined control 70: Control channel selection 71: Reference channel selection 72: Terminal module A/B selection 73 to 75: Reserved 76: Motor selection terminal 2 77: Operation enable (all modes) 78: Forward operation permission 79: Negative operation permission 80: RFG input cleared	1	-	At stop
F4-04	0xF404	DI2 function selection	Same as F4-03	4	-	At stop
F4-05	0xF405	DI3 function selection	Same as F4-03	0	-	At stop
F4-06	0xF406	DI4 function selection	Same as F4-03	0	-	At stop
F4-07	0xF407	DI5 function selection	Same as F4-03	0	-	At stop
F4-08	0xF408	DI6 function selection	Same as F4-03	0	-	At stop
F4-09	0xF409	DI7 function selection	Same as F4-03	0	-	At stop
F4-10	0xF40A	DI8 function selection	Same as F4-03	0	-	At stop
F4-11	0xF40B	DI9 function selection	Same as F4-03	0	-	At stop
F4-12	0xF40C	DI10 function selection	Same as F4-03	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-14	0xF40E	RO output selection	0: No output 1: Operating 2: Fault output 3: Frequency level detection FDT1 4: Frequency arrival 5: Operating at zero speed (OFF at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8 to 10: Reserved 11: Simple PLC cycle completed 12: Cumulative operating time arrival 13: Oscillation frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit arrival 18: Frequency lower limit arrival (OFF at stop) 19: Undervoltage state 20: Communication 21: Brake output 22: Reserved 23: Operating at zero speed 2 (ON at stop) 24: Cumulative power-on time arrival 25: Frequency level detection FDT2 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing expired 31: Reserved 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current exceeds the limit 37: Frequency lower limit arrival (ON at stop) 38: Error output (fault/minor fault/alarm) 39: Motor overtemperature 40: Current operating time arrival 41: Fault (except undervoltage) 42: STO output 43: Minor fault or alarm	21	-	Real time
F4-15	0xF40F	DO1 function selection	Same as F4-14	0	-	Real time
F4-16	0xF410	DO2 function selection	Same as F4-14	0	-	Real time
F4-17	0xF411	DO3 function selection	Same as F4-14	0	-	Real time
F4-18	0xF412	DO4 function selection	Same as F4-14	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
F4-19	0xF413	DO5 function selection	Same as F4-14	0	-	Real time
F4-20	0xF414	DO6 function selection	Same as F4-14	0	-	Real time
Fd-00	0xFD00	Commissioning address (used by commissioning software/operating panel)	1 to 127	1	-	At stop
Fd-01	0xFD01	Communication type selection	2: EtherNet/IP 3: PROFINET	2	-	At stop
Fd-47	0xFD2F	MAC1 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x0070	-	Read only
Fd-48	0xFD30	MAC2 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00CA	-	Read only
Fd-49	0xFD31	MAC3 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x004D	-	Read only
Fd-50	0xFD32	MAC4 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only
Fd-51	0xFD33	MAC5 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only
Fd-52	0xFD34	MAC6 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only
Fd-58	0xFD3A	EtherNet/IP-DHCP enable	0: Disable 1: Enable	0	-	At stop
Fd-59	0xFD3B	EtherNet/IP-Most significant byte of IP address	0 to 255	0	-	At stop
Fd-60	0xFD3C	EtherNet/IP-Second most significant byte of IP address	0 to 255	0	-	At stop
Fd-61	0xFD3D	EtherNet/IP-Third byte of IP address	0 to 255	0	-	At stop
Fd-62	0xFD3E	EtherNet/IP-Least significant byte of IP address	0 to 255	0	-	At stop
Fd-63	0xFD3F	EtherNet/IP-Most significant byte of subnet mask	0 to 255	0	-	At stop
Fd-64	0xFD40	EtherNet/IP-Second most significant byte of subnet mask	0 to 255	0	-	At stop
Fd-65	0xFD41	EtherNet/IP-Third byte of subnet mask	0 to 255	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Fd-66	0xFD42	EtherNet/IP-Least significant byte of subnet mask	0 to 255	0	-	At stop
Fd-67	0xFD43	EtherNet/IP-Most significant byte of gateway	0 to 255	0	-	At stop
Fd-68	0xFD44	EtherNet/IP-Second most significant byte of gateway	0 to 255	0	-	At stop
Fd-69	0xFD45	EtherNet/IP-Third byte of gateway	0 to 255	0	-	At stop
Fd-70	0xFD46	EtherNet/IP-Least significant byte of gateway	0 to 255	0	-	At stop
Fd-76	0xFD4C	PROFINET-Most significant byte of the IP address	0 to 255	0	-	At stop
Fd-77	0xFD4D	PROFINET-Second most significant byte of the IP address	0 to 255	0	-	At stop
Fd-78	0xFD4E	PROFINET-Third byte of the IP address	0 to 255	0	-	At stop
Fd-79	0xFD4F	PROFINET-Least significant byte of the IP address	0 to 255	0	-	At stop
Fd-80	0xFD50	PROFINET-Most significant byte of the subnet mask	0 to 255	0	-	At stop
Fd-81	0xFD51	PROFINET-Second most significant byte of the subnet mask	0 to 255	0	-	At stop
Fd-82	0xFD52	PROFINET-Third byte of subnet mask	0 to 255	0	-	At stop
Fd-83	0xFD53	PROFINET-Least significant byte of subnet mask	0 to 255	0	-	At stop
Fd-84	0xFD54	PROFINET-Most significant byte of gateway	0 to 255	0	-	At stop
Fd-85	0xFD55	PROFINET-Second most significant byte of gateway	0 to 255	0	-	At stop
Fd-86	0xFD56	PROFINET-Third byte of gateway	0 to 255	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Fd-87	0xFD57	PROFINET-Least significant byte of gateway	0 to 255	0	-	At stop
A0-00	0xA000	Parameter initialization	0: No action 1: Restore parameters (excluding motor parameters) to default values 2: Clear log information 3: Restore parameters (including motor parameters) to default values 4: Back up current user parameters 5: Clear fault information 501: Restore user backup parameters 503: Restore parameters (including motor parameters) to default values and clear log information	0	-	At stop
A0-10	0xA00A	Current system parameter access level	0: Standard 1: Extended 2: Expert 3: Manufacturer	0	-	Read only
A0-11	0xA00B	Parameter access level	0: Standard 1: Extended 2: Expert	0	-	Real time
A0-12	0xA00C	SD card parameter copy	Ones: Copy selection 0: Idle 1: Read parameters (AC drive to SD card) 2: Write parameters (SD card to AC drive) Tens: Copy parameter index 0: Parameter set 1 1: Parameter set 2 2: Parameter set 3 3: Parameter set 4 4: Parameter set 5 5: Parameter set 6 6: Parameter set 7 7: Parameter set 8 8: Parameter set 9 9: Parameter set 10 Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
A0-13	0xA00D	SD card parameter copy mode	1: Copy all parameters (including motor parameters) 2: Copy partial parameters (excluding motor parameters)	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-14	0xA00E	Expert password status display	0: Inactive expert password (no expert password) 1: Expert password locked (The expert password is set but locked.) 2: Expert password unlocked (The expert password is set and unlocked.)	0	-	Read only
A0-15	0xA00F	Expert password input	0 to 65535	0	-	Real time
A0-16	0xA010	Expert password setting	0 to 65535	0	-	Real time
A0-20	0xA014	Manufacturer password state display	1: Manufacturer password locked 2: Manufacturer password unlocked	1	-	Read only
A0-21	0xA015	Manufacturer password input	0 to 65535	0	-	Real time
A0-22	0xA016	Exit manufacturer level immediately	0: No action 1: Exit	0	-	Real time
A0-26	0xA01A	Level of parameters accessed via communication	Ones: Permission for accessing parameters via external communication protocols 0: Limited by A0-10 1: Not limited Tens: Permission for accessing parameters via internal communication protocols 1: Not limited Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	11	-	Real time
A0-29	0xA01D	SD card parameter copy timeout period	10 to 600	180	s	Real time
A0-30	0xA01E	Parameter Lock Status	0: Inactive (parameter lock not set) 1: Locked (parameter lock has been set, locked state) 2: Unlocked (parameter lock has been set, unlocked state)	0	-	Read only
A0-31	0xA01F	Parameter lock setting	0 to 65535	0	-	Real time
A0-32	0xA020	Hold time of unlock state	60 to 65535	3600	s	Real time
A0-33	0xA021	Lock parameter lock immediately	0: No action 1: Enable	0	-	Real time
A0-37	0xA025	Backup parameter clear	0: No operation 500: Clear all user backup parameters 1000: Clear all motor backup parameters	0	-	At stop
A0-38	0xA026	Recovery of backup parameters	0: No action 500: Restore user backup parameters	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-39	0xA027	User backup	0: No operation 400: User parameter backup	0	-	At stop
A0-44	0xA02C	Parameter write protection	0: Disable 1: Enable	0	-	Real time
A0-47	0xA02F	Mask operating panel parameter group	bit0: Group F 0: Hide 1: Show bit1: Group A 0: Hide 1: Show bit2: Group b 0: Hide 1: Show bit3: Group C 0: Hide 1: Show bit4: group d 0: Hide 1: Show bit5: group y 0: Hide 1: Show bit6: group E 0: Hide 1: Show bit7: group H 0: Hide 1: Show To be continued	0xFFFF	-	Real time
A0-47	0xA02F	Mask operating panel parameter group	Continued bit8: Reserved 0: Hide 1: Show bit9: Group n 0: Hide 1: Show bit10: Group o 0: Hide 1: Show bit11: Group P 0: Hide 1: Show bit12: Group L 0: Hide 1: Show bit13: Group U 0: Hide 1: Show bit14: Reserved bit15: Reserved	0xFFFF	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A0-70	0xA046	Decimal places of frequency reference	1: One decimal place 2: Two decimal places	2	-	At stop
A0-71	0xA047	Number of decimal places for load speed display in group U0	Ones: Decimal places of U0-14/U0-24 0: No decimal place 1: One decimal place 2: Two decimal places Tens: Decimal places of U0-19/U0-29 1: One decimal place 2: Two decimal places Hundreds: Decimal places of U0-30/U0-31 0: No decimal place 1: One decimal place 2: Two decimal places Thousands: Decimal places of U0-69 1: One decimal place 2: Two decimal places Ten thousands: Reserved	2220	-	Real time
A0-72	0xA048	User-defined parameter display mode	Ones: User mode selection 0: Hide user mode 1: 1: Show user mode Tens: Calibration mode 0: Hide calibration mode 1: 1: Show calibration mode Hundreds: Error menu 0: Hide error menu 1: Show error menu Thousands: Reserved Ten thousands: Reserved	111	-	Real time
A1-00	0xA100	Active fault 1	0.0 to 6553.5	0.0	-	Read only
A1-01	0xA101	Additional information of active fault 1	0 to 65535	0	-	Read only
A1-02	0xA102	Active fault 2	0.0 to 6553.5	0.0	-	Read only
A1-03	0xA103	Additional information of active fault 2	0 to 65535	0	-	Read only
A1-04	0xA104	Active fault 3	0.0 to 6553.5	0.0	-	Read only
A1-05	0xA105	Additional information of active fault 3	0 to 65535	0	-	Read only
A1-06	0xA106	Active fault 4	0.0 to 6553.5	0.0	-	Read only
A1-07	0xA107	Additional information of active fault 4	0 to 65535	0	-	Read only
A1-08	0xA108	Active fault 5	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A1-09	0xA109	Additional information of active fault 5	0 to 65535	0	-	Read only
A1-10	0xA10A	Active fault 6	0.0 to 6553.5	0.0	-	Read only
A1-11	0xA10B	Additional information of active fault 6	0 to 65535	0	-	Read only
A1-12	0xA10C	Active minor fault 1	0.0 to 6553.5	0.0	-	Read only
A1-13	0xA10D	Additional information of active minor fault 1	0 to 65535	0	-	Read only
A1-14	0xA10E	Active minor fault 2	0.0 to 6553.5	0.0	-	Read only
A1-15	0xA10F	Additional information of active minor fault 2	0 to 65535	0	-	Read only
A1-16	0xA110	Active minor fault 3	0.0 to 6553.5	0.0	-	Read only
A1-17	0xA111	Additional information of active minor fault 3	0 to 65535	0	-	Read only
A1-18	0xA112	Active minor fault 4	0.0 to 6553.5	0.0	-	Read only
A1-19	0xA113	Additional information of active minor fault 4	0 to 65535	0	-	Read only
A1-20	0xA114	Active minor fault 5	0.0 to 6553.5	0.0	-	Read only
A1-21	0xA115	Additional information of active minor fault 5	0 to 65535	0	-	Read only
A1-22	0xA116	Active minor fault 6	0.0 to 6553.5	0.0	-	Read only
A1-23	0xA117	Additional information of active minor fault 6	0 to 65535	0	-	Read only
A1-24	0xA118	Active alarm 1	0.0 to 6553.5	0.0	-	Read only
A1-25	0xA119	Additional information of active alarm 1	0 to 65535	0	-	Read only
A1-26	0xA11A	Active alarm 2	0.0 to 6553.5	0.0	-	Read only
A1-27	0xA11B	Additional information of active alarm 2	0 to 65535	0	-	Read only
A1-28	0xA11C	Active alarm 3	0.0 to 6553.5	0.0	-	Read only
A1-29	0xA11D	Additional information of active alarm 3	0 to 65535	0	-	Read only
A1-30	0xA11E	Active alarm 4	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A1-31	0xA11F	Additional information of active alarm 4	0 to 65535	0	-	Read only
A1-32	0xA120	Active alarm 5	0.0 to 6553.5	0.0	-	Read only
A1-33	0xA121	Additional information of active alarm 5	0 to 65535	0	-	Read only
A1-34	0xA122	Active alarm 6	0.0 to 6553.5	0.0	-	Read only
A1-35	0xA123	Additional information of active alarm 6	0 to 65535	0	-	Read only
A1-36	0xA124	Active prompt 1	0.0 to 6553.5	0.0	-	Read only
A1-37	0xA125	Additional information of active prompt 1	0 to 65535	0	-	Read only
A1-38	0xA126	Active prompt 2	0.0 to 6553.5	0.0	-	Read only
A1-39	0xA127	Additional information of active prompt 2	0 to 65535	0	-	Read only
A1-40	0xA128	Active prompt 3	0.0 to 6553.5	0.0	-	Read only
A1-41	0xA129	Additional information of active prompt 3	0 to 65535	0	-	Read only
A1-42	0xA12A	Active prompt 4	0.0 to 6553.5	0.0	-	Read only
A1-43	0xA12B	Additional information of active prompt 4	0 to 65535	0	-	Read only
A1-44	0xA12C	Active prompt 5	0.0 to 6553.5	0.0	-	Read only
A1-45	0xA12D	Additional information of active prompt 5	0 to 65535	0	-	Read only
A1-46	0xA12E	Active prompt 6	0.0 to 6553.5	0.0	-	Read only
A1-47	0xA12F	Additional information of active prompt 6	0 to 65535	0	-	Read only
A2-00	0xA200	Base value of per-unit voltage	0.0 to 6553.5	0.0	V	Read only
A2-01	0xA201	Base value of per-unit current	0.0 to 6553.5	0.0	A	Read only
A2-02	0xA202	Base value of per-unit speed	0 to 65535	0	rpm	Read only
A2-04	0xA204	Per-unit base value of frequency	0.0 to 6553.5	0.0	Hz	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A2-05	0xA205	Per-unit base value of power	0.00 to 655.35	0.00	kW	Read only
A2-06	0xA206	Per-unit base value of torque	0.00 to 655.35	0.00	N·m	Read only
A2-09	0xA209	Base value of per-unit DC voltage	0 to 65535	0	V	Read only
A2-16	0xA210	Maximum output frequency of the system	0.0 to 6553.5	599.0	Hz	Read only
A2-17	0xA211	Effective value of the maximum motor frequency	0.00 to 655.35	50.00	Hz	Read only
A2-18	0xA212	Maximum effective frequency of the motor (fixed decimal place)	0.0 to 6553.5	50.0	Hz	Read only
A2-20	0xA214	Product code	0: Reserved 60: DT60	0	-	Read only
A2-21	0xA215	Device type	0: Reserved 4: DT60 (Bus version+STO)	0	-	Read only
A2-22	0xA216	Performance software version	0.00 to 655.35	0.00	-	Read only
A2-23	0xA217	Function software version	0.00 to 655.35	0.00	-	Read only
A2-24	0xA218	Performance software sub-version	0.00 to 655.35	0.00	-	Read only
A2-25	0xA219	Function software sub-version	0.00 to 655.35	0.00	-	Read only
A2-32	0xA220	Function version of the operating panel board	0 to 65535	0	-	Read only
A2-33	0xA221	Communication version of operating panel board	0 to 65535	0	-	Read only
A2-45	0xA22D	Bus software (auxiliary integrated circuit) version	0 to 65535	0	-	Read only
A2-90	0xA25A	VRC version parameter 1	0.00 to 655.35	0.00	-	Read only
A2-91	0xA25B	VRC version parameter 2	0.00 to 655.35	0.00	-	Read only
A2-92	0xA25C	VRC version parameter 3	0.00 to 655.35	0.00	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A2-93	0xA25D	VRC version parameter 4	0.00 to 655.35	0.00	-	Read only
A3-00	0xA300	Drive model	5: 0.37 kW [380 V] 6: 0.55 kW [380 V] 7: 0.75 kW [380 V] 8: 1.1 kW [380 V] 9: 1.5 kW [380 V] 10: 2.2 kW [380 V]	9	-	At stop
A3-01	0xA301	Load type	0: High-load application 1: Low-load application	0	-	At stop
A3-02	0xA302	Rated power of the drive	0.00 to 655.35	4.00	kW	Read only
A3-03	0xA303	Rated current of the drive	0.0 to 6553.5	9.0	A	Read only
A3-04	0xA304	Rated voltage of the drive	0 to 65535	380	V	Read only
A3-05	0xA305	Maximum current of the drive	0 to 600	150	%	Real time
A3-11	0xA30B	Bus voltage calibration coefficient	80.0 to 150.0	100.0	%	Real time
A3-12	0xA30C	Phase current calibration coefficient	85.0 to 115.0	100.0	%	Real time
A3-13	0xA30D	U/V current sampling coefficient	85.0 to 115.0	100.0	%	Real time
A3-14	0xA30E	U/W current sampling coefficient	85.0 to 115.0	100.0	%	Real time
A3-17	0xA311	Oversampling mode	0: Adaptive 1: Single point 2: 8 points 3: 16 points 4: 32 points 5: 64 points 6: Cyclic	0	-	At stop
A3-18	0xA312	Sampling delay	0.0 to 30.0	0.0	μs	At stop
A3-19	0xA313	Saving model parameters	0: Inactive 1: Enable	0	-	At stop
A3-20	0xA314	Model parameter download state	100: Wait for the model parameters to be downloaded 200: Model parameters are being downloaded 300: Model parameters downloaded successfully 400: Failed to download model parameter	100	-	Read only
A3-30	0xA31E	Voltage drop of the drive	0.00 to 5.00	0.80	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-31	0xA31F	Dead zone curve current 1	0.0 to 150.0	1.0	%	Real time
A3-32	0xA320	Dead zone curve current 2	0.0 to 150.0	2.0	%	Real time
A3-33	0xA321	Dead zone curve current 3	0.0 to 150.0	5.0	%	Real time
A3-34	0xA322	Dead zone curve current 4	0.0 to 150.0	10.0	%	Real time
A3-35	0xA323	Dead zone curve current 5	0.0 to 150.0	20.0	%	Real time
A3-36	0xA324	Dead zone curve current 6	0.0 to 150.0	40.0	%	Real time
A3-37	0xA325	Dead zone curve current 7	0.0 to 150.0	60.0	%	Real time
A3-38	0xA326	Dead zone curve current 8	0.0 to 150.0	80.0	%	Real time
A3-39	0xA327	Dead zone curve time 1	0.0 to 300.0	10.0	%	Real time
A3-40	0xA328	Dead zone curve time 2	0.0 to 300.0	20.0	%	Real time
A3-41	0xA329	Dead zone curve time 3	0.0 to 300.0	50.0	%	Real time
A3-42	0xA32A	Dead zone curve time 4	0.0 to 300.0	80.0	%	Real time
A3-43	0xA32B	Dead zone curve time 5	0.0 to 300.0	90.0	%	Real time
A3-44	0xA32C	Dead zone curve time 6	0.0 to 300.0	90.0	%	Real time
A3-45	0xA32D	Dead zone curve time 7	0.0 to 300.0	90.0	%	Real time
A3-46	0xA32E	Dead zone curve time 8	0.0 to 300.0	90.0	%	Real time
A3-51	0xA333	Drive overtemperature threshold	0 to 65535	0	°C	Read only
A3-52	0xA334	Drive pre-overtemperature margin	0.0 to 60.0	5.0	°C	Real time
A3-53	0xA335	Drive pre-overload threshold	0.0 to 100.0	90.0	%	Real time
A3-54	0xA336	User-defined software overcurrent threshold	0.0 to 600.0	300.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-55	0xA337	Undervoltage threshold	300.0 to 440.0	350.0	V	Real time
A3-56	0xA338	Effective value of undervoltage threshold	300.0 to 440.0	350.0	V	Read only
A3-57	0xA339	Overvoltage threshold	650.0 to 820.0	820.0	V	Real time
A3-58	0xA33A	Effective value of overvoltage threshold	650.0 to 820.0	820.0	V	Read only
A3-59	0xA33B	Protection command word of the drive	bit0: Input phase loss detection (hardware) 0: Disable 1: Enable bit1: Input phase loss detection (software) 0: Disable 1: Enable bit2: Low-frequency derating off 0: ON 1: OFF bit3: Overvoltage reported or not at stop 0: Reported 1: Not reported bit4: Zero drift fault 0: Disable 1: Enable bit5: Bus voltage sampling analysis 0: Disable 1: Enable bit6: Software overcurrent 0: Disable 1: Enable bit7: CBC 0: Disable 1: Enable bit8: Overload curve 0: Disable 1: Enable bit9: Junction temperature estimation 0: Disable 1: Enable bit10: Capacitor leakage 0: Disable 1: Enable bit11 to bit15: Reserved	0x0193	-	Real time
A3-65	0xA341	Software detection range of input phase loss	10.0 to 500.0	65.0	V	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A3-66	0xA342	Software detection time of input phase loss	1.0 to 10.0	2.0	s	Real time
A3-67	0xA343	Automatic reset of undervoltage fault	0: Enable 1: Disable	0	-	Real time
A3-72	0xA348	Leakage current threshold	50.0 to 100.0	100.0	%	At stop
A3-73	0xA349	High frequency pulses for leakage detection	1 to 1000	6	-	At stop
A3-74	0xA34A	High frequency voltage threshold for leakage detection	1 to 1000	50	V	At stop
A3-75	0xA34B	Low frequency voltage threshold for leakage detection	1 to 1000	300	V	At stop
A3-78	0xA34E	Sampling configuration	bit0: Bus voltage lead-lag filter 0: Disable 1: Enable bit1: Calculation of effective phase value 0: Disable 1: Enable bit2 to bit4: Reserved bit5: Compatible model switchover 0: Default model 1: Compatible model bit6 to bit15: Reserved	0x0001	-	Real time
A4-00	0xA400	Braking unit activation voltage	600.0 to 820.0	760.0	V	At stop
A4-01	0xA401	Effective activation voltage of the braking unit	600.0 to 820.0	760.0	V	Read only
A4-02	0xA402	Braking duty cycle	0 to 100	100	%	Real time
A4-06	0xA406	Built-in/External braking resistor selection	0: Built-in braking resistor 1: External braking resistor	0	-	At stop
A4-11	0xA40B	General fan control mode	0: Operating during operation (operating at temperatures higher than 70°C in the stop state) 1: Operating continuously 2: Temperature-based operation	0	-	Real time
A4-50	0xA432	Parameter error detection upon power-off	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A4-51	0xA433	Power-on delay time	0.0 to 5.0	0.0	s	Real time
A4-52	0xA434	Zero drift error detection time	0.0 to 10.0	5.0	s	Real time
A5-00	0xA500	Maximum carrier frequency	0.0 to 24.0	16.0	kHz	Read only
A5-01	0xA501	Carrier frequency reference	0.8 to 20.0	4.0	kHz	Real time
A5-02	0xA502	Effective carrier frequency	0.8 to 20.0	4.0	kHz	Read only
A5-03	0xA503	DPWM up transfer frequency	5.0 to 6000.0	2000.0	Hz	Real time
A5-04	0xA504	Dead zone compensation mode	0: No compensation 1: Compensation mode 1	1	-	Real time
A5-05	0xA505	Cutoff frequency for dead zone compensation	0.0 to 6000.0	2000.0	Hz	Real time
A5-06	0xA506	Overmodulation coefficient	0.0 to 110.0	103.0	%	Real time
A5-08	0xA508	PWM command word	bit0: Carrier frequency adjusted with temperature 0: Disable 1: Enable bit1: Carrier frequency adjusted with synchronous frequency 0: Disable 1: Enable bit2: Synchronous modulation enable 0: Disable 1: Enable bit3: Reserved bit4: Output voltage calculation mode 0: High speed 1: High precision bit5: Overmodulation mode 0: Amplitude 1: Phase bit6: Common-mode suppression enable 0: Disable 1: Enable bit7: DPWM carrier frequency processing 0: Disable 1: Enable bit8 to bit15: Reserved	0x0022	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A5-09	0xA509	Hysteresis for adjusting carrier frequency with synchronous frequency	0.0 to 100.0	3.0	Hz	Real time
A5-10	0xA50A	Starting frequency for adjusting carrier frequency with synchronous frequency	0.0 to 600.0	5.0	Hz	Real time
A5-11	0xA50B	Random PWM depth	0 to 10	0	-	Real time
A5-12	0xA50C	Carrier frequency upper limit at low speed (V/f)	0.8 to 20.0	20.0	kHz	Real time
A5-15	0xA50F	Common mode suppression time	0.0 to 1000.0	5.0	μs	Real time
A6-01	0xA601	STOP/RESET key function	0: Active only in operating panel control mode 1: Active for ON_OFF1 (start/stop) command 2: Active for OFF2 (coast to stop) command 3: Active for OFF3 (quick stop)	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-03	0xA603	Parameter 1 displayed on LED operating panel during operation	bit0: Operating frequency (Hz) 0: Not displayed 1: Displayed bit1: Frequency reference (Hz) 0: Not displayed 1: Displayed bit2: Bus voltage (V) 0: Not displayed 1: Displayed bit3: Output voltage (V) 0: Not displayed 1: Displayed bit4: Output current (A) 0: Not displayed 1: Displayed bit5: Output power (kW) 0: Not displayed 1: Displayed bit6: Output torque (%) 0: Not displayed 1: Displayed bit7: DI input status 0: Not displayed 1: Displayed bit8: DO output state 0: Not displayed 1: Displayed bit9: Reserved 0: Not displayed 1: Displayed bit10: Reserved 0: Not displayed 1: Displayed bit11 to bit13: Reserved bit14: Load speed display 0: Not displayed 1: Displayed bit15: PID setting 0: Not displayed 1: Displayed	0x1F	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-04	0xA604	Parameter 2 displayed on LED operating panel during operation	bit0: PID feedback 0: Not displayed 1: Displayed bit1: PLC stage 0: Not displayed 1: Displayed bit2: Reserved bit3: Operating frequency 2 (Hz) 0: Not displayed 1: Displayed bit4: Remaining operating time 0: Not displayed 1: Displayed bit5: Reserved 0: Not displayed 1: Displayed bit6: Free mapping 0 0: Not displayed 1: Displayed bit7: Free mapping 1 0: Not displayed 1: Displayed bit8: Motor speed 0: Not displayed 1: Displayed bit9: Current power-on time (min) 0: Not displayed 1: Displayed bit10: Current operating time (min) 0: Not displayed 1: Displayed bit11: Reserved bit12: Reference set through communication 0: Not displayed 1: Displayed bit13: Encoder feedback speed 0: Not displayed 1: Displayed bit14: Display of main frequency 0: Not displayed 1: Displayed bit15: Display of auxiliary frequency Y 0: Not displayeded 1: Displayed	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-05	0xA605	Parameter displayed on LED operating panel at stop	bit0: Frequency reference (Hz) 0: Not displayed 1: Displayed bit1: Bus voltage (V) 0: Not displayed 1: Displayed bit2: DI input status 0: Not displayed 1: Displayed bit3: DO output state 0: Not displayed 1: Displayed bit4 to bit8: Reserved bit9: PLC phase 0: Not displayed 1: Displayed bit10: Reserved bit11: PID setting 0: Not displayed 1: Displayed bit12: Reserved bit13: Reserved bit14: Free mapping 0 0: Not displayed 1: Displayed bit15: Free mapping 1 0: Not displayed 1: Displayed	0x3	-	Real time
A6-07	0xA607	Address displayed by free mapping 0	0: Invalid address Other: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-08	0xA608	Display format of free mapping 0	Ones: Unit 0: None 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW A: kWh B: ℃ Tens: Number of decimal places 0: 0 decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places Hundreds: Enable 0: Disable 1: Enable Thousands: Reserved	0x0	-	Real time
A6-09	0xA609	Address displayed by free mapping 1	0: Invalid address Other: K connector	0	-	Real time
A6-10	0xA60A	Display format of free mapping 1	Same as A6-08	0x0	-	Real time
A6-14	0xA60E	Display priority of high bits and low bits of double-word connector	0: Low 16 bits displayed first 1: High16 bits displayed first	0	-	Real time
A6-15	0xA60F	Number of decimal places of floating-point connector	0: Two decimal places 1: One decimal place	1	-	Real time
A6-16	0xA610	LED operating panel direction display	Ones: Direction displayed at stop 0: Not displayed 1: Displayed Tens: Operating direction judgment 0: Judged based on the output frequency 1: Judged based on the feedback frequency Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	1	-	Real time
A6-17	0xA611	Update cycle of LED display	0 to 300	10	ms	Real time
A6-18	0xA612	LED error pop-up time	1 to 60	10	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A6-20	0xA614	Key test of the LED operating panel	0: Inactive 1: Active	0	-	At stop
A6-21	0xA615	LED operating panel test result	0 to 65535	0	-	Read only
A6-22	0xA616	LED default display test	0: Disable 1: All indicators on the LED operating panel are steady on. 2: All indicators on the LED operating panel are off. 3: All indicators on the LED operating panel blink.	0	-	At stop
A6-29	0xA61D	Parameter displayed on the LED operating panel at stop	0 to 65535	0	-	Read only
A6-34	0xA622	SOP-20 communication control timeout period	0.00 to 655.35	0.50	s	Real time
A6-35	0xA623	Commissioning software communication control timeout period	0.1 to 130.0	3.0	s	Real time
A6-45	0xA62D	Commissioning software control activation	0: Disable 1: Enable	1	-	At stop
A6-46	0xA62E	Setting of speed controlled by commissioning software	-800.0 to +800.0	100.0	%	Real time
A6-47	0xA62F	Jog 1 speed controlled by commissioning software	-100.0 to +100.0	4.0	%	Real time
A6-48	0xA630	Jog 2 speed controlled by commissioning software	-100.0 to +100.0	-4.0	%	Real time
A8-00	0xA800	Start/Stop of the trigger oscilloscope	0 to 2	2	-	Real time
A8-01	0xA801	Channel 1 parameter	0 to 2500	0	-	Real time
A8-02	0xA802	Channel 2 parameter	0 to 2500	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
A8-03	0xA803	Channel 3 parameter	0 to 2500	0	-	Real time
A8-04	0xA804	Channel 4 parameter	0 to 2500	0	-	Real time
A8-09	0xA809	Sampling interval (carrier period)	1 to 65535	1	-	Real time
A8-10	0xA80A	Trigger object A	0 to 2500	1	-	Real time
A8-11	0xA80B	Trigger condition A	0: > 1: = 2: <	0	-	Real time
A8-12	0xA80C	Trigger level A	-32768 to +32767	0	-	Real time
A8-13	0xA80D	Trigger object B	0 to 2500	1	-	Real time
A8-14	0xA80E	Trigger condition B	0: > 1: = 2: <	0	-	Real time
A8-15	0xA80F	Trigger level B	-32768 to +32767	0	-	Real time
A8-16	0xA810	Trigger condition selection	0: Triggered when triggering condition A is met 1: Triggered when triggering condition B is met 2: Triggered when triggering conditions A and B are met 3: Triggered when either triggering condition A or B is met	0	-	Real time
A8-17	0xA811	Carrier frequency cycle during data storage	0 to 65535	0	-	Read only
A8-18	0xA812	Fault value	0 to 65535	0	-	Read only
A8-19	0xA813	Data storage cycle	0: Carrier cycle 1: 0.5 ms 2: 2 ms	0	-	Real time
A8-22	0xA816	Timing advance for triggering oscilloscope sampling	0 to 100	0	%	Real time
Ab-00	0xAB00	Low word of RAM address 1 of 16-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-01	0xAB01	High word of RAM address 1 of 16-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-02	0xAB02	Low word of RAM address 2 of the 16-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-03	0xAB03	High word of RAM address 2 of 16-bit data	0x0 to 0xFFFF	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ab-04	0xAB04	Low word of RAM address 3 of 16-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-05	0xAB05	HIWORD of 16-bit RAM address 3	0x0 to 0xFFFF	0x0	-	Real time
Ab-06	0xAB06	LOWORD of 16-bit RAM address 4	0x0 to 0xFFFF	0x0	-	Real time
Ab-07	0xAB07	HIWORD of 16-bit RAM address 4	0x0 to 0xFFFF	0x0	-	Real time
Ab-08	0xAB08	LOWORD of 16-bit RAM address 5	0x0 to 0xFFFF	0x0	-	Real time
Ab-09	0xAB09	HIWORD of 16-bit RAM address 5	0x0 to 0xFFFF	0x0	-	Real time
Ab-10	0xAB0A	32-bit data type selection 1	0 to 1	0	-	Real time
Ab-11	0xAB0B	32-bit data scaling factor 1	0 to 10000	1	-	Real time
Ab-12	0xAB0C	Low word of 32-bit data RAM address 1	0x0 to 0xFFFF	0x0	-	Real time
Ab-13	0xAB0D	HIWORD of 32-bit RAM address 1	0x0 to 0xFFFF	0x0	-	Real time
Ab-14	0xAB0E	32-bit data type selection 2	0 to 1	0	-	Real time
Ab-15	0xAB0F	32-bit data scaling factor 2	0 to 10000	1	-	Real time
Ab-16	0xAB10	LOWORD of 32-bit RAM address 2	0x0 to 0xFFFF	0x0	-	Real time
Ab-17	0xAB11	HIWORD of 32-bit RAM address 2	0x0 to 0xFFFF	0x0	-	Real time
Ab-18	0xAB12	32-bit data type selection 3	0 to 1	0	-	Real time
Ab-19	0xAB13	32-bit data scaling factor 3	0 to 10000	1	-	Real time
Ab-20	0xAB14	Low word of RAM address 3 of 32-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-21	0xAB15	High word of RAM address 3 of the 32-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-22	0xAB16	32-bit data type selection 4	0 to 1	0	-	Real time
Ab-23	0xAB17	32-bit data scaling factor 4	0 to 10000	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ab-24	0xAB18	Low word of RAM address 4 of 32-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-25	0xAB19	High word of RAM address 4 of 32-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-26	0xAB1A	32-bit data type selection 5	0 to 1	0	-	Real time
Ab-27	0xAB1B	32-bit data scaling factor 5	0 to 10000	1	-	Real time
Ab-28	0xAB1C	Low word of 32-bit RAM address 5	0x0 to 0xFFFF	0x0	-	Real time
Ab-29	0xAB1D	High word of RAM address 5 of 32-bit data	0x0 to 0xFFFF	0x0	-	Real time
Ab-38	0xAB26	Internal parameter monitoring parameter input 1	0 to 97	0	-	Real time
Ab-39	0xAB27	Internal parameter monitoring input 2	0 to 97	0	-	Real time
Ab-40	0xAB28	Internal monitoring parameter input 3	0 to 97	0	-	Real time
Ab-41	0xAB29	Internal monitoring parameter input 4	0 to 97	0	-	Real time
Ab-42	0xAB2A	Internal monitoring parameter input 5	0 to 97	0	-	Real time
Ab-43	0xAB2B	Internal monitoring parameter input 6	0 to 97	0	-	Real time
Ab-44	0xAB2C	Internal monitoring parameter input 7	0 to 97	0	-	Real time
Ab-45	0xAB2D	Internal monitoring parameter input 8	0 to 97	0	-	Real time
Ab-58	0xAB3A	Monitoring variable 0	-32768 to +32767	0	-	Read only
Ab-59	0xAB3B	Monitoring variable 1	-32768 to +32767	0	-	Read only
Ab-60	0xAB3C	Monitoring variable 2	-32768 to +32767	0	-	Read only
Ab-61	0xAB3D	Monitoring variable 3	-32768 to +32767	0	-	Read only
Ab-62	0xAB3E	Monitoring variable 4	-32768 to +32767	0	-	Read only
Ab-63	0xAB3F	Monitoring variable 5	-32768 to +32767	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ab-64	0xAB40	Monitoring variable 6	-32768 to +32767	0	-	Read only
Ab-65	0xAB41	Monitoring variable 7	-32768 to +32767	0	-	Read only
Ab-66	0xAB42	Monitoring variable 8	-32768 to +32767	0	-	Read only
Ab-67	0xAB43	Monitoring variable 9	-32768 to +32767	0	-	Read only
Ab-70	0xAB46	Commissioning variable 0	-32768 to +32767	0	-	Real time
Ab-71	0xAB47	Commissioning variable 1	-32768 to +32767	0	-	Real time
Ab-72	0xAB48	Commissioning variable 2	-32768 to +32767	0	-	Real time
Ab-73	0xAB49	Commissioning variable 3	-32768 to +32767	0	-	Real time
Ab-74	0xAB4A	Commissioning variable 4	-32768 to +32767	0	-	Real time
Ab-75	0xAB4B	Commissioning variable 5	-32768 to +32767	0	-	Real time
Ab-76	0xAB4C	Commissioning variable 6	-32768 to +32767	0	-	Real time
Ab-77	0xAB4D	Commissioning variable 7	-32768 to +32767	0	-	Real time
Ab-78	0xAB4E	Commissioning variable 8	-32768 to +32767	0	-	Real time
Ab-79	0xAB4F	Commissioning variable 9	-32768 to +32767	0	-	Real time
AC-00	0xAC00	Sequence command word	Ones: Basic time slice monitoring 0: Disable statistics 1: Enable statistics and disable protection 2: Enable statistics and protection Tens: Basic control time sequence monitoring 0: Disable statistics 1: Enable statistics and disable protection 2: Enable statistics and protection Hundreds: Basic drive time sequence monitoring 0: Disable statistics 1: Enable statistics and disable protection 2: Enable statistics and protection Thousands: Reserved Ten thousands: Reserved	0	-	At stop
AC-01	0xAC01	Function block 1 execution interval	0 to 50	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
AC-02	0xAC02	Function block 2 execution interval	0 to 50	1	-	At stop
AC-03	0xAC03	Function block 3 execution interval	125 to 50000	500	-	At stop
AC-04	0xAC04	Function block 4 execution interval	0 to 20	4	-	At stop
AC-05	0xAC05	Function block 5 execution interval	0 to 20	0	-	At stop
AC-06	0xAC06	Function block 6 execution interval	0 to 20	4	-	At stop
AC-07	0xAC07	Function block 7 execution interval	0 to 20	1	-	At stop
AC-08	0xAC08	Function block 8 execution interval	0 to 20	1	-	At stop
AC-09	0xAC09	Function block 9 execution interval	0 to 20	1	-	At stop
AC-10	0xAC0A	Function block 10 execution interval	0 to 20	1	-	At stop
AC-11	0xAC0B	Function block 11 execution interval	0 to 20	0	-	At stop
AC-20	0xAC14	Carrier frequency threshold for single/ dual pulsing switchover	0.0 to 24.0	0.0	kHz	Real time
Ad-00	0xAD00	Cumulative operating time - hours	0 to 65535	0	h	Read only
Ad-01	0xAD01	Cumulative operating time - seconds	0 to 3599	0	s	Read only
Ad-02	0xAD02	Cumulative power-on time - hours	0 to 65535	0	h	Read only
Ad-03	0xAD03	Cumulative power-on time - seconds	0 to 3599	0	s	Read only
Ad-04	0xAD04	Cumulative power consumption	0 to 65535	0	kWh	Read only
Ad-05	0xAD05	Auxiliary calculation 1 of cumulative power consumption	0 to 65535	0	-	Read only
Ad-06	0xAD06	Auxiliary calculation 2 of cumulative power consumption	0 to 65535	0	-	Read only
Ad-07	0xAD07	Cumulative power consumption k	0.0 to 6553.5	0.0	kWh	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Ad-08	0xAD08	Cumulative power consumption M	0 to 65535	0	MWh	Read only
Ad-09	0xAD09	Cumulative energy auxiliary calculation 1	0 to 65535	0	-	Read only
Ad-10	0xAD0A	Cumulative energy auxiliary calculation 2	0 to 65535	0	-	Read only
Ad-11	0xAD0B	Cumulative energy saved (kWh)	0.0 to 999.9	0.0	kWh	Read only
Ad-12	0xAD0C	Cumulative energy saved (MWh)	0 to 999	0	MWh	Read only
Ad-13	0xAD0D	Cumulative energy saved (GWh)	0 to 65535	0	GWh	Read only
Ad-14	0xAD0E	Cumulative amount of savings	0.0 to 999.9	0.0	-	Read only
Ad-15	0xAD0F	Cumulative amount of savings (K)	0 to 65535	0	-	Read only
Ad-16	0xAD10	Cumulative CO2 emission reduction (ton)	0.0 to 999.9	0.0	-	Read only
Ad-17	0xAD11	Cumulative CO2 emission reduction (kiloton)	0 to 65535	0	-	Read only
Ad-18	0xAD12	Energy tax rate 1	0.0 to 6553.5	0.0	-	At stop
Ad-19	0xAD13	Energy tax rate 2	0.0 to 6553.5	0.0	-	At stop
Ad-20	0xAD14	Tax rate selection	0: Energy tax rate 1 1: Energy tax rate 2	0	-	At stop
Ad-21	0xAD15	Currency unit selection	0: RMB 1: EUR 2: USD	0	-	At stop
Ad-22	0xAD16	CO2 conversion factor	0.000 to 65.535	0.000	-	At stop
Ad-23	0xAD17	Reference power	0.0 to 6553.5	0.0	kW	At stop
Ad-24	0xAD18	Reset of cumulative energy calculation	0: Disable 1: Enable	0	-	At stop
AE-00	0x2F00	User parameter 0	0x0 to 0xFFFF	0xF000	-	Real time
AE-01	0x2F01	User parameter 1	0x0 to 0xFFFF	0xF000	-	Real time
AE-02	0x2F02	User parameter 2	0x0 to 0xFFFF	0xF000	-	Real time
AE-03	0x2F03	User parameter 3	0x0 to 0xFFFF	0xF000	-	Real time
AE-04	0x2F04	User parameter 4	0x0 to 0xFFFF	0xF000	-	Real time
AE-05	0x2F05	User parameter 5	0x0 to 0xFFFF	0xF000	-	Real time
AE-06	0x2F06	User parameter 6	0x0 to 0xFFFF	0xF000	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
AE-07	0x2F07	User parameter 7	0x0 to 0xFFFF	0xF000	-	Real time
AE-08	0x2F08	User parameter 8	0x0 to 0xFFFF	0xF000	-	Real time
AE-09	0x2F09	User parameter 9	0x0 to 0xFFFF	0xF000	-	Real time
AE-10	0x2F0A	User parameter 10	0x0 to 0xFFFF	0xF000	-	Real time
AE-11	0x2F0B	User parameter 11	0x0 to 0xFFFF	0xF000	-	Real time
AE-12	0x2F0C	User parameter 12	0x0 to 0xFFFF	0xF000	-	Real time
AE-13	0x2F0D	User parameter 13	0x0 to 0xFFFF	0xF000	-	Real time
AE-14	0x2F0E	User parameter 14	0x0 to 0xFFFF	0xF000	-	Real time
AE-15	0x2F0F	User parameter 15	0x0 to 0xFFFF	0xF000	-	Real time
AE-16	0x2F10	User parameter 16	0x0 to 0xFFFF	0xF000	-	Real time
AE-17	0x2F11	User parameter 17	0x0 to 0xFFFF	0xF000	-	Real time
AE-18	0x2F12	User parameter 18	0x0 to 0xFFFF	0xF000	-	Real time
AE-19	0x2F13	User parameter 19	0x0 to 0xFFFF	0xF000	-	Real time
AE-20	0x2F14	User parameter 20	0x0 to 0xFFFF	0xF000	-	Real time
AE-21	0x2F15	User parameter 21	0x0 to 0xFFFF	0xF000	-	Real time
AE-22	0x2F16	User parameter 22	0x0 to 0xFFFF	0xF000	-	Real time
AE-23	0x2F17	User parameter 23	0x0 to 0xFFFF	0xF000	-	Real time
AE-24	0x2F18	User parameter 24	0x0 to 0xFFFF	0xF000	-	Real time
AE-25	0x2F19	User parameter 25	0x0 to 0xFFFF	0xF000	-	Real time
AE-26	0x2F1A	User parameter 26	0x0 to 0xFFFF	0xF000	-	Real time
AE-27	0x2F1B	User parameter 27	0x0 to 0xFFFF	0xF000	-	Real time
AE-28	0x2F1C	User parameter 28	0x0 to 0xFFFF	0xF000	-	Real time
AE-29	0x2F1D	User parameter 29	0x0 to 0xFFFF	0xF000	-	Real time
AE-30	0x2F1E	User parameter 30	0x0 to 0xFFFF	0xF000	-	Real time
AE-31	0x2F1F	User parameter 31	0x0 to 0xFFFF	0xF000	-	Real time
b0-02	0xB002	Control channel selection	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b0-03	0xB003	Setting channel selection	0: Setting channel 1 1: Setting channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	At stop
b1-00	0xB100	Main command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: User-defined	0	-	At stop
b1-01	0xB101	User-defined ON_OFF1 (start/stop) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b1-02	0xB102	User-defined OFF2 (coast to stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
b1-03	0xB103	User-defined OFF3 (quick stop) source 1	Same as b1-02	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b1-04	0xB104	User-defined operation permission source	0: Operation not allowed 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
b1-05	0xB105	User-defined fault reset source 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b1-06	0xB106	User-defined jog (JOG1) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b1-07	0xB107	User-defined jog (JOG2) source	Same as b1-06	0	-	Real time
b1-08	0xB108	User-defined speed inversion source	Same as b1-05	0	-	Real time
b1-09	0xB109	Jog/ON_OFF1 priority mode selection	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b2-00	0xB200	OFF2 (coast to stop) source 2	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
b2-01	0xB201	OFF2 (coast to stop) source 3	Same as b2-00	1	-	Real time
b2-02	0xB202	OFF3 (quick stop) source 2	Same as b2-00	1	-	Real time
b2-03	0xB203	OFF3 (quick stop) source 3	Same as b2-00	1	-	Real time
b2-04	0xB204	Fault reset source 2	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b2-05	0xB205	Fault reset source 3	Same as b2-04	0	-	Real time
b2-06	0xB206	RFG inhibition source	Same as b2-00	1	-	Real time
b2-07	0xB207	RFG pause source	Same as b2-00	1	-	Real time
b2-08	0xB208	Source of setting ramp reference to 0	Same as b2-00	1	-	Real time
b3-00	0xB300	Main command source of control channel 2	0: Operating panel 1: Terminal 2: Communication 3: User-defined	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b3-01	0xB301	User-defined ON_OFF1 (start/stop) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b3-02	0xB302	User-defined OFF2 (coast to stop) source 1	0: Active 1: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
b3-03	0xB303	User-defined OFF3 (quick stop) source 1	Same as b3-02	1	-	Real time
b3-04	0xB304	User-defined operation permission source	0: Operation not allowed 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b3-05	0xB305	User-defined fault reset source 1	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b3-06	0xB306	User-defined jog (JOG1) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b3-07	0xB307	User-defined jog (JOG2) source	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b3-08	0xB308	User-defined speed inversion source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b3-09	0xB309	Jog/ON_OFF1 priority mode selection	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	0	-	Real time
b4-00	0xB400	OFF2 (coast to stop) source 2	Same as b3-02	1	-	Real time
b4-01	0xB401	OFF2 (coast to stop) source 3	Same as b3-02	1	-	Real time
b4-02	0xB402	OFF3 (quick stop) source 2	Same as b3-02	1	-	Real time
b4-03	0xB403	OFF3 (quick stop) source 3	Same as b3-02	1	-	Real time
b4-04	0xB404	Fault reset source 2	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b4-05	0xB405	Fault reset source 3	Same as b4-04	0	-	Real time
b4-06	0xB406	RFG inhibition source	Same as b3-02	1	-	Real time
b4-07	0xB407	RFG pause source	Same as b3-02	1	-	Real time
b4-08	0xB408	Source of setting ramp reference to 0	Same as b3-02	1	-	Real time
b5-00	0xB500	Main frequency source	0: b5-01 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b5-01	0xB501	Digital reference of main frequency	0.00 to A2-17	50.00	Hz	Real time
b5-02	0xB502	Auxiliary frequency source	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b5-03	0xB503	Calculation relationship between main and auxiliary references	0: Main+Auxiliary Main - Auxiliary 2: Max. (|main|, |auxiliary|) 3: Min. (|main|, |auxiliary|) 4: Main x Auxiliary	0	-	Real time
b5-04	0xB504	Additional frequency source	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b5-05	0xB505	Source of main frequency gain coefficient	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b5-06	0xB506	Auxiliary frequency gain factor source	Same as b5-05	0	-	Real time
b5-07	0xB507	Source of jog frequency 1	0: b5-08 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b5-08	0xB508	Digital reference of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real time
b5-09	0xB509	Source of jog frequency 2	0: b5-10 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b5-10	0xB50A	Digital reference of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real time
b5-11	0xB50B	Frequency ramp transition enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b5-12	0xB50C	Frequency ramp transition interval	2 to 10000	50	ms	Real time
b6-00	0xB600	Main frequency source	0: b6-01 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b6-01	0xB601	Digital reference of main frequency	0.00 to A2-17	50.00	Hz	Real time
b6-02	0xB602	Auxiliary frequency source	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b6-03	0xB603	Calculation relationship between main and auxiliary references	0: Main+Auxiliary Main - Auxiliary 2: Max. (|main|, |auxiliary\) 3: Min. (|main|, |auxiliary|) 4: Main x Auxiliary	0	-	Real time
b6-04	0xB604	Additional frequency source	Same as b6-02	0	-	Real time
b6-05	0xB605	Source of main frequency gain coefficient	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b6-06	0xB606	Auxiliary frequency gain factor source	Same as b6-05	0	-	Real time
b6-07	0xB607	Source of jog frequency 1	0: b6-08 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b6-08	0xB608	Digital reference of jog 1 frequency	-50.00 to +50.00	2.00	Hz	Real time
b6-09	0xB609	Source of jog frequency 2	0: b6-10 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b6-10	0xB60A	Digital reference of jog 2 frequency	-50.00 to +50.00	-2.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b6-11	0xB60B	Frequency ramp transition enable	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b6-12	0xB60C	Frequency ramp transition interval	2 to 10000	50	ms	Real time
b7-00	0xB700	Ramp-up/down mode	0: Linear ramp-up/down 1: S-curve ramp-up/down	0	-	Real time
b7-01	0xB701	Ramp-up/down time base	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	1	-	Real time
b7-02	0xB702	Ramp selection bit0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b7-03	0xB703	Ramp selection bit1	Same as b7-02	0	-	Real time
b7-04	0xB704	Ramp-up time of ramp 1	0.0 to 6500.0	20.0	s	Real time
b7-05	0xB705	Ramp-down time of ramp 1	0.0 to 6500.0	20.0	s	Real time
b7-06	0xB706	Ramp-up start arc of ramp 1	0.00 to 650.00	0.00	s	Real time
b7-07	0xB707	Ramp-up end arc of ramp 1	0.00 to 650.00	0.00	s	Real time
b7-08	0xB708	Ramp-down start arc of ramp 1	0.00 to 650.00	0.00	s	Real time
b7-09	0xB709	Ramp-down end arc of ramp 1	0.00 to 650.00	0.00	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b7-10	0xB70a	Ramp-up time of ramp 2	0.0 to 6500.0	20.0	s	Real time
b7-11	0xB70B	Ramp-down time of ramp 2	0.0 to 6500.0	20.0	s	Real time
b7-12	0xB70c	Ramp-up start arc of ramp 2	0.00 to 650.00	0.00	s	Real time
b7-13	0xB70d	Ramp-up end arc of ramp 2	0.00 to 650.00	0.00	s	Real time
b7-14	0xB70e	Ramp-down start arc of ramp 2	0.00 to 650.00	0.00	s	Real time
b7-15	0xB70f	Ramp-down end arc of ramp 2	0.00 to 650.00	0.00	s	Real time
b7-16	0xB710	Ramp-up time of ramp 3	0.00 to 650.00	20.00	s	Real time
b7-17	0xB711	Ramp-down time of ramp 3	0.00 to 650.00	20.00	s	Real time
b7-18	0xB712	Ramp-up start arc of ramp 3	0.00 to 650.00	0.00	s	Real time
b7-19	0xB713	Ramp-up end arc of ramp 3	0.00 to 650.00	0.00	s	Real time
b7-20	0xB714	Ramp-down start arc of ramp 3	0.00 to 650.00	0.00	s	Real time
b7-21	0xB715	Ramp-down end arc of ramp 3	0.00 to 650.00	0.00	s	Real time
b7-22	0xB716	Ramp-up time of ramp 4	0.00 to 650.00	20.00	s	Real time
b7-23	0xB717	Ramp-down time of ramp 4	0.00 to 650.00	20.00	s	Real time
b7-24	0xB718	Ramp-up start arc of ramp 4	0.00 to 650.00	0.00	s	Real time
b7-25	0xB719	Ramp-up end arc of ramp 4	0.00 to 650.00	0.00	s	Real time
b7-26	0xB71a	Ramp-down start arc of ramp 4	0.00 to 650.00	0.00	s	Real time
b7-27	0xB71B	Ramp-down end arc of ramp 4	0.00 to 650.00	0.00	s	Real time
b7-28	0xB71c	Ramps 1/2 frequency switchover	0: Disable 1: Enable	0	-	Real time
b7-29	0xB71d	Ramp-up switchover frequency threshold of ramps 1/2	0.0 to A2-18	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b7-30	0xB71e	Ramp-down switchover frequency threshold of ramps 1/2	0.0 to A2-18	0.0	Hz	Real time
b7-31	0xB71f	Jog ramp source	0: Ramp time during normal operation 1: Ramp time during jogging	0	-	Real time
b7-32	0xB720	Ramp-up time in jog	0.00 to 650.00	20.00	s	Real time
b7-33	0xB721	Ramp-down time in jog	0.00 to 650.00	20.00	s	Real time
b7-34	0xB722	Ramp-down time for quick stop	0.00 to 650.00	1.00	s	Real time
b7-35	0xB723	Start arc of quick stop	0.00 to 650.00	0.00	s	Real time
b7-36	0xB724	End arc of quick stop	0.00 to 650.00	0.00	s	Real time
b7-39	0xB727	Ramp-up time gain factor	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b7-40	0xB728	Ramp-down time gain factor	Same as b7-39	0	-	Real time
b7-41	0xB729	Ramp-up time gain coefficient in low-speed range	1.0 to 1000.0	100.0	%	Real time
b7-42	0xB72a	Threshold of low-speed range	0.00 to 100.00	15.00	%	Real time
b7-43	0xB72B	Ramp arc mode	0: Non-continuous smoothing 1: Continuous smoothing	0	-	Real time
b7-44	0xB72c	Ramp output enabled forcibly	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b7-45	0xB72d	Forced value of ramp output	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
b7-46	0xB72e	Ramp tracking enable	0: Disable 1: Enable 2: Torque limit reached Other: B connector	0	-	Real time
b7-47	0xB72f	Ramp tracking error	0.0 to 100.0	10.0	%	Real time
b7-48	0xB730	Effective time upon 0s ramp-down time in V/f control	0.000 to 60.000	0.100	s	Real time
b8-00	0xB800	Active multi-reference value x	0: Multi-reference 0 1: Multi-reference 1 2: Multi-reference 2 3: Multi-reference 3 4: Multi-reference 4 5: Multi-reference 5 6: Multi-reference 6 7: Multi-reference 7 8: Multi-reference 8 9: Multi-reference 9 10: Multi-reference 10 11: Multi-reference 11 12: Multi-reference 12 13: Multi-reference 13 14: Multi-reference 14 15: Multi-reference 15	0	-	Read only
b8-01	0xB801	Active multi-reference output	-3000.0 to +3000.0	0.0	%	Read only
b8-02	0xB802	Multi-reference unit selection	0: % (100% = rated motor frequency) 1: % (100% = maximum motor frequency) 2: User-defined (100% = b8-41) 3: Hz 4: rpm	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b8-03	0xB803	Multi-reference selection bit0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
b8-04	0xB804	Multi-reference selection bit1	Same as b8-03	0	-	Real time
b8-05	0xB805	Multi-reference selection bit2	Same as b8-03	0	-	Real time
b8-06	0xB806	Multi-reference selection bit3	Same as b8-03	0	-	Real time
b8-08	0xB808	Source of multi-reference 0	0: b8-09 5: PID 6: b5-01/b6-01 Other: F connector	0	-	Real time
b8-09	0xB809	Multi-reference 0	b8-42 to b8-43	0.0	-	Real time
b8-10	0xB80A	Multi-reference 1	b8-42 to b8-43	0.0	-	Real time
b8-11	0xB80B	Multi-reference 2	b8-42 to b8-43	0.0	-	Real time
b8-12	0xB80C	Multi-reference 3	b8-42 to b8-43	0.0	-	Real time
b8-13	0xB80D	Multi-reference 4	b8-42 to b8-43	0.0	-	Real time
b8-14	0xB80E	Multi-reference 5	b8-42 to b8-43	0.0	-	Real time
b8-15	0xB80F	Multi-reference 6	b8-42 to b8-43	0.0	-	Real time
b8-16	0xB810	Multi-reference 7	b8-42 to b8-43	0.0	-	Real time
b8-17	0xB811	Multi-reference 8	b8-42 to b8-43	0.0	-	Real time
b8-18	0xB812	Multi-reference 9	b8-42 to b8-43	0.0	-	Real time
b8-19	0xB813	Multi-reference 10	b8-42 to b8-43	0.0	-	Real time
b8-20	0xB814	Multi-reference 11	b8-42 to b8-43	0.0	-	Real time
b8-21	0xB815	Multi-reference 12	b8-42 to b8-43	0.0	-	Real time
b8-22	0xB816	Multi-reference 13	b8-42 to b8-43	0.0	-	Real time
b8-23	0xB817	Multi-reference 14	b8-42 to b8-43	0.0	-	Real time
b8-24	0xB818	Multi-reference 15	b8-42 to b8-43	0.0	-	Real time
b8-41	0xB829	User-defined base value	0.1 to 6553.5	100.0	-	At stop
b8-42	0xB82A	Multi-reference upper limit threshold	0.0 to 3000.0	3000.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b8-43	0xB82B	Multi-reference lower limit threshold	3000.0 to 0.0	-3000.0	-	Real time
b9-00	0xB900	Terminal start/stop module A/B selection	0: Module A 1: Module B Other: B connector	0	-	At stop
b9-01	0xB901	Mode of terminal start/stop module A	0: Disable 1: IN1 for start 2: IN1 for start; IN2 for direction 3: IN1 for forward start; IN2 for reverse start 4: IN1P (rising edge) for start; IN2 for stop 5: IN1P (rising edge) for start; IN2 for stop; IN3 for direction 6: IN1P (rising edge) for forward start; IN2P (rising edge) for reverse start; IN3 for stop	3	-	At stop
b9-02	0xB902	Terminal start/stop module A_IN1	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	At stop
b9-03	0xB903	Terminal start/stop module A_IN2	Same as b9-02	0	-	At stop
b9-04	0xB904	Terminal start/stop module A_IN3	Same as b9-02	0	-	At stop
b9-05	0xB905	Operation permission source of terminal start/ stop module A	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	At stop
b9-06	0xB906	Fault reset source of terminal start/stop module A	Same as b9-05	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
b9-07	0xB907	JOG1 source of terminal start/stop module A	Same as b9-02	0	-	At stop
b9-08	0xB908	JOG2 source of terminal start/stop module A	Same as b9-02	0	-	At stop
b9-09	0xB909	Mode of terminal start/stop module B	0: Disable 1: IN1 for start 2: IN1 for start; IN2 for direction 3: IN1 for forward start; IN2 for reverse start 4: IN1P (rising edge) for start; IN2 for stop 5: IN1P (rising edge) for start; IN2 for stop; IN3 for direction 6: IN1P (rising edge) for forward start; IN2P (rising edge) for reverse start; IN3 for stop	3	-	At stop
b9-10	0xB90A	Terminal start/stop module B_IN1	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	At stop
b9-11	0xB90B	Terminal start/stop module B_IN2	Same as b9-10	0	-	At stop
b9-12	0xB90C	Terminal start/stop module B_IN3	Same as b9-10	0	-	At stop
b9-13	0xB90D	Operation permission source of terminal start/ stop module B	Same as b9-05	1	-	At stop
b9-14	0xB90E	Fault reset source of terminal start/stop module B	Same as b9-05	1	-	At stop
b9-15	0xB90F	JOG1 source of terminal start/stop module B	Same as b9-10	0	-	At stop
b9-16	0xB910	JOG2 source of terminal start/stop module B	Same as b9-10	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-00	0xC200	Motor parameter auto-tuning mode	0: No operation 1: Static auto-tuning on partial parameters of asynchronous motor 2: No-load dynamic auto-tuning of asynchronous motor 3: Static auto-tuning on all parameters of asynchronous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 12: No-load dynamic auto-tuning of permanent magnet motor 13: Static auto-tuning on partial parameters of synchronous motor 14: Auto-tuning on gain difference between phases U/V	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-01	0xC201	Configuration item of auto-tuning	bit0: Adaptive speed loop parameters 0: Disable 1: Enable bit1: Adaptive current loop parameters 0: Disable 1: Enable bit2: Non-linear auto-tuning of the drive 0: Disable 1: Enable bit3: Phase-to-phase deviation coefficient auto-tuning 0: Disable 1: Enable bit4: Auto-tuning of initial magnetic pole position of synchronous motor 0: Disable 1: Enable bit5: Auto-tuning of d/q-axis inductance model of synchronous motor 0: Disable 1: Enable bit6: Auto-tuning of system moment of inertia 0: Disable 1: Enable bit7 to bit8: Reserved bit9: DC injection auto-tuning 0: Disable 1: Enable bit10 to bit11: Reserved bit12: Pre-positioning after initial position auto-tuning 0: Disable 1: Enable bit13: Back EMF auto-tuning calculation mode 0: Equation method 1: Saturation inductance method bit14: Encoder direction auto-tuning (reserved) 0: Disable 1: Enable bit15: Back EMF calculation 0: Disable 1: Enable	0x017D	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-02	0xC202	Auto-tuning configuration item 2	bit0: Auto-tuning scheme switchover 0: Scheme 1 1: Scheme 2 bit1: Auto-tuning calibration switch 0: ON 1: OFF bit2: 2nd segment auto-tuning switchover 0: OFF 1: OFF bit3: Auto-tuning method 0: Fixed 1: Adjustable bit4: Anti-saliency auto-tuning 0: OFF 1: ON bit5: Injection optimization 0: Not masked 1: Masked bit6 to bit15: Reserved	0x0010	-	At stop
C2-03	0xC203	Self-test configuration before startup	bit0: IGBT shoot-through self-test at start 0: Disable 1: Enable bit1: Ground fault self-test at start 0: Disable 1: Enable bit2: Phase loss self-test at start 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	At stop
C2-04	0xC204	Manual self-test	0: No command 1: Static self-test preparation	0	-	At stop
C2-05	0xC205	Manual self-test configuration	bit0: IGBT shoot-through self-test at start 0: Disable 1: Enable bit1: Ground fault self-test at start 0: Disable 1: Enable bit2: Phase loss self-test at start 0: Disable 1: Enable bit3 to bit15: Reserved	0x0007	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C2-06	0xC206	Self-test configuration upon power-on	bit0: IGBT shoot-through self-test upon power-on 0: Disable 1: Enable bit1: Ground fault self-test upon power-on 0: Disable 1: Enable bit2: Phase loss self-test upon power-on 0: Disable 1: Enable bit3 to bit15: Reserved	0x0002	-	At stop
C2-07	0xC207	Direction selection	0: Default 1: Inverted direction	1	-	At stop
C2-09	0xC209	No-load current auto-tuning speed	30.0 to 100.0	70.0%	%	At stop
C2-17	0xC211	Auto-tuning acceleration time	0.0 to 600.0	20.0	s	At stop
C2-18	0xC212	Auto-tuning deceleration time	0.0 to 600.0	20.0	s	At stop
C2-19	0xC213	Parameter Calculation	0: Inactive 1: Motor nameplate parameter calculation	0	-	At stop
C2-20	0xC214	Nameplate parameter calculation acknowledgment	0: Inactive 1: Active	0	-	At stop
C2-21	0xC215	TB calculation of synchronous motor	0: Inactive 1: Active	0	-	At stop
C2-22	0xC216	Maximum current of TB	0.0 to 400.0	200.0	%	At stop
C2-23	0xC217	Maximum d-axis current of TB	0.0 to 300.0	150.0	%	At stop
C2-24	0xC218	Field weakening coefficient 2 of TB	0 to 200	50	-	At stop
C2-25	0xC219	TB test parameter 1	0.0 to 200.0	0.0	%	At stop
C2-26	0xC21A	TB test parameter 2	0.0 to 200.0	0.0	%	At stop
C2-30	0xC21E	No-load current vector auto-tuning	0: Disable 1: Enable	0	-	At stop
C2-31	0xC21F	Speed source for no-load current vector auto-tuning	0: User-defined 1: Internally-defined	0	-	At stop
C4-00	0xC400	Motor type	0: Regular asynchronous motor 2: Permanent magnet synchronous motor	0	-	At stop
C4-01	0xC401	Rated power of the motor	0.01 to 655.35	3.70	kW	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C4-03	0xC403	Rated voltage of the motor	1 to 2000	380	V	At stop
C4-04	0xC404	Rated current of the motor	0.01 to 655.35	9.00	A	At stop
C4-06	0xC406	Rated frequency of the motor	0.01 to 599.00	50.00	Hz	At stop
C4-07	0xC407	Rated speed of the motor	1 to 65535	1460	rpm	At stop
C4-09	0xC409	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
C4-10	0xC40A	Maximum frequency of the motor	C4-06 to 599.00	50.00	Hz	At stop
C4-11	0xC40B	Minimum frequency of the motor	0.00 to C4-10	0.00	Hz	At stop
C4-13	0xC40D	Number of parallel motors	1 to 200	1	-	At stop
C4-14	0xC40E	Number of motor pole pairs (number of poles/2)	0 to 128	0	-	At stop
C4-15	0xC40F	Number of effective motor pole pairs	0 to 128	0	-	Read only
C4-20	0xC414	Stator resistance	0.001 to 65.535	1.204	Ω	Real time
C4-22	0xC416	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real time
C4-24	0xC418	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real time
C4-26	0xC41A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
C4-28	0xC41C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real time
C4-30	0xC41E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
C4-62	0xC43E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
C4-63	0xC43F	Electromechanical time constant	0.01 to 655.35	1.00	s	Read only
C4-64	0xC440	System moment of inertia	0.01 to 655.35	1.00	kg·m²	Read only
C5-02	0xC502	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	At stop
C5-03	0xC503	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C5-04	0xC504	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	At stop
C5-05	0xC505	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	At stop
C5-06	0xC506	Flux coefficient 1 of mutual inductance curve	10.0 to 100.0	50.0	%	At stop
C5-07	0xC507	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	At stop
C5-08	0xC508	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	At stop
C5-09	0xC509	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	At stop
C7-00	0xC700	Motor type	0: Regular asynchronous motor 2: Permanent magnet synchronous motor	0	-	At stop
C7-01	0xC701	Rated power of the motor	0.01 to 655.35	3.70	kW	At stop
C7-03	0xC703	Rated voltage of the motor	1 to 2000	380	V	At stop
C7-04	0xC704	Rated current of the motor	0.01 to 655.35	9.00	A	At stop
C7-06	0xC706	Rated frequency of the motor	0.01 to 599.00	50.00	Hz	At stop
C7-07	0xC707	Rated speed of the motor	1 to 65535	1460	rpm	At stop
C7-09	0xC709	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
C7-10	0xC70A	Maximum frequency of the motor	C7-06 to 599.00	50.00	Hz	At stop
C7-11	0xC70B	Minimum frequency of the motor	0.00 to C7-10	0.00	Hz	At stop
C7-13	0xC70D	Number of parallel motors	1 to 200	1	-	At stop
C7-15	0xC70F	Number of effective motor pole pairs	0 to 128	0	-	Read only
C7-20	0xC714	Stator resistance	0.001 to 65.535	1.204	Ω	Real time
C7-22	0xC716	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
C7-24	0xC718	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real time
C7-26	0xC71A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
C7-28	0xC71C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real time
C7-30	0xC71E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
C7-62	0xC73E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
C7-63	0xC73F	Electromechanical time constant	0.01 to 655.35	1.00	s	Read only
C7-64	0xC740	System moment of inertia	0.01 to 655.35	1.00	kg·m²	Read only
C8-02	0xC802	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	At stop
C8-03	0xC803	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	At stop
C8-04	0xC804	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	At stop
C8-05	0xC805	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	At stop
C8-06	0xC806	Flux coefficient 1 of mutual inductance curve	10.0 to 100.0	50.0	%	At stop
C8-07	0xC807	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	At stop
C8-08	0xC808	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	At stop
C8-09	0xC809	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	At stop
CA-00	0xCA00	Motor type	0: Regular asynchronous motor 2: Permanent magnet synchronous motor	0	-	At stop
CA-01	0xCA01	Rated power of the motor	0.01 to 655.35	3.70	kW	At stop
CA-03	0xCA03	Rated voltage of the motor	1 to 2000	380	V	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
CA-04	0xCA04	Rated current of the motor	0.01 to 655.35	9.00	A	At stop
CA-06	0xCA06	Rated frequency of the motor	0.01 to 599.00	50.00	Hz	At stop
CA-07	0xCA07	Rated speed of the motor	1 to 65535	1460	rpm	At stop
CA-09	0xCA09	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
CA-10	0xCA0A	Maximum frequency of the motor	CA-06 to 599.00	50.00	Hz	At stop
CA-11	0xCA0B	Minimum frequency of the motor	0.00 to CA-10	0.00	Hz	At stop
CA-13	0xCA0D	Number of parallel motors	1 to 200	1	-	At stop
CA-15	0xCA0F	Number of effective motor pole pairs	0 to 128	0	-	Read only
CA-20	0xCA14	Stator resistance	0.001 to 65.535	1.204	Ω	Real time
CA-22	0xCA16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real time
CA-24	0xCA18	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real time
CA-26	0xCA1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
CA-28	0xCA1C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real time
CA-30	0xCA1E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
CA-62	0xCA3E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
CA-63	0xCA3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Read only
CA-64	0xCA40	System moment of inertia	0.01 to 655.35	1.00	kg·m²	Read only
Cb-02	0xCB02	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	At stop
Cb-03	0xCB03	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	At stop
Cb-04	0xCB04	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Cb-05	0xCB05	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	At stop
Cb-06	0xCB06	Flux coefficient 1 of mutual inductance curve	10.0 to 100.0	50.0	%	At stop
Cb-07	0xCB07	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	At stop
Cb-08	0xCB08	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	At stop
Cb-09	0xCB09	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	At stop
Cd-00	0xCD00	Motor type	0: Regular asynchronous motor 2: Permanent magnet synchronous motor	0	-	At stop
Cd-01	0xCD01	Rated power of the motor	0.01 to 655.35	3.70	kW	At stop
Cd-03	0xCD03	Rated voltage of the motor	1 to 2000	380	V	At stop
Cd-04	0xCD04	Rated current of the motor	0.01 to 655.35	9.00	A	At stop
Cd-06	0xCD06	Rated frequency of the motor	0.01 to 599.00	50.00	Hz	At stop
Cd-07	0xCD07	Rated speed of the motor	1 to 65535	1460	rpm	At stop
Cd-09	0xCD09	Power factor of the motor	0.600 to 1.000	0.860	-	At stop
Cd-10	0xCD0A	Maximum frequency of the motor	Cd-06 to 599.00	50.00	Hz	At stop
Cd-11	0xCD0B	Minimum frequency of the motor	0.00 to Cd-10	0.00	Hz	At stop
Cd-13	0xCD0D	Number of parallel motors	1 to 200	1	-	At stop
Cd-15	0xCD0F	Number of effective motor pole pairs	0 to 128	0	-	Read only
Cd-20	0xCD14	Stator resistance	0.001 to 65.535	1.204	Ω	Real time
Cd-22	0xCD16	Asynchronous motor rotor resistance	0.001 to 65.535	0.908	Ω	Real time
Cd-24	0xCD18	Leakage inductance of asynchronous motor stator	0.01 to 655.35	5.28	mH	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Cd-26	0xCD1A	Leakage inductance of asynchronous motor rotor	0.01 to 655.35	5.28	mH	Real time
Cd-28	0xCD1C	Asynchronous motor mutual inductance	0.1 to 6553.5	156.8	mH	Real time
Cd-30	0xCD1E	No-load current of asynchronous motor	0.01 to 655.35	4.20	A	Real time
Cd-62	0xCD3E	Inertia ratio	0.0 to 6553.5	120.0	%	At stop
Cd-63	0xCD3F	Electromechanical time constant	0.01 to 655.35	1.00	s	Read only
Cd-64	0xCD40	System moment of inertia	0.01 to 655.35	1.00	kg·m²	Read only
CE-02	0xCE02	Current coefficient 1 of mutual inductance curve	5.0 to 100.0	50.0	%	At stop
CE-03	0xCE03	Current coefficient 2 of mutual inductance curve	5.0 to 100.0	75.0	%	At stop
CE-04	0xCE04	Current coefficient 3 of mutual inductance curve	100.0 to 800.0	150.0	%	At stop
CE-05	0xCE05	Current coefficient 4 of mutual inductance curve	100.0 to 800.0	210.0	%	At stop
CE-06	0xCE06	Flux coefficient 1 of mutual inductance curve	10.0 to 100.0	50.0	%	At stop
CE-07	0xCE07	Flux coefficient 2 of mutual inductance curve	10.0 to 100.0	85.0	%	At stop
CE-08	0xCE08	Flux coefficient 3 of mutual inductance curve	100.0 to 300.0	115.0	%	At stop
CE-09	0xCE09	Flux coefficient 4 of mutual inductance curve	100.0 to 300.0	125.0	%	At stop
d0-00	0xD000	Motor control method	0: SVC 2: V/f	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-01	0xD001	Motor control mode	0: Speed Control 1: Torque Control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8 : DI6 9: DI7 10 : DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
d0-02	0xD002	Startup mode	0: Direct start 1: Flying start	0	-	At stop
d0-03	0xD003	Speed tracking mode	0: Starting from the frequency at stop 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	4	-	Real time
d0-04	0xD004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	-	Real time
d0-05	0xD005	OFF2 (coast to stop) mode	0: Coast to stop	0	-	Read only
d0-06	0xD006	OFF3 (quick stop) mode	0: Quick stop 1: Stop at maximum capability	0	-	Real time
d0-07	0xD007	Stop mode during operation	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real time
d0-09	0xD009	Zero speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real time
d0-10	0xD00A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
d0-11	0xD00B	Zero speed threshold for stop at synchronous frequency	0.00 to 200.00	1.00	%	Real time
d0-12	0xD00C	Zero speed judgment time of synchronous frequency	0.00 to 100.00	2.00	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-13	0xD00D	Start/Stop frequency reference following	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
d0-14	0xD00E	Motor direction selection	0: Default 1: Inverted direction	0	-	At stop
d0-16	0xD010	Stop delay time	0.00 to 655.35	0.00	s	At stop
d0-20	0xD014	Demagnetization time	0.00 to 5.00	0.50	s	Real time
d0-23	0xD017	Starting frequency	0.00 to 10.00	0.00	Hz	Real time
d0-24	0xD018	Starting frequency hold time	0.0 to 1000.0	0.0	s	At stop
d0-25	0xD019	DC braking time at start	0.0 to 100.0	0.0	s	At stop
d0-26	0xD01A	DC braking current at start	0 to 800	50	%	At stop
d0-27	0xD01B	Starting frequency of DC braking at stop	0.0 to 600.0	0.0	Hz	Real time
d0-28	0xD01C	Waiting time of DC braking at stop	0.0 to 100.0	0.0	s	Real time
d0-29	0xD01D	DC braking time at stop	0.0 to 100.0	0.0	s	Real time
d0-30	0xD01E	DC braking current at stop	0 to 800	50	%	Real time
d0-31	0xD01F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
d0-32	0xD020	Ki adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
d0-33	0xD021	DC braking superimposed frequency	0.00 to 10.00	0.00	Hz	Real time
d0-34	0xD022	DC braking current rise time	0.00 to 100.00	0.00	s	At stop
d0-35	0xD023	Current limit during constant current	50.0 to 800.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d0-41	0xD029	Over-excitation gain (V/f)	0 to 200	90	%	Real time
d0-43	0xD02B	Speed of speed tracking	1 to 100	20	-	Real time
d0-44	0xD02C	Frequency sweep Kp during speed tracking	100 to 1000	500	-	Real time
d0-45	0xD02D	Frequency sweep Ki during speed tracking	100 to 1000	800	-	Real time
d0-46	0xD02E	Speed tracking current	30 to 200	80	%	At stop
d0-70	0xD046	Initial position detection of synchronous motor before startup	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	-	At stop
d0-71	0xD047	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	-	At stop
d0-72	0xD048	Auto-tuning configuration before start	bit0: Reserved bit1: Start quick stator resistance auto-tuning 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection searching method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
d0-74	0xD04A	Auto-tuning mode	0: OFF 1: Enabled before initial operation after power-on 2: Enabled before operation	0	-	Real time
d1-00	0xD100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-01	0xD101	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
d1-02	0xD102	Negative speed selection	Same as d1-01	1	-	Real time
d1-03	0xD103	Digital reference of positive frequency upper limit 1	d1-07 to 800.0	800.0	%	At stop
d1-04	0xD104	Digital reference of negative frequency upper limit 1	-800.0 to d1-08	-800.0	%	At stop
d1-05	0xD105	Source of positive frequency upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d1-06	0xD106	Source of negative frequency upper limit 2	0: 800% 1: Inverted value of F2-24 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
d1-07	0xD107	Digital reference of positive frequency lower limit 1	0.0 to d1-03	0.0	%	At stop
d1-08	0xD108	Digital reference of negative frequency lower limit 1	d1-04 to 0.0	0.0	%	At stop
d1-09	0xD109	Digital reference of torque upper limit 1	0.0 to 800.0	150.0	%	Real time
d1-10	0xD10A	Digital reference of torque lower limit 1	-800.0 to 0.0	-150.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-11	0xD10B	Source of torque upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d1-12	0xD10C	Source of torque lower limit 2	0: 800% 1: Inverted value of d1-11 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
d1-33	0xD121	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Demagnetization protection of permanent synchronous motor 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Output single-phase loss detection 0: Disable 1: Enable bit10 to bit15: Reserved	0x0687	-	Real time
d1-35	0xD123	Overspeed protection	0: Disable 1: Enable	1	-	Real time
d1-36	0xD124	Overspeed protection time	0.0 to 60.0	0.5	s	Real time
d1-37	0xD125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real time
d1-38	0xD126	Excessive speed deviation	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-39	0xD127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real time
d1-40	0xD128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real time
d1-45	0xD12D	Motor overload protection	0: Disable 1: Enable	1	-	Real time
d1-46	0xD12E	Motor overload protection coefficient	20 to 1000	100	%	Real time
d1-47	0xD12F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real time
d1-54	0xD136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression in vector control 0: Disable 1: Enable bit2 to bit15: Reserved	0x0	-	Real time
d1-55	0xD137	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real time
d1-56	0xD138	Effective voltage threshold for overvoltage suppression	600.0 to 1000.0	770.0	V	Read only
d1-57	0xD139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real time
d1-58	0xD13A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real time
d1-59	0xD13B	Overvoltage suppression feedforward coefficient (V/f)	0 to 500	100	%	Real time
d1-60	0xD13C	Maximum frequency rise during overvoltage suppression (V/f)	0.0 to 200.0	20.0	Hz	At stop
d1-63	0xD13F	Response upon undervoltage	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-64	0xD140	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real time
d1-65	0xD141	Actual effective voltage threshold for undervoltage suppression	0.0 to 500.0	430.0	V	Read only
d1-66	0xD142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real time
d1-67	0xD143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real time
d1-68	0xD144	Maximum operating time during undervoltage suppression	0.1 to 600.0	0.5	s	Real time
d1-69	0xD145	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real time
d1-70	0xD146	Voltage hysteresis recovery upon undervoltage	1 to 100	30	V	Real time
d1-71	0xD147	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	At stop
d1-76	0xD14C	Overvoltage/ Undervoltage suppression command word	bit0: Overvoltage suppression integral (vector) 0: Disable 1: Enable bit1: Undervoltage suppression operating time limit 0: Disable 1: Enable bit2: Immediate response to acceleration/ deceleration change in VDC control 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	Real time
d1-78	0xD14E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
d1-81	0xD151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real time
d1-82	0xD152	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d1-89	0xD159	Single phase loss detection time	0.05 to 650.00	0.20	s	Real time
d2-00	0xD200	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: Decoupled V/f	0	-	At stop
d2-01	0xD201	Multi-point curve source	0: Three-point curve	0	-	Real time
d2-02	0xD202	Frequency point 1 of multi-point V/f curve	0.0 to d2-03	0.0	Hz	Real time
d2-03	0xD203	Frequency point 2 of multi-point V/f curve	d2-02 to d2-04	0.0	Hz	Real time
d2-04	0xD204	Frequency point 3 of multi-point V/f curve	d2-03 to 600.0	0.0	Hz	Real time
d2-08	0xD208	Voltage point 1 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
d2-09	0xD209	Voltage point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
d2-10	0xD20A	Voltage point 3 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
d2-14	0xD20E	Manual torque boost	0.0 to 100.0	3.0	%	Real time
d2-15	0xD20F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real time
d2-16	0xD210	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real time
d2-17	0xD211	Automatic torque boost filter time	10 to 1000	100	ms	Real time
d2-18	0xD212	Automatic torque boost gain	80 to 150	100	-	Real time
d2-22	0xD216	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real time
d2-23	0xD217	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real time
d2-24	0xD218	Cutoff frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d2-25	0xD219	Effective cutoff frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real time
d2-26	0xD21A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
d2-27	0xD21B	Overcurrent suppression threshold	80 to 300	200	%	At stop
d2-28	0xD21C	Overcurrent suppression Kp	1 to 500	100	%	Real time
d2-29	0xD21D	Overcurrent suppression Ki	10 to 1000	100	%	At stop
d2-30	0xD21E	Frequency for activating field weakening upon overcurrent suppression	60 to 500	100	%	Real time
d2-31	0xD21F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real time
d2-32	0xD220	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real time
d2-35	0xD223	Energy-saving control in V/f mode	0: Inactive 1: Active	0	-	Real time
d2-36	0xD224	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real time
d2-37	0xD225	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
d2-38	0xD226	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
d2-41	0xD229	Slip compensation mode	0: Disable 1: Enable	0	-	At stop
d2-42	0xD22A	Slip compensation gain	0.0 to 200.0	100.0	%	Real time
d2-43	0xD22B	Slip compensation filter time	0.1 to 10.0	0.5	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d2-47	0xD22F	Voltage upper limit in decoupled V/f	50.0 to 200.0	100.0	%	At stop
d2-48	0xD230	Source of V/f decoupled voltage	0: d2-49 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d2-49	0xD231	Digital reference of V/f decoupled voltage	0 to C4-03	0	V	Real time
d2-50	0xD232	Voltage ramp-up time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
d2-51	0xD233	Voltage ramp-down time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
d2-52	0xD234	RFG time of V/f decoupled frequency	0: RFG time set be 0 forcibly 1: Preset RFG time	0	-	At stop
d2-53	0xD235	Stop mode in decoupled V/f	0: Frequency and voltage decline to 0 separately 1: Frequency declined after voltage declined to 0 2: Coast to stop	0	-	Real time
d2-59	0xD23B	Synchronous motor V/f mode	0: Synchronous motor V/f 1 1: Synchronous motor V/f 2	1	-	At stop
d3-02	0xD302	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real time
d3-03	0xD303	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real time
d3-06	0xD306	Zero speed switchover frequency	0.0 to d3-09	1.0	%	Real time
d3-07	0xD307	Zero speed Kp calibration coefficient	0.0 to 1000.0	100.0	%	Real time
d3-08	0xD308	Zero speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
d3-09	0xD309	Low speed switchover frequency	0.0 to d3-12	10.0	%	Real time
d3-10	0xD30A	Low speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
d3-11	0xD30B	Low speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d3-12	0xD30C	High speed switchover frequency	d3-09 to 400.0	100.0	%	Real time
d3-13	0xD30D	High speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
d3-14	0xD30E	High speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
d3-19	0xD313	Adaptive source of speed loop Kp	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d3-21	0xD315	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real time
d3-22	0xD316	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real time
d3-23	0xD317	Lower limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
d3-24	0xD318	Upper limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
d3-27	0xD31B	Droop function	0: Disable 1: Enable	0	-	Real time
d3-28	0xD31C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Speed regulator integral component	1	-	At stop
d3-29	0xD31D	Droop coefficient	0.0 to 50.0	0.0	%	Real time
d3-33	0xD321	Forced integral enable	0: Inactive 1: Enable Other: B connector	0	-	Real time
d3-34	0xD322	Forced integral source	0: d3-35 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d3-35	0xD323	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
d3-38	0xD326	Acceleration torque feedforward enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d3-39	0xD327	Acceleration torque feedforward coefficient	0.0 to 1000.0	100.0	%	Real time
d3-40	0xD328	Acceleration source of acceleration torque feedforward	0: RFG setting 1: Automatic calculation Other: F connector	0	-	Real time
d3-41	0xD329	Reference model bandwidth	0.00 to 300.00	0.00	Hz	Real time
d3-42	0xD32A	Automatic calculation interval of acceleration torque feedforward	0 to 50	4	-	Real time
d3-45	0xD32D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
d3-46	0xD32E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
d3-47	0xD32F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
d3-48	0xD330	Low-pass filter time of torque current reference	0.0 to 100.0	0.0	ms	At stop
d3-49	0xD331	Torque coefficient adjustment value	0.0 to 200.0	120.0	%	Real time
d3-50	0xD332	Torque coefficient mode	Ones: Torque coefficient mode 0: Standard mode 1: Rated current 2: Fixed 1 Tens to ten thousands: Reserved	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d3-53	0xD335	Speed loop command word	bit0: Speed loop selection 0: Disable 1: Enable bit1: Integral mode selection 0: Conventional integral 1: Position-type integral bit2: Exit integral upon stall (reserved) 0: Disable 1: Enable bit3: Speed loop parameter flux adaption 0: Disable 1: Enable bit4: Reserved bit5: Regulator limit mode 0: Default mode 1: Associated with additional torque bit6: Torque mode setting at zero speed 0: Switching to speed mode 1: Keeping torque mode bit7 to bit15: Reserved	0x000B	-	Real time
d3-55	0xD337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time
d3-57	0xD339	Anti-load disturbance bandwidth	0.01 to 300.00	1.00	Hz	Real time
d3-58	0xD33A	Anti-load disturbance coefficient	0.0 to 1000.0	100.0	%	Real time
d3-59	0xD33B	Pseudo-integral coefficient	0.0 to 1000.0	100.0	%	Real time
d3-62	0xD33E	Center frequency of notch filter 1	0.0 to 4000.0	4000.0	-	Real time
d3-63	0xD33F	Center frequency of notch filter 2	0.0 to 4000.0	4000.0	-	Real time
d5-00	0xD500	Voltage margin for field weakening	0.1 to 50.0	3.0	%	Real time
d5-03	0xD503	Rated flux tuning factor	50.0 to 200.0	100.0	%	Real time
d7-01	0xD701	DC bus voltage filter time	0 to 10000	4	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d7-35	0xD723	TLC control word	bit0: Reserved bit1: CPC selection 0: Disable 1: Enable bit2: Speed source 0: Source 1 1: Source 2 bit3: Angle source 0: Source 1 1: Source 2 bit4: Energy-saving mode 0: Mode 1 1: Mode 2bit5: Inductance calculation 0: Using saturation model 1: Not using saturation model not used bit6: Inverse curve 0: ON 1: OFF bit7: Overvoltage suppression optimization 0: ON 1: OFF bit8: Undervoltage suppression optimization 0: ON : OFF bit9: IF switchover mode 0: Mode 0 1: Mode 1 bit10 to bit15: Reserved	0x0003	-	Real time
d7-36	0xD724	Field weakening coefficient in TLC control	0.1 to 5000.0	100.0	%	Real time
d7-37	0xD725	d-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
d7-38	0xD726	d-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
d7-39	0xD727	q-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
d7-40	0xD728	q-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
d7-41	0xD729	Lower limit of TLC reference	0.0 to 1000.0	0.0	%	Real time
d7-42	0xD72A	TLC phase lock loop scaling factor	0.1 to 5000.0	100.0	%	Real time
d7-43	0xD72B	TLC reference coefficient	0.1 to 1000.0	100.0	%	Real time
d8-00	0xD800	Control mode	0: SVC 2: V/f	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-01	0xD801	Motor control mode	0: Speed Control 1: Torque Control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8 : DI6 9: DI7 10 : DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
d8-02	0xD802	Startup mode	0: Direct start 1: Flying start	0	-	At stop
d8-03	0xD803	Speed tracking mode	0: Starting from the frequency at stop 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	4	-	Real time
d8-04	0xD804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	-	Real time
d8-05	0xD805	OFF2 (coast to stop) mode	0: Coast to stop	0	-	Read only
d8-06	0xD806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	-	Real time
d8-07	0xD807	Stop mode during operation	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real time
d8-09	0xD809	Zero speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real time
d8-10	0xD80A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
d8-11	0xD80B	Zero speed threshold for stop at synchronous frequency	0.00 to 200.00	1.00	%	Real time
d8-12	0xD80C	Zero speed judgment time of synchronous frequency	0.00 to 100.00	2.00	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-13	0xD80D	Start/Stop frequency reference following	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
d8-14	0xD80E	Motor direction selection	0: Default 1: Inverted direction	0	-	At stop
d8-16	0xD810	Stop delay time	0.00 to 655.35	0.00	s	At stop
d8-20	0xD814	Demagnetization time	0.00 to 5.00	0.50	s	Real time
d8-23	0xD817	Starting frequency	0.00 to 10.00	0.00	Hz	Real time
d8-24	0xD818	Starting frequency hold time	0.0 to 1000.0	0.0	s	At stop
d8-25	0xD819	DC braking time at start	0.0 to 100.0	0.0	s	At stop
d8-26	0xD81A	DC braking current at start	0 to 800	50	%	At stop
d8-27	0xD81B	Starting frequency of DC braking at stop	0.0 to 600.0	0.0	Hz	Real time
d8-28	0xD81C	Waiting time of DC braking at stop	0.0 to 100.0	0.0	s	Real time
d8-29	0xD81D	DC braking time at stop	0.0 to 100.0	0.0	s	Real time
d8-30	0xD81E	DC braking current at stop	0 to 800	50	%	Real time
d8-31	0xD81F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
d8-32	0xD820	Ki adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
d8-33	0xD821	DC braking superimposed frequency	0.00 to 10.00	0.00	Hz	Real time
d8-34	0xD822	DC braking current rise time	0.00 to 100.00	0.00	s	At stop
d8-35	0xD823	Current limit during constant current	50.0 to 800.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d8-41	0xD829	Over-excitation gain (V/f)	0 to 200	90	%	Real time
d8-43	0xD82B	Speed of speed tracking	1 to 100	20	-	Real time
d8-44	0xD82C	Frequency sweep Kp during speed tracking	100 to 1000	500	-	Real time
d8-45	0xD82D	Frequency sweep Ki during speed tracking	100 to 1000	800	-	Real time
d8-46	0xD82E	Speed tracking current	30 to 200	80	%	At stop
d8-70	0xD846	Initial position detection of synchronous motor before startup	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	-	At stop
d8-71	0xD847	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	-	At stop
d8-72	0xD848	Auto-tuning configuration before start	bit0: Reserved bit1: Start quick stator resistance auto-tuning 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection searching method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
d8-74	0xD84A	Auto-tuning mode	0: OFF 1: Enabled before initial operation after power-on 2: Enabled before operation	0	-	Real time
d9-00	0xD900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-01	0xD901	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
d9-02	0xD902	Negative speed selection	Same as d9-01	1	-	Real time
d9-03	0xD903	Digital reference of positive frequency upper limit 1	d9-07 to 800.0	800.0	%	At stop
d9-04	0xD904	Digital reference of negative frequency upper limit 1	-800.0 to d9-08	-800.0	%	At stop
d9-05	0xD905	Source of positive frequency upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d9-06	0xD906	Source of negative frequency upper limit 2	0: 800% 1: Inverted value of F2-24 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
d9-07	0xD907	Digital reference of positive frequency lower limit 1	0.0 to d9-03	0.0	%	At stop
d9-08	0xD908	Digital reference of negative frequency lower limit 1	d9-04 to 0.0	0.0	%	At stop
d9-09	0xD909	Digital reference of torque upper limit 1	0.0 to 800.0	150.0	%	Real time
d9-10	0xD90A	Digital reference of torque lower limit 1	-800.0 to 0.0	-150.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-11	0xD90B	Source of torque upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
d9-12	0xD90C	Source of torque lower limit 2	0: 800% 1: Inverted value of F2-32 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
d9-33	0xD921	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Permanent magnet synchronous motor demagnetization protection 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Output single phase loss detection 0: Disable 1: Enable bit10 to bit15: Reserved	0x0687	-	Real time
d9-35	0xD923	Overspeed protection	0: Disable 1: Enable	1	-	Real time
d9-36	0xD924	Overspeed protection time	0.0 to 60.0	0.5	s	Real time
d9-37	0xD925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real time
d9-38	0xD926	Excessive speed deviation	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-39	0xD927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real time
d9-40	0xD928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real time
d9-45	0xD92D	Motor overload protection	0: Disable 1: Enable	1	-	Real time
d9-46	0xD92E	Motor overload protection coefficient	20 to 1000	100	%	Real time
d9-47	0xD92F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real time
d9-54	0xD936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression in vector control 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real time
d9-55	0xD937	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real time
d9-56	0xD938	Effective voltage threshold for overvoltage suppression	600.0 to 1000.0	770.0	V	Read only
d9-57	0xD939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real time
d9-58	0xD93A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real time
d9-59	0xD93B	Overvoltage suppression feedforward coefficient (V/f)	0 to 500	100	%	Real time
d9-60	0xD93C	Maximum frequency rise during overvoltage suppression (V/f)	0.0 to 200.0	20.0	Hz	At stop
d9-63	0xD93F	Response to undervoltage	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-64	0xD940	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real time
d9-65	0xD941	Actual effective voltage threshold for undervoltage suppression	0.0 to 500.0	430.0	V	Read only
d9-66	0xD942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real time
d9-67	0xD943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real time
d9-68	0xD944	Maximum operating time during undervoltage suppression	0.1 to 600.0	0.5	s	Real time
d9-69	0xD945	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real time
d9-70	0xD946	Voltage hysteresis recovery upon undervoltage	1 to 100	30	V	Real time
d9-71	0xD947	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	At stop
d9-76	0xD94C	Overvoltage/ Undervoltage suppression command word	bit0: Overvoltage suppression integral (vector) 0: Disable 1: Enable bit1: Undervoltage suppression operating time limit 0: Disable 1: Enable bit2: Immediate response to acceleration/ deceleration change in VDC control 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	Real time
d9-78	0xD94E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
d9-81	0xD951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real time
d9-82	0xD952	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
d9-89	0xD959	Single phase loss detection time	0.05 to 650.00	0.20	s	Real time
dA-00	0xDA00	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: Decoupled V/f	0	-	At stop
dA-01	0xDA01	Multi-point curve source	0: Three-point curve	0	-	Real time
dA-02	0xDA02	Frequency point 1 of multi-point V/f curve	0.0 to dA-03	0.0	Hz	Real time
dA-03	0xDA03	Frequency point 2 of multi-point V/f curve	dA-02 to dA-04	0.0	Hz	Real time
dA-04	0xDA04	Frequency point 3 of multi-point V/f curve	dA-03 to 600.0	0.0	Hz	Real time
dA-08	0xDA08	Voltage point 1 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
dA-09	0xDA09	Voltage point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
dA-10	0xDA0A	Voltage point 3 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
dA-14	0xDA0E	Manual torque boost	0.0 to 100.0	3.0	%	Real time
dA-15	0xDA0F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real time
dA-16	0xDA10	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real time
dA-17	0xDA11	Automatic torque boost filter time	10 to 1000	100	ms	Real time
dA-18	0xDA12	Automatic torque boost gain	80 to 150	100	-	Real time
dA-22	0xDA16	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real time
dA-23	0xDA17	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real time
dA-24	0xDA18	Cutoff frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
dA-25	0xDA19	Effective cutoff frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real time
dA-26	0xDA1A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
dA-27	0xDA1B	Overcurrent suppression threshold	80 to 300	200	%	At stop
dA-28	0xDA1C	Overcurrent suppression Kp	1 to 500	100	%	Real time
dA-29	0xDA1D	Overcurrent suppression Ki	10 to 1000	100	%	At stop
dA-30	0xDA1E	Frequency for activating field weakening upon overcurrent suppression	60 to 500	100	%	Real time
dA-31	0xDA1F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real time
dA-32	0xDA20	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real time
dA-35	0xDA23	Energy-saving control in V/f mode	0: Inactive 1: Active	0	-	Real time
dA-36	0xDA24	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real time
dA-37	0xDA25	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
dA-38	0xDA26	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
dA-41	0xDA29	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	-	At stop
dA-42	0xDA2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real time
dA-43	0xDA2B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
dA-47	0xDA2F	Voltage upper limit in decoupled V/f	50.0 to 200.0	100.0	%	At stop
dA-48	0xDA30	Source of V/f decoupled voltage	0: d2-49 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
dA-49	0xDA31	Digital reference of V/f decoupled voltage	0 to C7-03	0	V	Real time
dA-50	0xDA32	Voltage ramp-up time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
dA-51	0xDA33	Voltage ramp-down time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
dA-52	0xDA34	RFG time of V/f decoupled frequency	0: RFG time set be 0 forcibly 1: Preset RFG time	0	-	At stop
dA-53	0xDA35	Stop mode in decoupled V/f	0: Frequency and voltage decline to 0 separately 1: Frequency declined after voltage declined to 0 2: Coast to stop	0	-	Real time
dA-59	0xDA3B	Synchronous motor V/f mode	0: Synchronous motor V/f 1 1: Synchronous motor V/f 2	1	-	At stop
db-02	0xDB02	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real time
db-03	0xDB03	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real time
db-06	0xDB06	Zero speed switchover frequency	0.0 to db-09	1.0	%	Real time
db-07	0xDB07	Zero speed Kp calibration coefficient	0.0 to 1000.0	100.0	%	Real time
db-08	0xDB08	Zero speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
db-09	0xDB09	Low speed switchover frequency	0.0 to db-12	10.0	%	Real time
db-10	0xDB0A	Low speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
db-11	0xDB0B	Low speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
db-12	0xDB0C	High speed switchover frequency	db-09 to 400.0	100.0	%	Real time
db-13	0xDB0D	High speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
db-14	0xDB0E	High speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
db-19	0xDB13	Adaptive source of speed loop Kp	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
db-21	0xDB15	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real time
db-22	0xDB16	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real time
db-23	0xDB17	Lower limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
db-24	0xDB18	Upper limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
db-27	0xDB1B	Droop function	0: Disable 1: Enable	0	-	Real time
db-28	0xDB1C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Speed regulator integral component	1	-	At stop
db-29	0xDB1D	Droop coefficient	0.0 to 50.0	0.0	%	Real time
db-33	0xDB21	Forced integral enable	0: Inactive 1: Enable Other: B connector	0	-	Real time
db-34	0xDB22	Forced integral source	0: db-35 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
db-35	0xDB23	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
db-38	0xDB26	Feedforward torque enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
db-39	0xDB27	Feedforward torque coefficient	0.0 to 1000.0	100.0	%	Real time
db-40	0xDB28	Feedforward acceleration source	0: RFG setting 1: Automatic calculation Other: F connector	0	-	Real time
db-41	0xDB29	Reference model bandwidth	0.00 to 300.00	0.00	Hz	Real time
db-42	0xDB2A	Automatic calculation interval of feedforward torque	0 to 50	4	-	Real time
db-45	0xDB2D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
db-46	0xDB2E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
db-47	0xDB2F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
db-48	0xDB30	Current filter time of torque reference	0.0 to 100.0	0.0	ms	At stop
db-49	0xDB31	Torque coefficient adjustment value	0.0 to 200.0	80.0	%	Real time
db-50	0xDB32	Torque coefficient mode	Ones: Torque coefficient mode 0: Standard mode 1: Rated current 2: Fixed 1 Tens to ten thousands: Reserved	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
db-53	0xDB35	Speed loop command word	bit0: Speed loop enable 0: Disable 1: Enable bit1: Integral method selection 0: Conventional integral 1: Position-type integral bit2: Exit integral upon stall (reserved) 0: Disable 1: Enable bit3: Speed loop parameter flux adaptation 0: Disable 1: Enable bit4: Anti-load disturbance 0: Disable 1: Enable bit5: Regulator limit method selection 0: Default method 1: Associated with additional torque bit6: Torque mode setting at zero speed 0: Switching to speed mode 1: Keeping torque mode bit7 to bit15: Reserved	0x000B	-	Real time
db-55	0xDB37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time
db-57	0xDB39	Load observer bandwidth	0.01 to 300.00	1.00	Hz	Real time
db-58	0xDB3A	Load observer coefficient	0.0 to 1000.0	100.0	%	Real time
db-59	0xDB3B	Pseudo-integral coefficient	0.0 to 1000.0	100.0	%	Real time
db-62	0xDB3E	Center frequency of notch filter 1	0.0 to 4000.0	4000.0	-	Real time
db-63	0xDB3F	Center frequency of notch filter 2	0.0 to 4000.0	4000.0	-	Real time
dF-01	0xDF01	DC bus voltage filter time	0 to 10000	4	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
dF-35	0xDF23	TLC control word	bit0: Reserved bit1: CPC selection 0: Disable 1: Enable bit2: Speed source 0: Source 1 1: Source 2 bit3: Angle source 0: Source 1 1: Source 2 bit4: Energy-saving mode 0: Mode 1 1: Mode 2bit5: Inductance calculation 0: Using saturation model 1: Not using saturation model not used bit6: Inverse curve 0: ON 1: OFF bit7: Overvoltage suppression optimization 0: ON 1: OFF bit8: Undervoltage suppression optimization 0: ON : OFF bit9: IF switchover mode 0: Mode 0 1: Mode 1 bit10 to bit15: Reserved	0x0003	-	Real time
dF-36	0xDF24	Field weakening coefficient in TLC control	0.1 to 5000.0	100.0	%	Real time
dF-37	0xDF25	d-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
dF-38	0xDF26	d-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
dF-39	0xDF27	q-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
dF-40	0xDF28	q-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
dF-41	0xDF29	Lower limit of TLC reference	0.0 to 1000.0	0.0	%	Real time
dF-42	0xDF2A	TLC phase lock loop scaling factor	0.1 to 5000.0	100.0	%	Real time
dF-43	0xDF2B	TLC reference coefficient	0.1 to 1000.0	100.0	%	Real time
y0-00	0x4000	Control mode	0: SVC 2: V/f	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-01	0x4001	Motor control mode	0: Speed Control 1: Torque Control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8 : DI6 9: DI7 10 : DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
y0-02	0x4002	Startup mode	0: Direct start 1: Flying start	0	-	At stop
y0-03	0x4003	Speed tracking mode	0: Starting from the frequency at stop 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	4	-	Real time
y0-04	0x4004	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	-	Real time
y0-05	0x4005	OFF2 (coast to stop) mode	0: Coast to stop	0	-	Read only
y0-06	0x4006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	-	Real time
y0-07	0x4007	Stop mode during operation	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real time
y0-09	0x4009	Zero speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real time
y0-10	0x400A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
y0-11	0x400B	Zero speed threshold for stop at synchronous frequency	0.00 to 200.00	1.00	%	Real time
y0-12	0x400C	Zero speed judgment time of synchronous frequency	0.00 to 100.00	2.00	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-13	0x400D	Start/Stop frequency reference following	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
y0-14	0x400E	Motor direction selection	0: Default 1: Inverted direction	0	-	At stop
y0-16	0x4010	Stop delay time	0.00 to 655.35	0.00	s	At stop
y0-20	0x4014	Demagnetization time	0.00 to 5.00	0.50	s	Real time
y0-23	0x4017	Starting frequency	0.00 to 10.00	0.00	Hz	Real time
y0-24	0x4018	Starting frequency hold time	0.0 to 1000.0	0.0	s	At stop
y0-25	0x4019	DC braking time at start	0.0 to 100.0	0.0	s	At stop
y0-26	0x401A	DC braking current at start	0 to 800	50	%	At stop
y0-27	0x401B	Starting frequency of DC braking at stop	0.0 to 600.0	0.0	Hz	Real time
y0-28	0x401C	Waiting time of DC braking at stop	0.0 to 100.0	0.0	s	Real time
y0-29	0x401D	DC braking time at stop	0.0 to 100.0	0.0	s	Real time
y0-30	0x401E	DC braking current at stop	0 to 800	50	%	Real time
y0-31	0x401F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
y0-32	0x4020	Ki adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
y0-33	0x4021	DC braking superimposed frequency	0.00 to 10.00	0.00	Hz	Real time
y0-34	0x4022	DC braking current rise time	0.00 to 100.00	0.00	s	At stop
y0-35	0x4023	Current limit during constant current	50.0 to 800.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y0-41	0x4029	Over-excitation gain (V/f)	0 to 200	90	%	Real time
y0-43	0x402B	Speed of speed tracking	1 to 100	20	-	Real time
y0-44	0x402C	Frequency sweep Kp during speed tracking	100 to 1000	500	-	Real time
y0-45	0x402D	Frequency sweep Ki during speed tracking	100 to 1000	800	-	Real time
y0-46	0x402E	Speed tracking current	30 to 200	80	%	At stop
y0-70	0x4046	Initial position detection of synchronous motor before startup	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	-	At stop
y0-71	0x4047	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	-	At stop
y0-72	0x4048	Auto-tuning configuration before start	bit0: Reserved bit1: Start quick stator resistance auto-tuning 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection searching method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
y0-74	0x404A	Auto-tuning mode	0: OFF 1: Enabled before initial operation after power-on 2: Enabled before operation	0	-	Real time
y1-00	0x4100	Maximum motor current	0.0 to 1000.0	1000.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-01	0x4101	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
y1-02	0x4102	Negative speed selection	Same as y1-01	1	-	Real time
y1-03	0x4103	Digital reference of positive frequency upper limit 1	y1-07 to 800.0	800.0	%	At stop
y1-04	0x4104	Digital reference of negative frequency upper limit 1	-800.0–y1-08	-800.0	%	At stop
y1-05	0x4105	Source of positive frequency upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y1-06	0x4106	Source of negative frequency upper limit 2	0: 800% 1: Inverted value of F2-24 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
y1-07	0x4107	Digital reference of positive frequency lower limit 1	0.0–y1-03	0.0	%	At stop
y1-08	0x4108	Digital reference of negative frequency lower limit 1	y1-04 to 0.0	0.0	%	At stop
y1-09	0x4109	Digital reference of torque upper limit 1	0.0 to 800.0	150.0	%	Real time
y1-10	0x410A	Digital reference of torque lower limit 1	-800.0 to 0.0	-150.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-11	0x410B	Source of torque upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y1-12	0x410C	Source of torque lower limit 2	0: 800% 1: Inverted value of F2-32 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
y1-33	0x4121	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Permanent magnet synchronous motor demagnetization protection 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Output single phase loss detection 0: Disable 1: Enable bit10 to bit15: Reserved	0x0687	-	Real time
y1-35	0x4123	Overspeed protection	0: Disable 1: Enable	1	-	Real time
y1-36	0x4124	Overspeed protection time	0.0 to 60.0	0.5	s	Real time
y1-37	0x4125	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real time
y1-38	0x4126	Excessive speed deviation	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-39	0x4127	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real time
y1-40	0x4128	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real time
y1-45	0x412D	Motor overload protection	0: Disable 1: Enable	1	-	Real time
y1-46	0x412E	Motor overload protection coefficient	20 to 1000	100	%	Real time
y1-47	0x412F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real time
y1-54	0x4136	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression in vector control 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real time
y1-55	0x4137	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real time
y1-56	0x4138	Effective voltage threshold for overvoltage suppression	600.0 to 1000.0	770.0	V	Read only
y1-57	0x4139	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real time
y1-58	0x413A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real time
y1-59	0x413B	Overvoltage suppression feedforward coefficient (V/f)	0 to 500	100	%	Real time
y1-60	0x413C	Maximum frequency rise during overvoltage suppression (V/f)	0.0 to 200.0	20.0	Hz	At stop
y1-63	0x413F	Response to undervoltage	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-64	0x4140	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real time
y1-65	0x4141	Actual effective voltage threshold for undervoltage suppression	0.0 to 500.0	430.0	V	Read only
y1-66	0x4142	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real time
y1-67	0x4143	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real time
y1-68	0x4144	Maximum operating time during undervoltage suppression	0.1 to 600.0	0.5	s	Real time
y1-69	0x4145	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real time
y1-70	0x4146	Voltage hysteresis recovery upon undervoltage	1 to 100	30	V	Real time
y1-71	0x4147	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	At stop
y1-76	0x414C	Overvoltage/ Undervoltage suppression command word	bit0: Overvoltage suppression integral (vector) 0: Disable 1: Enable bit1: Undervoltage suppression operating time limit 0: Disable 1: Enable bit2: Immediate response to acceleration/ deceleration change in VDC control 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	Real time
y1-78	0x414E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
y1-81	0x4151	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real time
y1-82	0x4152	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y1-89	0x4159	Single phase loss detection time	0.05 to 650.00	0.20	s	Real time
y2-00	0x4200	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: Decoupled V/f	0	-	At stop
y2-01	0x4201	Multi-point curve source	0: Three-point curve	0	-	Real time
y2-02	0x4202	Frequency point 1 of multi-point V/f curve	0.0 to y2-03	0.0	Hz	Real time
y2-03	0x4203	Frequency point 2 of multi-point V/f curve	y2-02 to y2-04	0.0	Hz	Real time
y2-04	0x4204	Frequency point 3 of multi-point V/f curve	y2-03 to 600.0	0.0	Hz	Real time
y2-08	0x4208	Voltage point 1 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
y2-09	0x4209	Voltage point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
y2-10	0x420A	Voltage point 3 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
y2-14	0x420E	Manual torque boost	0.0 to 100.0	3.0	%	Real time
y2-15	0x420F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real time
y2-16	0x4210	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real time
y2-17	0x4211	Automatic torque boost filter time	10 to 1000	100	ms	Real time
y2-18	0x4212	Automatic torque boost gain	80 to 150	100	-	Real time
y2-22	0x4216	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real time
y2-23	0x4217	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real time
y2-24	0x4218	Cutoff frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y2-25	0x4219	Effective cutoff frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real time
y2-26	0x421A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
y2-27	0x421B	Overcurrent suppression threshold	80 to 300	200	%	At stop
y2-28	0x421C	Overcurrent suppression Kp	1 to 500	100	%	Real time
y2-29	0x421D	Overcurrent suppression Ki	10 to 1000	100	%	At stop
y2-30	0x421E	Frequency for activating field weakening upon overcurrent suppression	60 to 500	100	%	Real time
y2-31	0x421F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real time
y2-32	0x4220	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real time
y2-35	0x4223	Energy-saving control in V/f mode	0: Inactive 1: Active	0	-	Real time
y2-36	0x4224	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real time
y2-37	0x4225	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
y2-38	0x4226	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
y2-41	0x4229	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	-	At stop
y2-42	0x422A	Slip compensation gain	0.0 to 200.0	100.0	%	Real time
y2-43	0x422B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y2-47	0x422F	Voltage upper limit in decoupled V/f	50.0 to 200.0	100.0	%	At stop
y2-48	0x4230	Source of V/f decoupled voltage	0: d2-49 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y2-49	0x4231	Digital reference of V/f decoupled voltage	0 to CA-03	0	V	Real time
y2-50	0x4232	Voltage ramp-up time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
y2-51	0x4233	Voltage ramp-down time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
y2-52	0x4234	RFG time of V/f decoupled frequency	0: RFG time set be 0 forcibly 1: Preset RFG time	0	-	At stop
y2-53	0x4235	Stop mode in decoupled V/f	0: Frequency and voltage decline to 0 separately 1: Frequency declined after voltage declined to 0 2: Coast to stop	0	-	Real time
y2-59	0x423B	Synchronous motor V/f mode	0: Synchronous motor V/f 1 1: Synchronous motor V/f 2	1	-	At stop
y3-02	0x4302	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real time
y3-03	0x4303	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real time
y3-06	0x4306	Zero speed switchover frequency	0.0 to y3-09	1.0	%	Real time
y3-07	0x4307	Zero speed Kp calibration coefficient	0.0 to 1000.0	100.0	%	Real time
y3-08	0x4308	Zero speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
y3-09	0x4309	Low speed switchover frequency	0.0 to y3-12	10.0	%	Real time
y3-10	0x430A	Low speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
y3-11	0x430B	Low speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y3-12	0x430C	High speed switchover frequency	y3-09 to 400.0	100.0	%	Real time
y3-13	0x430D	High speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
y3-14	0x430E	High speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
y3-19	0x4313	Adaptive source of speed loop Kp	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y3-21	0x4315	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real time
y3-22	0x4316	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real time
y3-23	0x4317	Lower limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
y3-24	0x4318	Upper limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
y3-27	0x431B	Droop function	0: Disable 1: Enable	0	-	Real time
y3-28	0x431C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Speed regulator integral component	1	-	At stop
y3-29	0x431D	Droop coefficient	0.0 to 50.0	0.0	%	Real time
y3-33	0x4321	Forced integral enable	0: Inactive 1: Enable Other: B connector	0	-	Real time
y3-34	0x4322	Forced integral source	0: y3-35 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y3-35	0x4323	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
y3-38	0x4326	Feedforward torque enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y3-39	0x4327	Feedforward torque coefficient	0.0 to 1000.0	100.0	%	Real time
y3-40	0x4328	Feedforward acceleration source	0: RFG setting 1: Automatic calculation Other: F connector	0	-	Real time
y3-41	0x4329	Reference model bandwidth	0.00 to 300.00	0.00	Hz	Real time
y3-42	0x432A	Automatic calculation interval of feedforward torque	0 to 50	4	-	Real time
y3-45	0x432D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
y3-46	0x432E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
y3-47	0x432F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
y3-48	0x4330	Current filter time of torque reference	0.0 to 100.0	0.0	ms	At stop
y3-49	0x4331	Torque coefficient adjustment value	0.0 to 200.0	80.0	%	Real time
y3-50	0x4332	Torque coefficient mode	Ones: Torque coefficient mode 0: Standard mode 1: Rated current 2: Fixed Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y3-53	0x4335	Speed loop command word	bit0: Speed loop enable 0: Disable 1: Enable bit1: Integral method selection 0: Conventional integral 1: Position-type integral bit2: Exit integral upon stall (reserved) 0: Disable 1: Enable bit3: Speed loop parameter flux adaptation 0: Disable 1: Enable bit4: Anti-load disturbance 0: Disable 1: Enable bit5: Regulator limit method selection 0: Default method 1: Associated with additional torque bit6: Torque mode setting at zero speed 0: Switching to speed mode 1: Keeping torque mode bit7 to bit15: Reserved	0x000B	-	Real time
y3-55	0x4337	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time
y3-57	0x4339	Load observer bandwidth	0.01 to 300.00	1.00	Hz	Real time
y3-58	0x433A	Load observer coefficient	0.0 to 1000.0	100.0	%	Real time
y3-59	0x433B	Pseudo-integral coefficient	0.0 to 1000.0	100.0	%	Real time
y3-62	0x433E	Center frequency of notch filter 1	0.0 to 4000.0	4000.0	-	Real time
y3-63	0x433F	Center frequency of notch filter 2	0.0 to 4000.0	4000.0	-	Real time
y7-01	0x4701	DC bus voltage filter time	0 to 10000	4	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y7-35	0x4723	TLC control word	bit0: Reserved bit1: CPC selection 0: Disable 1: Enable bit2: Speed source 0: Source 1 1: Source 2 bit3: Angle source 0: Source 1 1: Source 2 bit4: Energy-saving mode 0: Mode 1 1: Mode 2bit5: Inductance calculation 0: Using saturation model 1: Not using saturation model not used bit6: Inverse curve 0: ON 1: OFF bit7: Overvoltage suppression optimization 0: ON 1: OFF bit8: Undervoltage suppression optimization 0: ON : OFF bit9: IF switchover mode 0: Mode 0 1: Mode 1 bit10 to bit15: Reserved	0x0003	-	Real time
y7-36	0x4724	Field weakening coefficient in TLC control	0.1 to 5000.0	100.0	%	Real time
y7-37	0x4725	d-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
y7-38	0x4726	d-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
y7-39	0x4727	q-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
y7-40	0x4728	q-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
y7-41	0x4729	Lower limit of TLC reference	0.0 to 1000.0	0.0	%	Real time
y7-42	0x472A	TLC phase lock loop scaling factor	0.1 to 5000.0	100.0	%	Real time
y7-43	0x472B	TLC reference coefficient	0.1 to 1000.0	100.0	%	Real time
y8-00	0x4800	Control mode	0: SVC 2: V/f	2	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-01	0x4801	Motor control mode	0: Speed Control 1: Torque Control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8 : DI6 9: DI7 10 : DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
y8-02	0x4802	Startup mode	0: Direct start 1: Flying start	0	-	At stop
y8-03	0x4803	Speed tracking mode	0: Starting from the frequency at stop 1: Starting from the mains frequency 2: Starting from the maximum frequency 4: Field-oriented speed tracking	4	-	Real time
y8-04	0x4804	OFF1 stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	-	Real time
y8-05	0x4805	OFF2 (coast to stop) mode	0: Coast to stop	0	-	Read only
y8-06	0x4806	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	-	Real time
y8-07	0x4807	Stop mode during operation	0: ON_OFF1 (start/stop) stop 1: OFF2 (coast to stop) stop 2: OFF3 (quick stop) stop	1	-	Real time
y8-09	0x4809	Zero speed threshold (actual speed)	0.10 to 200.00	2.00	%	Real time
y8-10	0x480A	Zero speed judgment time (actual speed)	0.00 to 10.00	0.10	s	At stop
y8-11	0x480B	Zero speed threshold for stop at synchronous frequency	0.00 to 200.00	1.00	%	Real time
y8-12	0x480C	Zero speed judgment time of synchronous frequency	0.00 to 100.00	2.00	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-13	0x480D	Start/Stop frequency reference following	0: Inhibited 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
y8-14	0x480E	Motor direction selection	0: Default 1: Inverted direction	0	-	At stop
y8-16	0x4810	Stop delay time	0.00 to 655.35	0.00	s	At stop
y8-20	0x4814	Demagnetization time	0.00 to 5.00	0.50	s	Real time
y8-23	0x4817	Starting frequency	0.00 to 10.00	0.00	Hz	Real time
y8-24	0x4818	Starting frequency hold time	0.0 to 1000.0	0.0	s	At stop
y8-25	0x4819	DC braking time at start	0.0 to 100.0	0.0	s	At stop
y8-26	0x481A	DC braking current at start	0 to 800	50	%	At stop
y8-27	0x481B	Starting frequency of DC braking at stop	0.0 to 600.0	0.0	Hz	Real time
y8-28	0x481C	Waiting time of DC braking at stop	0.0 to 100.0	0.0	s	Real time
y8-29	0x481D	DC braking time at stop	0.0 to 100.0	0.0	s	Real time
y8-30	0x481E	DC braking current at stop	0 to 800	50	%	Real time
y8-31	0x481F	Kp adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
y8-32	0x4820	Ki adjustment of DC braking current loop	0.1 to 800.0	100.0	%	Real time
y8-33	0x4821	DC braking superimposed frequency	0.00 to 10.00	0.00	Hz	Real time
y8-34	0x4822	DC braking current rise time	0.00 to 100.00	0.00	s	At stop
y8-35	0x4823	Current limit during constant current	50.0 to 800.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y8-41	0x4829	Over-excitation gain (V/f)	0 to 200	90	%	Real time
y8-43	0x482B	Speed of speed tracking	1 to 100	20	-	Real time
y8-44	0x482C	Frequency sweep Kp during speed tracking	100 to 1000	500	-	Real time
y8-45	0x482D	Frequency sweep Ki during speed tracking	100 to 1000	800	-	Real time
y8-46	0x482E	Speed tracking current	30 to 200	80	%	At stop
y8-70	0x4846	Initial position detection of synchronous motor before startup	0: Detected every time upon operation 1: Not detected 2: Detected upon initial power-on	0	-	At stop
y8-71	0x4847	Initial position detection method of synchronous motor before startup	0: Voltage pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	-	At stop
y8-72	0x4848	Auto-tuning configuration before start	bit0: Reserved bit1: Start quick stator resistance auto-tuning 0: Disable 1: Enable bit2 to bit6: Reserved bit7: High-frequency injection polarity auto-tuning mode 0: Method 0 1: Method 1 bit8: High-frequency injection searching method 0: Disable 1: Enable bit9 to bit15: Reserved	0x0	-	At stop
y8-74	0x484A	Auto-tuning mode	0: OFF 1: Enabled before initial operation after power-on 2: Enabled before operation	0	-	Real time
y9-00	0x4900	Maximum motor current	0.0 to 1000.0	1000.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-01	0x4901	Positive speed permission	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
y9-02	0x4902	Negative speed selection	Same as y9-01	1	-	Real time
y9-03	0x4903	Digital reference of positive frequency upper limit 1	y9-07 to 800.0	800.0	%	At stop
y9-04	0x4904	Digital reference of negative frequency upper limit 1	-800.0–y9-08	-800.0	%	At stop
y9-05	0x4905	Source of positive frequency upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y9-06	0x4906	Source of negative frequency upper limit 2	0: 800% 1: Inverted value of F2-24 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
y9-07	0x4907	Digital reference of positive frequency lower limit 1	0.0 to y9-03	0.0	%	At stop
y9-08	0x4908	Digital reference of negative frequency lower limit 1	y9-04 to 0.0	0.0	%	At stop
y9-09	0x4909	Digital reference of torque upper limit 1	0.0 to 800.0	150.0	%	Real time
y9-10	0x490A	Digital reference of torque lower limit 1	-800.0 to 0.0	-150.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-11	0x490B	Source of torque upper limit 2	0: 800% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
y9-12	0x490C	Source of torque lower limit 2	0: 800% 1: Inverted value of F2-32 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	1	-	Real time
y9-33	0x4921	Motor protection	bit0: Reserved bit1: Current control error detection 0: Disable 1: Enable bit2: Motor step loss error detection 0: Disable 1: Enable bit3: Reserved bit4: Permanent magnet synchronous motor demagnetization protection 0: Disable 1: Enable bit5: Runaway protection 0: Disable 1: Enable bit6: Speed reversal protection 0: Disable 1: Enable bit7: Reserved bit8: Motor parameter error check 0: Disable 1: Enable bit9: Output single phase loss detection 0: Disable 1: Enable bit10 to bit15: Reserved	0x0687	-	Real time
y9-35	0x4923	Overspeed protection	0: Disable 1: Enable	1	-	Real time
y9-36	0x4924	Overspeed protection time	0.0 to 60.0	0.5	s	Real time
y9-37	0x4925	Overspeed protection threshold	0.0 to 50.0	20.0	%	Real time
y9-38	0x4926	Excessive speed deviation	0: Disable 1: Enable	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-39	0x4927	Excessive speed deviation protection time	0.0 to 60.0	1.0	s	Real time
y9-40	0x4928	Threshold for excessive speed deviation	0.0 to 50.0	20.0	%	Real time
y9-45	0x492D	Motor overload protection	0: Disable 1: Enable	1	-	Real time
y9-46	0x492E	Motor overload protection coefficient	20 to 1000	100	%	Real time
y9-47	0x492F	Motor overload pre-alarm coefficient	50 to 100	80	%	Real time
y9-54	0x4936	Overvoltage suppression enable	bit0: Overvoltage suppression in V/f mode 0: Disable 1: Enable bit1: Overvoltage suppression in vector control 0: Disable 1: Enable bit2 to bit15: Reserved	0x0001	-	Real time
y9-55	0x4937	Voltage threshold for overvoltage suppression	600.0 to A3-57	770.0	V	Real time
y9-56	0x4938	Effective voltage threshold for overvoltage suppression	600.0 to 1000.0	770.0	V	Read only
y9-57	0x4939	Overvoltage suppression Kp adjustment	0 to 1000	100	%	Real time
y9-58	0x493A	Overvoltage suppression Ki adjustment	0 to 1000	100	%	Real time
y9-59	0x493B	Overvoltage suppression feedforward coefficient (V/f)	0 to 500	100	%	Real time
y9-60	0x493C	Maximum frequency rise during overvoltage suppression (V/f)	0.0 to 200.0	20.0	Hz	At stop
y9-63	0x493F	Response to undervoltage	0: No action 1: Undervoltage suppression 2: Decelerate to stop	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-64	0x4940	Voltage threshold for undervoltage suppression	A3-55 to 500.0	430.0	V	Real time
y9-65	0x4941	Actual effective voltage threshold for undervoltage suppression	0.0 to 500.0	430.0	V	Read only
y9-66	0x4942	Undervoltage suppression Kp adjustment	0 to 1000	100	%	Real time
y9-67	0x4943	Undervoltage suppression Ki adjustment	0 to 1000	100	%	Real time
y9-68	0x4944	Maximum operating time during undervoltage suppression	0.1 to 600.0	0.5	s	Real time
y9-69	0x4945	Time for decelerating to stop upon undervoltage	0.0 to 300.0	20.0	s	Real time
y9-70	0x4946	Voltage hysteresis recovery upon undervoltage	1 to 100	30	V	Real time
y9-71	0x4947	Waiting time for recovering from undervoltage (V/f)	0.0 to 100.0	0.5	s	At stop
y9-76	0x494C	Overvoltage/ Undervoltage suppression command word	bit0: Overvoltage suppression integral (vector) 0: Disable 1: Enable bit1: Undervoltage suppression operating time limit 0: Disable 1: Enable bit2: Immediate response to acceleration/ deceleration change in VDC control 0: Disable 1: Enable bit3 to bit15: Reserved	0x0	-	Real time
y9-78	0x494E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
y9-81	0x4951	Detection time for three-phase output loss	0.0 to 5.0	1.0	s	Real time
y9-82	0x4952	Current threshold for three-phase output loss	0.0 to 100.0	10.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
y9-89	0x4959	Single phase loss detection time	0.05 to 650.00	0.20	s	Real time
yA-00	0x4A00	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: Decoupled V/f	0	-	At stop
yA-01	0x4A01	Multi-point curve source	0: Three-point curve	0	-	Real time
yA-02	0x4A02	Frequency point 1 of multi-point V/f curve	0.0 to yA-03	0.0	Hz	Real time
yA-03	0x4A03	Frequency point 2 of multi-point V/f curve	yA-02 to yA-04	0.0	Hz	Real time
yA-04	0x4A04	Frequency point 3 of multi-point V/f curve	yA-03 to 600.0	0.0	Hz	Real time
yA-08	0x4A08	Voltage point 1 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
yA-09	0x4A09	Voltage point 2 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
yA-10	0x4A0A	Voltage point 3 of multi-point V/f curve	0.0 to 1000.0	0.0	V	Real time
yA-14	0x4A0E	Manual torque boost	0.0 to 100.0	3.0	%	Real time
yA-15	0x4A0F	Cutoff frequency of torque boost	0.0 to 400.0	100.0	%	Real time
yA-16	0x4A10	Torque boost mode	0: Manual 1: Automatic 2: Manual+Automatic	2	-	Real time
yA-17	0x4A11	Automatic torque boost filter time	10 to 1000	100	ms	Real time
yA-18	0x4A12	Automatic torque boost gain	80 to 150	100	-	Real time
yA-22	0x4A16	Oscillation suppression in V/f mode	0: Disable 1: Enable	1	-	Real time
yA-23	0x4A17	Oscillation suppression gain in V/f mode	0 to 400	100	%	Real time
yA-24	0x4A18	Cutoff frequency of oscillation suppression filter in V/f mode	1.0 to 50.0	8.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yA-25	0x4A19	Effective cutoff frequency of oscillation suppression in V/f mode	0.0 to 600.0	400.0	%	Real time
yA-26	0x4A1A	Overcurrent suppression enable	0: Disable 1: Enable	1	-	At stop
yA-27	0x4A1B	Overcurrent suppression threshold	80 to 300	200	%	At stop
yA-28	0x4A1C	Overcurrent suppression Kp	1 to 500	100	%	Real time
yA-29	0x4A1D	Overcurrent suppression Ki	10 to 1000	100	%	At stop
yA-30	0x4A1E	Frequency for activating field weakening upon overcurrent suppression	60 to 500	100	%	Real time
yA-31	0x4A1F	Minimum suppression threshold of overcurrent suppression in field weakening range	20 to 100	100	%	Real time
yA-32	0x4A20	Field weakening current coefficient for overcurrent suppression	1 to 500	100	%	Real time
yA-35	0x4A23	Energy-saving control in V/f mode	0: Inactive 1: Active	0	-	Real time
yA-36	0x4A24	Cutoff frequency of energy-saving control in V/f mode	20 to 100	30	%	Real time
yA-37	0x4A25	Voltage drop gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
yA-38	0x4A26	Voltage boost gain of energy-saving control in V/f mode	10 to 500	100	%	Real time
yA-41	0x4A29	Slip compensation mode	0: Disable 1: Slip compensation without PG	0	-	At stop
yA-42	0x4A2A	Slip compensation gain	0.0 to 200.0	100.0	%	Real time
yA-43	0x4A2B	Filter time of slip compensation	0.1 to 10.0	0.5	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yA-47	0x4A2F	Voltage upper limit in decoupled V/f	50.0 to 200.0	100.0	%	At stop
yA-48	0x4A30	Source of V/f decoupled voltage	0: d2-49 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
yA-49	0x4A31	Digital reference of V/f decoupled voltage	0 to Cd-03	0	V	Real time
yA-50	0x4A32	Voltage ramp-up time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
yA-51	0x4A33	Voltage ramp-down time in decoupled V/f	0.0 to 1000.0	0.0	s	Real time
yA-52	0x4A34	RFG time of V/f decoupled frequency	0: RFG time set be 0 forcibly 1: Preset RFG time	0	-	At stop
yA-53	0x4A35	Stop mode in decoupled V/f	0: Frequency and voltage decline to 0 separately 1: Frequency declined after voltage declined to 0 2: Coast to stop	0	-	Real time
yA-59	0x4A3B	Synchronous motor V/f mode	0: Synchronous motor V/f 1 1: Synchronous motor V/f 2	1	-	At stop
yb-02	0x4B02	Speed loop Kp in SVC mode	0.0 to 6000.0	5.0	-	Real time
yb-03	0x4B03	Speed loop Ti in SVC mode	0.000 to 20.000	0.127	s	Real time
yb-06	0x4B06	Zero speed switchover frequency	0.0% to yb-09	1.0	%	Real time
yb-07	0x4B07	Zero speed Kp calibration coefficient	0.0 to 1000.0	100.0	%	Real time
yb-08	0x4B08	Zero speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
yb-09	0x4B09	Low speed switchover frequency	0.0 to yb-12	10.0	%	Real time
yb-10	0x4B0A	Low speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
yb-11	0x4B0B	Low speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yb-12	0x4B0C	High speed switchover frequency	yb-09 to 400.0	100.0	%	Real time
yb-13	0x4B0D	High speed Kp calibration factor	0.0 to 1000.0	100.0	%	Real time
yb-14	0x4B0E	High speed Ti calibration factor	0.0 to 1000.0	100.0	%	Real time
yb-19	0x4B13	Adaptive source of speed loop Kp	0: Inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
yb-21	0x4B15	Lower limit of speed loop adaptive switchover	0.0 to 1000.0	40.0	%	Real time
yb-22	0x4B16	Upper limit of speed loop adaptive switchover	0.0 to 1000.0	100.0	%	Real time
yb-23	0x4B17	Lower limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
yb-24	0x4B18	Upper limit of speed loop adaptive calibration	0.0 to 1000.0	100.0	%	Real time
yb-27	0x4B1B	Droop function	0: Disable 1: Enable	0	-	Real time
yb-28	0x4B1C	Droop source	0: Output torque 1: Torque reference 2: Speed regulator output 3: Speed regulator integral component	1	-	At stop
yb-29	0x4B1D	Droop coefficient	0.0 to 50.0	0.0	%	Real time
yb-33	0x4B21	Forced integral enable	0: Inactive 1: Enable Other: B connector	0	-	Real time
yb-34	0x4B22	Forced integral source	0: yb-35 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
yb-35	0x4B23	Digital reference of forced integral	-800.0 to +800.0	0.0	%	Real time
yb-38	0x4B26	Feedforward torque enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yb-39	0x4B27	Feedforward torque coefficient	0.0 to 1000.0	100.0	%	Real time
yb-40	0x4B28	Feedforward acceleration source	0: RFG setting 1: Automatic calculation Other: F connector	0	-	Real time
yb-41	0x4B29	Reference model bandwidth	0.00 to 300.00	0.00	Hz	Real time
yb-42	0x4B2A	Automatic calculation interval of feedforward torque	0 to 50	4	-	Real time
yb-45	0x4B2D	Speed control window	0.00 to 10.00	0.00	Hz	At stop
yb-46	0x4B2E	Filter time of frequency reference	0.0 to 100.0	0.0	ms	At stop
yb-47	0x4B2F	Filter time of feedback frequency	0.0 to 100.0	0.0	ms	At stop
yb-48	0x4B30	Current filter time of torque reference	0.0 to 100.0	0.0	ms	At stop
yb-49	0x4B31	Torque coefficient adjustment value	0.0 to 200.0	80.0	%	Real time
yb-50	0x4B32	Torque coefficient mode	Ones: Torque coefficient mode 0: Standard mode 1: Rated current 2: Fixed Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yb-53	0x4B35	Speed loop command word	bit0: Speed loop enable 0: Disable 1: Enable bit1: Integral method selection 0: Conventional integral 1: Position-type integral bit2: Exit integral upon stall (reserved) 0: Disable 1: Enable bit3: Speed loop parameter flux adaptation 0: Disable 1: Enable bit4: Anti-load disturbance 0: Disable 1: Enable bit5: Regulator limit method selection 0: Default method 1: Associated with additional torque bit6: Torque mode setting at zero speed 0: Switching to speed mode 1: Keeping torque mode bit7 to bit15: Reserved	0x000B	-	Real time
yb-55	0x4B37	Anti-load disturbance	0: Disable 1: Enable	0	-	Real time
yb-57	0x4B39	Load observer bandwidth	0.01 to 300.00	1.00	Hz	Real time
yb-58	0x4B3A	Load observer coefficient	0.0 to 1000.0	100.0	%	Real time
yb-59	0x4B3B	Pseudo-integral coefficient	0.0 to 1000.0	100.0	%	Real time
yb-62	0x4B3E	Center frequency of notch filter 1	0.0 to 4000.0	4000.0	-	Real time
yb-63	0x4B3F	Center frequency of notch filter 2	0.0 to 4000.0	4000.0	-	Real time
yF-01	0x4F01	DC bus voltage filter time	0 to 10000	4	ms	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
yF-35	0x4F23	TLC control word	bit0: Reserved bit1: CPC selection 0: Disable 1: Enable bit2: Speed source 0: Source 1 1: Source 2 bit3: Angle source 0: Source 1 1: Source 2 bit4: Energy-saving mode 0: Mode 1 1: Mode 2bit5: Inductance calculation 0: Using saturation model 1: Not using saturation model not used bit6: Inverse curve 0: ON 1: OFF bit7: Overvoltage suppression optimization 0: ON 1: OFF bit8: Undervoltage suppression optimization 0: ON : OFF bit9: IF switchover mode 0: Mode 0 1: Mode 1 bit10 to bit15: Reserved	0x0003	-	Real time
yF-36	0x4F24	Field weakening coefficient in TLC control	0.1 to 5000.0	100.0	%	Real time
yF-37	0x4F25	d-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
yF-38	0x4F26	d-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
yF-39	0x4F27	q-axis proportion in TLC control	0.0 to 5000.0	100.0	%	Real time
yF-40	0x4F28	q-axis integral in TLC control	0.0 to 5000.0	100.0	%	Real time
yF-41	0x4F29	Lower limit of TLC reference	0.0 to 1000.0	0.0	%	Real time
yF-42	0x4F2A	TLC phase lock loop scaling factor	0.1 to 5000.0	100.0	%	Real time
yF-43	0x4F2B	TLC reference coefficient	0.1 to 1000.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-00	0xE000	DI1 function selection	0: No function 1: Terminal control IN1 2: Terminal control IN2 3: Terminal control IN3 4: Jog 1 5: Jog 2 6: Used as UP key for frequency adjustment 7: Used as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Operation pause (terminal control) 11: Normally open (NO) input of external fault 12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4 16: Terminal 1 for acceleration/deceleration selection 17: Terminal 2 for acceleration/deceleration selection 18: Reserved 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Reserved 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC state reset 24 to 28: Reserved 29: Torque control inhibited 30 to 31: Reserved 32: Immediate DC braking 33: Normally closed (NC) input of external fault 34: Frequency modification enable 35: PID action direction inverted 36: External stop terminal 1 37: Reserved 38: PID integral paurse 39 to 40: Reserved 41: Motor selection terminal 1 42: Reserved 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control selection 47: Emergency stop 48: Reserved 49: Decelerate to DC braking 50: Clear current operating time To be continued	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-00	0xE000	DI1 function selection	Continued 51: Positive limit 52: Negative limit 53 to 63: Reserved 64: Terminal B jog 1 (JOG1) 65: Terminal B jog 2 (JOG2) 66: Forced local control 67: Forced terminal control 68: Forced communication control 69: Forced user-defined control 70: Control channel selection 71: Setting channel selection 72: Terminal module A/B selection 73 to 75: Reserved 76: Motor selection terminal 2 77: Operation enable (all modes) 78: Positive operation allowed 79: Negative operation allowed 80: RFG input cleared	1	-	At stop
E0-01	0xE001	DI2 function selection	Same as E0-00	4	-	At stop
E0-02	0xE002	DI3 function selection	Same as E0-00	0	-	At stop
E0-03	0xE003	DI4 function selection	Same as E0-00	0	-	At stop
E0-04	0xE004	DI5 function selection	Same as E0-00	0	-	At stop
E0-05	0xE005	DI6 function selection	Same as E0-00	0	-	At stop
E0-06	0xE006	DI7 function selection	Same as E0-00	0	-	At stop
E0-07	0xE007	DI8 function selection	Same as E0-00	0	-	At stop
E0-08	0xE008	DI9 function selection	Same as E0-00	0	-	At stop
E0-09	0xE009	DI10 function selection	Same as E0-00	0	-	At stop
E0-10	0xE00A	VDI1 function selection	Same as E0-00	0	-	At stop
E0-11	0xE00B	VDI2 function selection	Same as E0-00	0	-	At stop
E0-12	0xE00C	VDI3 function selection	Same as E0-00	0	-	At stop
E0-13	0xE00D	VDI4 function selection	Same as E0-00	0	-	At stop
E0-14	0xE00E	VDI5 function selection	Same as E0-00	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-15	0xE00F	VDI6 function selection	Same as E0-00	0	-	At stop
E0-16	0xE010	DI input filter time 1	0.000 to 1.000	0.010	s	Real time
E0-17	0xE011	DI input filter time 2	0.000 to 1.000	0.010	s	Real time
E0-18	0xE012	DI input filter time selection	bit0: DI1 filter time 0: Filter time 1 1: Filter time 2 bit1: DI2 filter time 0: Filter time 1 1: Filter time 2 bit2: DI3 filter time 0: Filter time 1 1: Filter time 2 bit3: DI4 filter time 0: Filter time 1 1: Filter time 2 bit4: DI5 filter time 0: Filter time 1 1: Filter time 2 bit5: DI6 filter time 0: Filter time 1 1: Filter time 2 bit6: DI7 filter time 0: Filter time 1 1: Filter time 2 bit7: DI8 filter time 0: Filter time 1 1: Filter time 2 bit8: DI9 filter time 0: Filter time 1 1: Filter time 2 bit9: DI10 filter time 0: Filter time 1 1: Filter time 2 bit10 to bit15: Reserved	0x0	-	Real time
E0-20	0xE014	DI1 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-21	0xE015	DI1 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-22	0xE016	DI2 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-23	0xE017	DI2 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-24	0xE018	DI3 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-25	0xE019	DI3 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-26	0xE01A	DI4 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-27	0xE01B	DI4 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-28	0xE01C	DI5 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-29	0xE01D	DI5 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-30	0xE01E	DI6 switch-on delay	0.0 to 3600.0	0.0	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-31	0xE01F	DI6 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-32	0xE020	DI7 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-33	0xE021	DI7 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-34	0xE022	DI8 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-35	0xE023	DI8 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-36	0xE024	DI9 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-37	0xE025	DI9 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-38	0xE026	DI10 switch-on delay	0.0 to 3600.0	0.0	s	At stop
E0-39	0xE027	DI10 switch-off delay	0.0 to 3600.0	0.0	s	At stop
E0-40	0xE028	DI source	bit0: DI1 source 0: Hardware sampling 1: Forced setpoint bit1: DI2 source 0: Hardware sampling 1: Forced setpoint bit2: DI3 source 0: Hardware sampling 1: Forced setpoint bit3: DI4 source 0: Hardware sampling 1: Forced setpoint bit4: DI5 source 0: Hardware sampling 1: Forced setpoint bit5: DI6 source 0: Hardware sampling 1: Forced setpoint bit6: DI7 source 0: Hardware sampling 1: Forced setpoint bit7: DI8 source 0: Hardware sampling 1: Forced setpoint bit8: DI9 source 0: Hardware sampling 1: Forced setpoint bit9: DI10 source 0: Hardware sampling 1: Forced setpoint bit10 to bit15: Reserved	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-50	0xE032	VDI1 source	1: Forced value 11: DI1 12: DI2 13: DI3 14: DI4 15: DI5 16: DI6 17: DI7 18: DI8 19: DI9 20: DI10 22: VDI2 23: VDI3 24: VDI4 25: VDI5 26: VDI6 51: RO1 53: DO1 61: VDO1 62: VDO2 63: VDO3 64: VDO4 65: VDO5 66: VDO6	1	-	At stop
E0-51	0xE033	VDI2 source	Same as E0-50	1	-	At stop
E0-52	0xE034	VDI3 source	Same as E0-50	1	-	At stop
E0-53	0xE035	VDI4 source	Same as E0-50	1	-	At stop
E0-54	0xE036	VDI5 source	Same as E0-50	1	-	At stop
E0-55	0xE037	VDI6 source	Same as E0-50	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-56	0xE038	Forced DI data	bit0: DI1 setting 0: Inactive level 1: Active level bit1: DI2 setting 0: Inactive level 1: Active level bit2: DI3 setting 0: Inactive level 1: Active level bit3: DI4 setting 0: Inactive level 1: Active level bit4: DI5 setting 0: Inactive level 1: Active level bit5: DI6 setting 0: Inactive level 1: Active level bit6: DI7 setting 0: Inactive level 1: Active level bit7: DI8 setting 0: Inactive level 1: Active level bit8: DI9 setting 0: Inactive level 1: Active level To be continued	0x0	-	Real time
E0-56	0xE038	Forced DI data	Continued bit9: DI10 setting 0: Inactive level 1: Active level bit10: VDI1 setting 0: Inactive level 1: Active level bit11: VDI2 setting 0: Inactive level 1: Active level bit12: VDI3 setting 0: Inactive level 1: Active level bit13: VDI4 setting 0: Inactive level 1: Active level bit14: VDI5 setting 0: Inactive level 1: Active level bit15: VDI6 setting 0: Inactive level 1: Active level	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-57	0xE039	DI active mode selection	bit0: DI1 active mode 0: Active high 1: Active low bit1: DI2 active mode 0: Active high 1: Active low bit2: DI3 active mode 0: Active high 1: Active low bit3: DI4 active mode 0: Active high 1: Active low bit4: DI5 active mode 0: Active high 1: Active low bit5: DI6 active mode 0: Active high 1: Active low bit6: DI7 active mode 0: Active high 1: Active low bit7: DI8 active mode 0: Active high 1: Active low bit8: DI9 active mode 0: Active high 1: Active low To be continued	0x0	-	Real time
E0-57	0xE039	DI active mode selection	Continued bit9: DI10 active mode 0: Active high 1: Active low bit10: VDI1 active mode 0: Active high 1: Active low bit11: VDI2 active mode 0: Active high 1: Active low bit12: VDI3 active mode 0: Active high 1: Active low bit13: VDI4 active mode 0: Active high 1: Active low bit14: VDI5 active mode 0: Active high 1: Active low bit15: VDI6 active mode 0: Active high 1: Active low	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E0-59	0xE03B	DIO mode selection 1	Ones: DIO1模式选择 0: DI 1: DO Tens: DIO2模式选择 0: DI 1: DO Hundreds: DIO3模式选择 0: DI 1: DO Thousands: DIO4模式选择 0: DI 1: DO Ten thousands: DIO5模式选择 0: DI 1: DO	0	-	At stop
E0-60	0xE03C	DIO mode selection 2	Ones: DIO6 mode selection 0: DI 1: DO Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-00	0xE100	RO output selection	0: No output 1: Operating 2: Fault 3: Frequency level detection FDT1 4: Frequency arrival 5: Operating at zero speed (OFF at stop) 6: Motor overload pre-alarm 7: AC drive overload pre-alarm 8 to 10: Reserved 11: Simple PLC cycle completed 12: Cumulative operating time arrival 13: Oscillation frequency limited 14: Torque limited 15: Ready to run 17: Frequency upper limit arrival 18: Frequency lower limit arrival (OFF at stop) 19: Undervoltage state 20: Communication setting 21: Brake output 22: Reserved 23: Operating at zero speed 2 (ON at stop) 24: Cumulative power-on time arrival 25: Frequency level detection FDT2 26: Frequency 1 arrival 27: Frequency 2 arrival 28: Current 1 arrival 29: Current 2 arrival 30: Timing arrival 31: Reserved 32: Three-phase loss 33: Reverse run in progress 34: Zero current state 35: Module temperature arrival 36: Output current exceeds the limit 37: Frequency lower limit arrival (ON at stop) 38: Error output (fault/minor fault/alarm) 39: Motor overtemperature 40: Current operating time arrival 41: Fault (except undervoltage) output 42: STO output 43: Output upon minor fault or alarm Other: B connector	21	-	Real time
E1-01	0xE101	DO1 function selection	Same as E1-00	0	-	Real time
E1-02	0xE102	DO2 function selection	Same as E1-00	0	-	Real time
E1-03	0xE103	DO3 function selection	Same as E1-00	0	-	Real time
E1-04	0xE104	DO4 function selection	Same as E1-00	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-05	0xE105	DO5 function selection	Same as E1-00	0	-	Real time
E1-06	0xE106	DO6 function selection	Same as E1-00	0	-	Real time
E1-10	0xE10A	VDO1 function selection	Same as E1-00	0	-	Real time
E1-11	0xE10B	VDO2 function selection	Same as E1-00	0	-	Real time
E1-12	0xE10C	VDO3 function selection	Same as E1-00	0	-	Real time
E1-13	0xE10D	VDO4 function selection	Same as E1-00	0	-	Real time
E1-14	0xE10E	VDO5 function selection	Same as E1-00	0	-	Real time
E1-15	0xE10F	VDO6 function selection	Same as E1-00	0	-	Real time
E1-16	0xE110	RO switch-on delay time	0.0 to 3600.0	0.0	s	Real time
E1-17	0xE111	RO switch-off delay time	0.0 to 3600.0	0.0	s	Real time
E1-18	0xE112	DO1 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-19	0xE113	DO1 switch-off delay	0.0 to 3600.0	0.0	s	Real time
E1-20	0xE114	DO2 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-21	0xE115	DO2 switch-off delay	0.0 to 3600.0	0.0	s	Real time
E1-22	0xE116	DO3 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-23	0xE117	DO3 switch-off delay	0.0 to 3600.0	0.0	s	Real time
E1-24	0xE118	DO4 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-25	0xE119	DO4 switch-off delay	0.0 to 3600.0	0.0	s	Real time
E1-26	0xE11A	DO5 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-27	0xE11B	DO5 switch-off delay	0.0 to 3600.0	0.0	s	Real time
E1-28	0xE11C	DO6 switch-on delay	0.0 to 3600.0	0.0	s	Real time
E1-29	0xE11D	DO6 switch-off delay	0.0 to 3600.0	0.0	s	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-36	0xE124	DO/RO/VDO output source	bit0: RO output source 0: Output function setting 1: Forced setpoint bit1: DO1 output source 0: Output function setting 1: Forced setpoint bit2: DO2 output source 0: Output function setting 1: Forced setpoint bit3: DO3 output source 0: Output function setting 1: Forced setpoint bit4: DO4 output source 0: Output function setting 1: Forced setpoint bit5: DO5 output source 0: Output function setting 1: Forced setpoint bit6: DO6 output source 0: Output function setting 1: Forced setpoint bit7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 output source 0: Output function setting 1: Forced setpoint bit11: VDO2 output source 0: Output function setting 1: Forced setpoint bit12: VDO3 output source 0: Output function setting 1: Forced setpoint bit13: VDO4 output source 0: Output function setting 1: Forced setpoint bit14: VDO5 output source 0: Output function setting 1: Forced setpoint bit15: VDO6 output source 0: Output function setting 1: Forced setpoint	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-37	0xE125	Force value of DO/ RO/VDO	bit0: RO setting 0: Low level 1: High level bit1: DO1 setting 0: Low level 1: High level bit2: DO2 setting 0: Low level 1: High level bit3: DO3 setting 0: Low level 1: High level bit4: DO4 setting 0: Low level 1: High level bit5: DO5 setting 0: Low level 1: High level bit6: DO6 setting 0: Low level 1: High level bit7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 setting 0: Low level 1: High level bit11: VDO2 setting 0: Low level 1: High level bit12: VDO3 setting 0: Low level 1: High level bit13: VDO4 setting 0: Low level 1: High level bit14: VDO5 setting 0: Low level 1: High level bit15: VDO6 setting 0: Low level 1: High level	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-38	0xE126	DO/RO/VDO output logic selection	bit0: RO output logic 0: Positive logic 1: Negative logic bit1: DO1 output logic 0: Positive logic 1: Negative logic bit2: DO2 output logic 0: Positive logic 1: Negative logic bit3: DO3 output logic 0: Positive logic 1: Negative logic bit4: DO4 output logic 0: Positive logic 1: Negative logic bit5: DO5 output logic 0: Positive logic 1: Negative logic bit6: DO6 output logic 0: Positive logic 1: Negative logic bit7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 output logic 0: Positive logic 1: Negative logic bit11: VDO2 output logic 0: Positive logic 1: Negative logic bit12: VDO3 output logic 0: Positive logic 1: Negative logic bit13: VDO4 output logic 0: Positive logic 1: Negative logic bit14: VDO5 output logic 0: Positive logic 1: Negative logic bit15: VDO6 output logic 0: Positive logic 1: Negative logic	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
E1-39	0xE127	24 V safety power supply output selection	Ones: 24 V safety power supply 1 output selection 0: OFF 1: Output Tens: 24 V safety power supply 2 and 24 V power supply output of IO3 0: OFF 1: Output Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E2-19	0xE213	Motor temperature filter time	0.00 to 10.00	0.10	s	Real time
E2-73	0xE249	Motor temperature sensor type	0: Inactive 1: PT100 2: PT1000 3: KTY84-130 4: PTC130 (single-core) 5: PTC130 (three-core)	0	-	Real time
E2-74	0xE24A	Motor temperature arrival	0 to 100	75	°C	Real time
E2-75	0xE24B	Motor overtemperature pre-alarm threshold	0 to E2-76	90	°C	Real time
E2-76	0xE24C	Motor overtemperature protection threshold	0 to E2-75	110	°C	Real time
H1-00	0x8100	Protective action selection 0 upon fault	Ones: Overcurrent (E002) 0: Coast to stop Tens: Overvoltage (E005) 0: Coast to stop Hundreds: Pre-charge fault (E008) 0: Coast to stop Thousands: Undervoltage (E009) 0: Coast to stop	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-01	0x8101	Protective action selection 1 upon fault	Ones: Inverter overload (E010) 0: Coast to stop Tens: Motor overload (E011) 0: Coast to stop Hundreds: Phase loss on the input side (E012) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at speed limited A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: Output phase loss (E013) 0: Coast to stop	0x0	-	Real time
H1-02	0x8102	Protective action selection 2 upon fault	Ones: Module overtemperature (E014) 0: Coast to stop Tens: External fault (E015) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-03	0x8103	Protective action selection 3 upon fault	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop F: Ignore	0x0	-	Real time
H1-04	0x8104	Protective action selection 4 upon fault	Ones: Output ground fault (E023) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Cumulative operating time arrival (E026) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: User-defined fault (E027) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-05	0x8105	Fault protection action selection 5	Ones: User-defined alarm(E028) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Cumulative power-on time arrival (E029) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore To be continued	0xDD	-	Real time
H1-05	0x8105	Fault protection action selection 5	Contined Hundreds: Three-phase loss (E030) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: PID fault feedback loss (E031) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0xDD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-06	0x8106	Protection action selection 6 upon fault	Ones: Parameter reset error (E032) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Excessive speed deviation (E042) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: Motor speed exceeds the limit (E043) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0x000D	-	Real time
H1-07	0x8107	Protective action selection 7 upon fault	Ones: Retain 0: Coast to stop Tens: Retain 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Auto-tuned pole position error (E051) 0: Coast to stop	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-08	0x8108	Protective action selection 8 upon fault	Ones: Reserved 0: Coast to stop Tens: Self-test fault 1(E056) 0: Coast to stop Hundreds: Self-test fault 2 (E057) 0: Coast to stop Thousands: Self-test fault 3 (E058) 0: Coast to stop	0x0	-	Read only
H1-09	0x8109	Protective action selection 9 upon fault	Ones: Self-test fault 4(E059) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-10	0x810A	Protective action selection 10 upon fault	Ones: Fan fault (E080) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: DO hardware fault (E155) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x00DD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-11	0x810B	Protection action selection 11 upon fault	Ones: Reserved 0: Coast to stop Tens: Brake fault (E084) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop D: Alarm F: Ignore Hundreds: Sequence fault (E085) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: Current control error 1(E093) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0xF00	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-12	0x810C	Protective action selection 12 upon fault	Ones: Motor control error 2(E094) D: Alarm Tens: Drive pre-overload (E110) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Hundreds: Motor pre-overload (E111) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: Module pre-overtemperature (E114) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0xDDDD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-14	0x810E	Protective action selection 14 upon fault	Ones: Reserved 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Power limit B: Current-limited operation C: Torque-limited operating D: Displays the warning E: Prompt F: Not detected Tens position: Limit fault (E150) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Power limit B: Current-limited operation C: Torque-limited operating D: Displays the warning E: Prompt F: Hundreds position not detected: 24 V safety power supply fault (E174) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed A: Power limit B: Current-limited operation C: Torque-limited operating D: Displays the warning E: Prompt F: No detection Thousands: Automatic fault reset failure (E159) 0: Coast to stop	0x0DDF	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-15	0x810F	Protective action selection 15 upon fault	Ones: Modbus communication timeout fault (E160) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: CANopen fault (E161) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Hundreds: CANlink fault (E162) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Thousands: SD card parameter copy fault (E198) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop D: Alarm F: Not detected	0x3333	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-16	0x8110	Protective action selection 16 upon fault	Ones: EtherNET/IP fault (active for DT60) (E165) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: PROFINET fault (active for DT60)(E166) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Hundreds: Reserved Thousands: Reserved	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-17	0x8111	Protective action selection 17 upon fault	Ones: Inobus expansion protocol (E170) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore Tens: Junction temperature fault (E191) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Ignore To be continued	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-17	0x8111	Protective action selection 17 upon fault	Continued Hundreds: Speed tracking fault (E192) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: Undervoltage suppression reaches limit (E193) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-18	0x8112	Fault protection action selection 18	Ones: Main circuit capacitor service life pre-alarm (E179) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Tens: Control circuit capacitor service life pre-alarm (E180) 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected To be continued	0xDDDD	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-18	0x8112	Fault protection action selection 18	Continued Hundreds: IGBT service life pre-alarm 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected Thousands: Fan service life pre-alarm 0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Operating at limited power B: Operating at limited current C: Operating at limited torque D: Alarm E: Prompt F: Not detected	0xDDDD	-	Real time
H1-30	0x811E	Setting of the 1st group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-31	0x811F	Setting of the first group of fault level	0000H: Coast to stop 0001H: Stop at maximum capability 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Operating at limited speed 000AH: Operating at limited power 000BH: Operating at limited current 000CH: Operating at limited torque 000DH: Alarm 000EH: Prompt 000FH: Not detected	0x000F	-	At stop
H1-32	0x8120	Setting of the 2nd group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-33	0x8121	Setting of the 2nd group of fault level	Same as H1-31.	0x000F	-	At stop
H1-34	0x8122	Setting of 3rd group of fault codes	0.0 to 255.9	0.0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-35	0x8123	Setting of the 3rd group of fault level	Same as H1-31.	0x000F	-	At stop
H1-36	0x8124	Setting of the 4th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-37	0x8125	Setting of the 4th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-38	0x8126	Setting of 5th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-39	0x8127	Setting of the 5th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-40	0x8128	Setting of the 6th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-41	0x8129	Setting of the 6th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-42	0x812A	Setting of the 7th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-43	0x812B	Setting of the 7th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-44	0x812C	Setting of the 8th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-45	0x812D	Setting of the 8th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-46	0x812E	Setting of the 9th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-47	0x812F	Setting of the 9th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-48	0x8130	Setting of the 10th group of fault codes	0.0 to 255.9	0.0	-	At stop
H1-49	0x8131	Setting of the 10th group of fault level	Same as H1-31.	0x000F	-	At stop
H1-60	0x813C	Operation mode for operating at limited speed	0: Operating at limited frequency 1: Operating at the operating frequency upon fault 2: Operating at the designated safe frequency 3: Operating at the set frequency 4: Operating at the frequency upper limit in current direction 5: Operating at the frequency lower limit in current direction	1	-	Real time
H1-61	0x813D	Designated safe operating frequency	0.0 to 800.0	0.0	%	Real time
H1-62	0x813E	Maximum positive frequency limit	0.0 to 800.0	100.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H1-63	0x813F	Maximum negative frequency limit	0.0 to 800.0	100.0	%	Real time
H1-64	0x8140	Maximum motoring power limit	0.0 to 400.0	50.0	%	Real time
H1-65	0x8141	Maximum regenerative power limit	0.0 to 400.0	50.0	%	Real time
H1-66	0x8142	Maximum positive torque limit	0.0 to 400.0	50.0	%	Real time
H1-67	0x8143	Maximum negative torque limit	0.0 to 400.0	50.0	%	Real time
H1-68	0x8144	Maximum current limit	0.0 to 400.0	50.0	%	Real time
H2-00	0x8200	External fault 1 (NO) source	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-01	0x8201	External fault 2 (NC) source	0: Inactive 1: Active Other: B connector	1	-	Real time
H2-02	0x8202	Source of user-defined fault 1	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-03	0x8203	Source of user-defined fault 2	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-04	0x8204	Source of user-defined fault 3	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-05	0x8205	Source of user-defined fault 4	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-06	0x8206	Source of user-defined fault 5	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-07	0x8207	Source of user-defined fault 6	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-08	0x8208	Source of user-defined fault 7	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-09	0x8209	Source of user-defined fault 8	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-10	0x820A	Source of user-defined alarm 1	0: Inactive 1: Active Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H2-11	0x820B	Source of user-defined alarm 2	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-12	0x820C	Source of user-defined alarm 3	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-13	0x820D	Source of user-defined alarm 4	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-14	0x820E	Source of user-defined alarm 5	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-15	0x820F	Source of user-defined alarm 6	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-16	0x8210	Source of user-defined alarm 7	0: Inactive 1: Active Other: B connector	0	-	Real time
H2-17	0x8211	Source of user-defined alarm 8	0: Inactive 1: Active Other: B connector	0	-	Real time
H3-00	0x8300	Automatic fault reset selection	0: Disable 1: Enable	1	-	Real time
H3-01	0x8301	Number of automatic fault resets	0 to 100	0	-	Real time
H3-02	0x8302	Interval time of automatic fault reset	0.1 to 600.0	1.0	s	Real time
H3-03	0x8303	Automatic reset disabled upon manual reset	0: Automatic reset deactivated 1: Automatic reset continued	1	-	Real time
H3-04	0x8304	Waiting time for restoring the number of automatic fault resets	0 to 6000	10	min	Real time
H3-05	0x8305	Cumulative number of fault resets	0 to 65535	0	-	Read only
H3-06	0x8306	Action when automatic fault reset count exhausted	0: Restoring the number of automatic fault resets 1: Not restoring the number of automatic fault resets	0	-	Real time
H3-07	0x8307	Fault flag output selection	0: Not outputted during automatic fault reset 1: Outputted during automatic fault reset	0	-	Real time
H3-13	0x830D	Fault code 1 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H3-14	0x830E	Fault code 2 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-15	0x830F	Fault code 3 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-16	0x8310	Fault code 4 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-17	0x8311	Fault code 5 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-18	0x8312	Fault code 6 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-19	0x8313	Fault code 7 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-20	0x8314	Fault code 8 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-21	0x8315	Fault code 9 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-22	0x8316	Fault code 10 that inhibits automatic reset	0.0 to 255.9	0.0	-	Real time
H3-28	0x831C	Restart after automatic fault reset	0: Disable 1: Enable	0	-	Real time
H3-29	0x831D	Restart delay after automatic fault reset	0.0 to 600.0	0.5	s	Real time
H3-30	0x831E	Flying start applied forcibly after automatic fault reset	0: No 1: Yes	0	-	Real time
H3-31	0x831F	Faults allowing restart after automatic reset	0: White list 1: Black list	1	-	Real time
H3-34	0x8322	Specified fault code 1	0.0 to 255.9	0.0	-	Real time
H3-35	0x8323	Specified fault code 2	0.0 to 255.9	0.0	-	Real time
H3-36	0x8324	Specified fault code 3	0.0 to 255.9	0.0	-	Real time
H3-37	0x8325	Specified fault code 4	0.0 to 255.9	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H3-38	0x8326	Specified fault code 5	0.0 to 255.9	0.0	-	Real time
H3-39	0x8327	Specified fault code 6	0.0 to 255.9	0.0	-	Real time
H6-00	0x8600	Fault code 1 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-01	0x8601	Additional information of fault code 1 in fault log 1	0 to 65535	0	-	Read only
H6-06	0x8606	Fault code 2 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-07	0x8607	Additional information of fault code 2 in fault log 1	0 to 65535	0	-	Read only
H6-12	0x860C	Fault code 3 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-13	0x860D	Additional information of fault code 3 in fault log 1	0 to 65535	0	-	Read only
H6-18	0x8612	Fault code 4 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-19	0x8613	Additional information of fault code 4 in fault log 1	0 to 65535	0	-	Read only
H6-24	0x8618	Fault code 5 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-25	0x8619	Additional information of fault code 5 in fault log 1	0 to 65535	0	-	Read only
H6-30	0x861E	Fault code 6 in fault log 1	0.0 to 6553.5	0.0	-	Read only
H6-31	0x861F	Additional information of fault code 6 in fault log 1	0 to 65535	0	-	Read only
H6-36	0x8624	Frequency upon fault log 1	0.0 to 6553.5	0.0	Hz	Read only
H6-37	0x8625	Current upon fault log 1	0.00 to 655.35	0.00	A	Read only
H6-38	0x8626	Bus voltage upon fault log 1	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-39	0x8627	Input terminal status upon fault log 1	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-40	0x8628	Output terminal status upon fault log 1	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
H6-41	0x8629	Drive state upon fault log 1	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-42	0x862A	Power-on time upon fault log 1	0 to 65535	0	min	Read only
H6-43	0x862B	Operating time upon fault log 1	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-44	0x862C	Status word 1 upon fault log 1	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-45	0x862D	Status word 2 upon fault log 1	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-46	0x862E	Command word upon fault log 1	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H6-47	0x862F	RFG status word upon fault log 1	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
H7-00	0x8700	Fault code 1 in fault log 2	0.0 to 6553.5	0.0	-	Read only
H7-01	0x8701	Additional information of fault code 1 in fault log 2	0 to 65535	0	-	Read only
H7-06	0x8706	Fault code 2 in fault log 2	0.0 to 6553.5	0.0	-	Read only
H7-07	0x8707	Additional information of fault code 2 in fault log 2	0 to 65535	0	-	Read only
H7-12	0x870C	Fault code 3 in fault log 2	0.0 to 6553.5	0.0	-	Read only
H7-13	0x870D	Additional information of fault code 3 in fault log 2	0 to 65535	0	-	Read only
H7-18	0x8712	Fault code 4 in fault log 2	0.0 to 6553.5	0.0	-	Read only
H7-19	0x8713	Additional information of fault code 4 in fault log 2	0 to 65535	0	-	Read only
H7-24	0x8718	Fault code 5 in fault log 2	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-25	0x8719	Additional information of fault code 5 in fault log 2	0 to 65535	0	-	Read only
H7-30	0x871E	Fault code 6 in fault log 2	0.0 to 6553.5	0.0	-	Read only
H7-31	0x871F	Additional information of fault code 6 in fault log 2	0 to 65535	0	-	Read only
H7-36	0x8724	Frequency upon fault log 2	0.0 to 6553.5	0.0	Hz	Read only
H7-37	0x8725	Current upon fault log 2	0.00 to 655.35	0.00	A	Read only
H7-38	0x8726	Bus voltage upon fault log 2	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-39	0x8727	Input terminal status upon fault log 2	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-40	0x8728	Output terminal status upon fault log 2	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
H7-41	0x8729	Drive state upon fault log 2	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-42	0x872A	Power-on time upon fault log 2	0 to 65535	0	min	Read only
H7-43	0x872B	Operating time upon fault log 2	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-44	0x872C	Status word 1 upon fault log 2	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-45	0x872D	Status word 2 upon fault log 2	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-46	0x872E	Command word upon fault log 2	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H7-47	0x872F	RFG status word upon fault log 2	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
H8-00	0x8800	Fault code 1 in fault log 3	0.0 to 6553.5	0.0	-	Read only
H8-01	0x8801	Additional information of fault code 1 in fault log 3	0 to 65535	0	-	Read only
H8-06	0x8806	Fault code 2 in fault log 3	0.0 to 6553.5	0.0	-	Read only
H8-07	0x8807	Additional information of fault code 2 in fault log 3	0 to 65535	0	-	Read only
H8-12	0x880C	Fault code 3 in fault log 3	0.0 to 6553.5	0.0	-	Read only
H8-13	0x880D	Additional information of fault code 3 in fault log 3	0 to 65535	0	-	Read only
H8-18	0x8812	Fault code 4 in fault log 3	0.0 to 6553.5	0.0	-	Read only
H8-19	0x8813	Additional information of fault code 4 in fault log 3	0 to 65535	0	-	Read only
H8-24	0x8818	Fault code 5 in fault log 3	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-25	0x8819	Additional information of fault code 5 in fault log 3	0 to 65535	0	-	Read only
H8-30	0x881E	Fault code 6 in fault log 3	0.0 to 6553.5	0.0	-	Read only
H8-31	0x881F	Additional information of fault code 6 in fault log 3	0 to 65535	0	-	Read only
H8-36	0x8824	Frequency upon fault log 3	0.0 to 6553.5	0.0	Hz	Read only
H8-37	0x8825	Current upon fault log 3	0.00 to 655.35	0.00	A	Read only
H8-38	0x8826	Bus voltage upon fault log 3	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-39	0x8827	Input terminal status upon fault log 3	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-40	0x8828	Output terminal status upon fault log 3	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
H8-41	0x8829	Drive state upon fault log 3	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-42	0x882A	Power-on time upon fault log 3	0 to 65535	0	min	Read only
H8-43	0x882B	Operating time upon fault log 3	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-44	0x882C	Status word 1 upon fault log 3	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-45	0x882D	Status word 2 upon fault log 3	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-46	0x882E	Command word upon fault log 3	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H8-47	0x882F	RFG status word upon fault log 3	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
H9-00	0x8900	Fault code 1 in fault log 4	0.0 to 6553.5	0.0	-	Read only
H9-01	0x8901	Additional information of fault code 1 in fault log 4	0 to 65535	0	-	Read only
H9-06	0x8906	Fault code 2 in fault log 4	0.0 to 6553.5	0.0	-	Read only
H9-07	0x8907	Additional information of fault code 2 in fault log 4	0 to 65535	0	-	Read only
H9-12	0x890C	Fault code 3 in fault log 4	0.0 to 6553.5	0.0	-	Read only
H9-13	0x890D	Additional information of fault code 3 in fault log 4	0 to 65535	0	-	Read only
H9-18	0x8912	Fault code 4 in fault log 4	0.0 to 6553.5	0.0	-	Read only
H9-19	0x8913	Additional information of fault code 4 in fault log 4	0 to 65535	0	-	Read only
H9-24	0x8918	Fault code 5 in fault log 4	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-25	0x8919	Additional information of fault code 5 in fault log 4	0 to 65535	0	-	Read only
H9-30	0x891E	Fault code 6 in fault log 4	0.0 to 6553.5	0.0	-	Read only
H9-31	0x891F	Additional information of fault code 6 in fault log 4	0 to 65535	0	-	Read only
H9-36	0x8924	Frequency upon fault log 4	0.0 to 6553.5	0.0	Hz	Read only
H9-37	0x8925	Current upon fault log 4	0.00 to 655.35	0.00	A	Read only
H9-38	0x8926	Bus voltage upon fault log 4	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-39	0x8927	Input terminal status upon fault log 4	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-40	0x8928	Output terminal status upon fault log 4	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
H9-41	0x8929	Drive state upon fault log 4	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-42	0x892A	Power-on time upon fault log 4	0 to 65535	0	min	Read only
H9-43	0x892B	Operating time upon fault log 4	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-44	0x892C	Status word 1 upon fault log 4	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-45	0x892D	Status word 2 upon fault log 4	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-46	0x892E	Command word upon fault log 4	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
H9-47	0x892F	RFG status word upon fault log 4	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
HA-00	0x8A00	Fault code 1 in fault log 5	0.0 to 6553.5	0.0	-	Read only
HA-01	0x8A01	Additional information of fault code 1 in fault log 5	0 to 65535	0	-	Read only
HA-06	0x8A06	Fault code 2 in fault log 5	0.0 to 6553.5	0.0	-	Read only
HA-07	0x8A07	Additional information of fault code 2 in fault log 5	0 to 65535	0	-	Read only
HA-12	0x8A0C	Fault code 3 in fault log 5	0.0 to 6553.5	0.0	-	Read only
HA-13	0x8A0D	Additional information of fault code 3 in fault log 5	0 to 65535	0	-	Read only
HA-18	0x8A12	Fault code 4 in fault log 5	0.0 to 6553.5	0.0	-	Read only
HA-19	0x8A13	Additional information of fault code 4 in fault log 5	0 to 65535	0	-	Read only
HA-24	0x8A18	Fault code 5 in fault log 5	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-25	0x8A19	Additional information of fault code 5 in fault log 5	0 to 65535	0	-	Read only
HA-30	0x8A1E	Fault code 6 in fault log 5	0.0 to 6553.5	0.0	-	Read only
HA-31	0x8A1F	Additional information of fault code 6 in fault log 5	0 to 65535	0	-	Read only
HA-36	0x8A24	Frequency upon fault log 5	0.0 to 6553.5	0.0	Hz	Read only
HA-37	0x8A25	Current upon fault log 5	0.00 to 655.35	0.00	A	Read only
HA-38	0x8A26	Bus voltage upon fault log 5	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-39	0x8A27	Input terminal status upon fault log 5	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-40	0x8A28	Output terminal status upon fault log 5	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
HA-41	0x8A29	Drive state upon fault log 5	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-42	0x8A2A	Power-on time upon fault log 5	0 to 65535	0	min	Read only
HA-43	0x8A2B	Operating time upon fault log 5	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-44	0x8A2C	Status word 1 upon fault log 5	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-45	0x8A2D	Status word 2 upon fault log 5	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-46	0x8A2E	Command word upon fault log 5	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
HA-47	0x8A2F	RFG status word upon fault log 5	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
Hb-00	0x8B00	Fault code 1 in fault log 6	0.0 to 6553.5	0.0	-	Read only
Hb-01	0x8B01	Additional information of fault code 1 in fault log 6	0 to 65535	0	-	Read only
Hb-06	0x8B06	Fault code 2 in fault log 6	0.0 to 6553.5	0.0	-	Read only
Hb-07	0x8B07	Additional information of fault code 2 in fault log 6	0 to 65535	0	-	Read only
Hb-12	0x8B0C	Fault code 3 in fault log 6	0.0 to 6553.5	0.0	-	Read only
Hb-13	0x8B0D	Additional information of fault code 3 in fault log 6	0 to 65535	0	-	Read only
Hb-18	0x8B12	Fault code 4 in fault log 6	0.0 to 6553.5	0.0	-	Read only
Hb-19	0x8B13	Additional information of fault code 4 in fault log 6	0 to 65535	0	-	Read only
Hb-24	0x8B18	Fault code 5 in fault log 6	0.0 to 6553.5	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-25	0x8B19	Additional information of fault code 5 in fault log 6	0 to 65535	0	-	Read only
Hb-30	0x8B1E	Fault code 6 in fault log 6	0.0 to 6553.5	0.0	-	Read only
Hb-31	0x8B1F	Additional information of fault code 6 in fault log 6	0 to 65535	0	-	Read only
Hb-36	0x8B24	Frequency upon fault log 6	0.0 to 6553.5	0.0	Hz	Read only
Hb-37	0x8B25	Current upon fault log 6	0.00 to 655.35	0.00	A	Read only
Hb-38	0x8B26	Bus voltage upon fault log 6	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-39	0x8B27	Input terminal status upon fault log 6	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-40	0x8B28	Output terminal status upon fault log 6	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved 0: Low level 1: High level bit8: Reserved 0: Low level 1: High level bit9: Reserved 0: Low level 1: High level bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
Hb-41	0x8B29	Drive state upon fault log 6	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-42	0x8B2A	Power-on time upon fault log 6	0 to 65535	0	min	Read only
Hb-43	0x8B2B	Operating time upon fault log 6	0.0 to 6553.5	0.0	min	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-44	0x8B2C	Status word 1 upon fault log 6	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Operation 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3(quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Inactive 1: Active bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Operation (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-45	0x8B2D	Status word 2 upon fault log 6	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Non-jog operation 0: Inactive 1: Active bit11: Jog operation 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Reserved bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-46	0x8B2E	Command word upon fault log 6	bit0: ON_OFF1(start/stop) 0: Stop 1: Operation bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3(quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control reserved 0: Inactive 1: Active bit11: Speed inverted 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
Hb-47	0x8B2F	RFG status word upon fault log 6	bit0 and bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit2 and bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8 and bit9: Acceleration/Deceleration state of last cycle 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration bit10 and bit11: Arc state of last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
n0-09	0x2009	Active communication mode	2: EtherNet/IP 3: PROFINET	2	-	Read only
n0-10	0x200A	Communication type selection	2: EtherNet/IP 3: PROFINET	2	-	At stop
n0-11	0x200B	Communication status	0 to 65535	0	-	Read only
n0-12	0x200C	Compatibility with legacy communication address	0: Not compatible 1: Compatible	1	-	At stop
n0-13	0x200D	Speed set through 1000H	0: Percentage (corresponding to the rated frequency/one decimal place) 1: Percentage (corresponding to the rated frequency/two decimal places) 2: Percentage (corresponding to the maximum frequency/two decimal places)	2	-	At stop
n0-14	0x200E	Speed set through 7310H	0: Frequency (unsigned 16-bit) 1: Frequency (signed 16-bit) 2: Speed (signed 16-bit) 3: Percentage (corresponds to the rated frequency/signed 16-bit/Two decimal places) 4: Percentage (corresponds to the maximum frequency/signed 16-bit/Two decimal places)	1	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
n0-15	0x200F	Save parameters written through communication (group AE)	0: Inactive 1: Active	0	-	Real time
n0-16	0x2010	Automatic reset of communication fault	0: Inactive 1: Active	1	-	Real time
n0-17	0x2011	Current resolution (U0-04) read through communication	0: 0.01 A 1: 0.1 A	0	-	Real time
n0-18	0x2012	Communication protocol	0: Standard Inovance protocol 1: SEW protocol 2: AB protocol	0	-	Real time
n0-20	0x2014	Main device type	0x0 to 0xFFFF	0x102	-	Read only
n0-32	0x2020	Bus hardware (auxiliary integrated circuit) version	0 to 65535	1	-	Read only
n0-45	0x202D	RPDO data processing mode after communication disconnection	0: RPDO data cleared 1: Keep the data of the previous cycle before disconnection	0	-	Real time
n0-46	0x202E	Original data retention time after communication re-connection	0 to 10000	50	ms	Real time
n0-47	0x202F	Communication fault mode selection (communication control)	0: Normal mode 1: No fault mode	0	-	Real time
n0-50	0x2032	Start protection upon fault (communication control)	0: Enable 1: Disable	0	-	At stop
n0-56	0x2038	Clear process data address mapping	0: Disable 1: Enable	0	-	At stop
n0-60	0x203C	MAC1 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x0070	-	Read only
n0-61	0x203D	MAC2 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00CA	-	Read only
n0-62	0x203E	MAC3 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x004D	-	Read only
n0-63	0x203F	MAC4 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
n0-64	0x2040	MAC5 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only
n0-65	0x2041	MAC6 (EtherNet/IP, PROFINET)	0x0 to 0xFFFF	0x00AA	-	Read only
n1-00	0x2100	Commissioning baud rate	9: 115200 bps	9	-	Read only
n1-02	0x2102	Commissioning address	1 to 127	1	-	At stop
n5-00	0x2500	DHCP enable	0: Disable 1: Enable	0	-	At stop
n5-01	0x2501	Most significant byte of the IP address	0 to 255	0	-	At stop
n5-02	0x2502	Second most significant byte of the IP address	0 to 255	0	-	At stop
n5-03	0x2503	Third byte of the IP address	0 to 255	0	-	At stop
n5-04	0x2504	Least significant byte of the IP address	0 to 255	0	-	At stop
n5-05	0x2505	Most significant byte of the subnet mask	0 to 255	0	-	At stop
n5-06	0x2506	Second most significant byte of the subnet mask	0 to 255	0	-	At stop
n5-07	0x2507	Third byte of subnet mask	0 to 255	0	-	At stop
n5-08	0x2508	Least significant byte of the subnet mask	0 to 255	0	-	At stop
n5-09	0x2509	Most significant byte of the gateway	0 to 255	0	-	At stop
n5-10	0x250A	Second most significant byte of the gateway	0 to 255	0	-	At stop
n5-11	0x250B	Third byte of gateway	0 to 255	0	-	At stop
n5-12	0x250C	Least significant byte of the gateway	0 to 255	0	-	At stop
n5-21	0x2515	Packet loss count value	0 to 65535	0	-	Read only
n5-22	0x2516	Linkdown counts of port 0	0 to 65535	0	-	Read only
n5-23	0x2517	Linkdown counts of port 1	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
n5-24	0x2518	Number of errors received by port 0	0 to 65535	0	-	Read only
n5-25	0x2519	Number of errors received by port 1	0 to 65535	0	-	Read only
n5-26	0x251A	Number of communication timeout events	0 to 65535	0	-	Read only
n5-27	0x251B	Number of errors sent by port 0	0 to 65535	0	-	Read only
n5-28	0x251C	Number of errors sent by port 1	0 to 65535	0	-	Read only
n6-01	0x2601	Most significant byte of the IP address	0 to 255	0	-	At stop
n6-02	0x2602	Second most significant byte of the IP address	0 to 255	0	-	At stop
n6-03	0x2603	Third byte of the IP address	0 to 255	0	-	At stop
n6-04	0x2604	Least significant byte of the IP address	0 to 255	0	-	At stop
n6-05	0x2605	Most significant byte of the subnet mask	0 to 255	0	-	At stop
n6-06	0x2606	Second most significant byte of the subnet mask	0 to 255	0	-	At stop
n6-07	0x2607	Third byte of subnet mask	0 to 255	0	-	At stop
n6-08	0x2608	Least significant byte of the subnet mask	0 to 255	0	-	At stop
n6-09	0x2609	Most significant byte of the gateway	0 to 255	0	-	At stop
n6-10	0x260A	Second most significant byte of the gateway	0 to 255	0	-	At stop
n6-11	0x260B	Third byte of gateway	0 to 255	0	-	At stop
n6-12	0x260C	Least significant byte of the gateway	0 to 255	0	-	At stop
n6-20	0x2614	Message number	0 to 65535	0	-	Read only
n6-21	0x2615	Control word for node search	0 to 65535	0	-	Read only
nd-00	0x2D00	CiA 402	0: Disable 1: Enable	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
nd-01	0x2D01	Save written parameters based on CiA 402	0: Disable 1: Enable	0	-	Real time
nd-02	0x2D02	Speed reference type of CiA 402	0: Frequency 1: Speed	0	-	At stop
nd-03	0x2D03	Acceleration/ deceleration time selection of CiA 402	Ones: Acceleration/Deceleration time selection 0: System acceleration/deceleration time 1: CIA402 acceleration/deceleration time Tens: Frequency upper/lower limit selection 0: Not writing frequency upper/lower limit to CIA402 1: Writing frequency upper/lower limit to CIA402 Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
nE-00	0x2E00	RPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-01	0x2E01	RPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-02	0x2E02	RPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-03	0x2E03	RPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-04	0x2E04	RPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-05	0x2E05	RPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-06	0x2E06	RPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-07	0x2E07	RPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-08	0x2E08	RPDO2-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-09	0x2E09	RPDO2-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-10	0x2E0A	RPDO2-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-11	0x2E0B	RPDO2-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-12	0x2E0C	RPDO2-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-13	0x2E0D	RPDO2-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-14	0x2E0E	RPDO2-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-15	0x2E0F	RPDO2-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-16	0x2E10	RPDO3-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-17	0x2E11	RPDO3-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-18	0x2E12	RPDO3-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-19	0x2E13	RPDO3-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-20	0x2E14	RPDO3-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-21	0x2E15	RPDO3-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-22	0x2E16	RPDO3-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-23	0x2E17	RPDO3-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-24	0x2E18	RPDO4-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-25	0x2E19	RPDO4-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-26	0x2E1A	RPDO4-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
nE-27	0x2E1B	RPDO4-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-28	0x2E1C	RPDO4-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-29	0x2E1D	RPDO4-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-30	0x2E1E	RPDO4-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-31	0x2E1F	RPDO4-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-32	0x2E20	TPDO1-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-33	0x2E21	TPDO1-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-34	0x2E22	TPDO1-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-35	0x2E23	TPDO1-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-36	0x2E24	TPDO1-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-37	0x2E25	TPDO1-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-38	0x2E26	TPDO1-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-39	0x2E27	TPDO1-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-40	0x2E28	TPDO2-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-41	0x2E29	TPDO2-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-42	0x2E2A	TPDO2-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-43	0x2E2B	TPDO2-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-44	0x2E2C	TPDO2-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-45	0x2E2D	TPDO2-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-46	0x2E2E	TPDO2-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-47	0x2E2F	TPDO2-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-48	0x2E30	TPDO3-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-49	0x2E31	TPDO3-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-50	0x2E32	TPDO3-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-51	0x2E33	TPDO3-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-52	0x2E34	TPDO3-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-53	0x2E35	TPDO3-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-54	0x2E36	TPDO3-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-55	0x2E37	TPDO3-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-56	0x2E38	TPDO4-SubIndex0-H	0x0 to 0xFFFF	0x0	-	Real time
nE-57	0x2E39	TPDO4-SubIndex0-L	0x0 to 0xFFFF	0x0	-	Real time
nE-58	0x2E3A	TPDO4-SubIndex1-H	0x0 to 0xFFFF	0x0	-	Real time
nE-59	0x2E3B	TPDO4-SubIndex1-L	0x0 to 0xFFFF	0x0	-	Real time
nE-60	0x2E3C	TPDO4-SubIndex2-H	0x0 to 0xFFFF	0x0	-	Real time
nE-61	0x2E3D	TPDO4-SubIndex2-L	0x0 to 0xFFFF	0x0	-	Real time
nE-62	0x2E3E	TPDO4-SubIndex3-H	0x0 to 0xFFFF	0x0	-	Real time
nE-63	0x2E3F	TPDO4-SubIndex3-L	0x0 to 0xFFFF	0x0	-	Real time
nE-66	0x2E42	Number of valid RPDOs	0x0 to 0xFFFF	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
nE-67	0x2E43	Number of valid TPDOs	0x0 to 0xFFFF	0x0	-	Read only
o1-00	0x5100	Constant value setting 1 (per-unit value)	-300.00 to +300.00	0.00	%	Real time
o1-01	0x5101	Constant value setting 2 (per-unit value)	-300.00 to +300.00	100.00	%	Real time
o1-02	0x5102	Constant value setting 3 (per-unit value)	-300.00 to +300.00	-100.00	%	Real time
o1-03	0x5103	Constant value setting 4 (per-unit value)	-300.00 to +300.00	0.00	%	Real time
o1-04	0x5104	Constant value setting 5 (per-unit value)	-3000.0 to +3000.0	0.0	%	Real time
o1-05	0x5105	Constant value setting 6 (per-unit value)	-3000.0 to +3000.0	0.0	%	Real time
o1-06	0x5106	Constant value setting 7 (per-unit value)	-3000.0 to +3000.0	0.0	%	Real time
o1-07	0x5107	Constant value setting 8 (per-unit value)	-3000.0 to +3000.0	0.0	%	Real time
o1-08	0x5108	Constant value setting 1 (single word)	-32768 to +32767	0	-	Real time
o1-09	0x5109	Constant value setting 2 (single word)	-32768 to +32767	0	-	Real time
o1-10	0x510A	Constant value setting 3 (single word)	-32768 to +32767	0	-	Real time
o1-11	0x510B	Constant value setting 4 (single word)	-32768 to +32767	0	-	Real time
o1-12	0x510C	Constant value setting 5 (single word)	-32768 to +32767	0	-	Real time
o1-13	0x510D	Constant value setting 6 (single word)	-32768 to +32767	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o1-14	0x510E	Constant value setting 7 (single word)	-32768 to +32767	0	-	Real time
o1-15	0x510F	Constant value setting 8 (single word)	-32768 to +32767	0	-	Real time
o2-00	0x5200	Input of multi-point curve module A	0: Disable Other: F connector	0	-	Real time
o2-01	0x5201	Setpoint X1 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-02	0x5202	Setpoint X2 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-03	0x5203	Setpoint X3 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-04	0x5204	Setpoint X4 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-05	0x5205	Setpoint X5 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-06	0x5206	Setpoint X6 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-07	0x5207	Setpoint X7 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-08	0x5208	Setpoint X8 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-09	0x5209	Setpoint X9 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-10	0x520A	Setpoint X10 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-11	0x520B	Setpoint Y1 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-12	0x520C	Setpoint Y2 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o2-13	0x520D	Setpoint Y3 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-14	0x520E	Setpoint Y4 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-15	0x520F	Setpoint Y5 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-16	0x5210	Setpoint Y6 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-17	0x5211	Setpoint Y7 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-18	0x5212	Setpoint Y8 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-19	0x5213	Setpoint Y9 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-20	0x5214	Setpoint Y10 of multi-point curve module A	-600.0 to +600.0	0.0	%	Real time
o2-21	0x5215	Input of multi-point curve module B	0: Disable Other: F connector	0	-	Real time
o2-22	0x5216	Setpoint X1 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-23	0x5217	Setpoint X2 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-24	0x5218	Setpoint X3 of multi-point curve module	-600.0 to +600.0	0.0	%	Real time
o2-25	0x5219	Setpoint X4 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-26	0x521A	Setpoint X5 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-27	0x521B	Setpoint X6 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-28	0x521C	Setpoint X7 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o2-29	0x521D	Setpoint X8 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-30	0x521E	Setpoint X9 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-31	0x521F	Setpoint X10 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-32	0x5220	Setpoint Y1 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-33	0x5221	Setpoint Y2 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-34	0x5222	Setpoint Y3 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-35	0x5223	Setpoint Y4 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-36	0x5224	Setpoint Y5 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-37	0x5225	Setpoint Y6 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-38	0x5226	Setpoint Y7 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-39	0x5227	Setpoint Y8 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-40	0x5228	Setpoint Y9 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o2-41	0x5229	Setpoint Y10 of multi-point curve module B	-600.0 to +600.0	0.0	%	Real time
o3-00	0x5300	Input of word-to-bit function A	0: Inactive Other: K connector	0	-	Real time
o3-01	0x5301	Input of word-to-bit function B	0: Inactive Other: K connector	0	-	Real time
o3-02	0x5302	Input of word-to-bit function C	0: Inactive Other: K connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-03	0x5303	Input of word-to-bit function D	0: Inactive Other: K connector	0	-	Real time
o3-04	0x5304	Direct logic and inverted logic of word-to-bit function A	bit0: bit00 0: Not inverted 1: Inverted bit1: bit01 0: Not inverted 1: Inverted bit2: bit02 0: Not inverted 1: Inverted bit3: bit03 0: Not inverted 1: Inverted bit4: bit04 0: Not inverted 1: Inverted bit5: bit05 0: Not inverted 1: Inverted bit6: bit06 0: Not inverted 1: Inverted bit7: bit07 0: Not inverted 1: Inverted bit8: bit08 0: Not inverted 1: Inverted bit9: bit09 0: Not inverted 1: Inverted bit10: bit10 0: Not inverted 1: Inverted bit11: bit11 0: Not inverted 1: Inverted bit12: bit12 0: Not inverted 1: Inverted bit13: bit13 0: Not inverted 1: Inverted bit14: bit14 0: Not inverted 1: Inverted bit15: bit15 0: Not inverted 1: Inverted	0x0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-05	0x5305	Positive and negative logic of word-to-bit function B	Same as o3-04	0x0	-	Real time
o3-06	0x5306	Positive and negative logic of word-to-bit function C	Same as o3-04	0x0	-	Real time
o3-07	0x5307	Positive and negative logic of word-to-bit function D	Same as o3-04	0x0	-	Real time
o3-08	0x5308	Bit-to-word module A	0: Disable 1: Enable	0	-	Real time
o3-09	0x5309	Direct logic and inverted logic of bit-to-word module A	Same as o3-04	0x0	-	Real time
o3-10	0x530A	bit0 selection of bit-to-word module A	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
o3-11	0x530B	bit1 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-12	0x530C	bit2 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-13	0x530D	bit3 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-14	0x530E	bit4 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-15	0x530F	bit5 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-16	0x5310	bit6 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-17	0x5311	bit7 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-18	0x5312	bit8 selection of bit-to-word module A	Same as o3-10	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-19	0x5313	bit9 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-20	0x5314	bit10 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-21	0x5315	bit11 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-22	0x5316	bit12 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-23	0x5317	bit13 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-24	0x5318	bit14 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-25	0x5319	bit15 selection of bit-to-word module A	Same as o3-10	0	-	Real time
o3-26	0x531A	Bit-to-word module B enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-27	0x531B	Positive and negative logic of bit-to-word module B	bit0: bit00 0: Not inverted 1: Inverted bit1: bit01 0: Not inverted 1: Inverted bit2: bit02 0: Not inverted 1: Inverted bit3: bit03 0: Not inverted 1: Inverted bit4: bit04 0: Not inverted 1: Inverted bit5: bit05 0: Not inverted 1: Inverted bit6: bit06 0: Not inverted 1: Inverted bit7: bit07 0: Not inverted 1: Inverted bit8: bit08 0: Not inverted 1: Inverted bit9: bit09 0: Not inverted 1: Inverted bit10: bit10 0: Not inverted 1: Inverted bit11: bit11 0: Not inverted 1: Inverted bit12: bit12 0: Not inverted 1: Inverted bit13: bit13 0: Not inverted 1: Inverted bit14: bit14 0: Not inverted 1: Inverted bit15: bit15 0: Not inverted 1: Inverted	0x0	-	Real time
o3-28	0x531C	bit0 selection of bit-to-word module B	Same as o3-10	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-29	0x531D	bit1 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-30	0x531E	bit2 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-31	0x531F	bit3 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-32	0x5320	bit4 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-33	0x5321	bit5 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-34	0x5322	bit6 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-35	0x5323	bit7 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-36	0x5324	bit8 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-37	0x5325	bit9 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-38	0x5326	bit10 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-39	0x5327	bit11 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-40	0x5328	bit12 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-41	0x5329	bit13 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-42	0x532A	bit14 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-43	0x532B	bit15 selection of bit-to-word module B	Same as o3-10	0	-	Real time
o3-44	0x532C	Bit-to-word module C enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-45	0x532D	Positive and negative logic of bit-to-word module C	bit0: bit00 0: Not inverted 1: Inverted bit1: bit01 0: Not inverted 1: Inverted bit2: bit02 0: Not inverted 1: Inverted bit3: bit03 0: Not inverted 1: Inverted bit4: bit04 0: Not inverted 1: Inverted bit5: bit05 0: Not inverted 1: Inverted bit6: bit06 0: Not inverted 1: Inverted bit7: bit07 0: Not inverted 1: Inverted bit8: bit08 0: Not inverted 1: Inverted bit9: bit09 0: Not inverted 1: Inverted bit10: bit10 0: Not inverted 1: Inverted bit11: bit11 0: Not inverted 1: Inverted bit12: bit12 0: Not inverted 1: Inverted bit13: bit13 0: Not inverted 1: Inverted bit14: bit14 0: Not inverted 1: Inverted bit15: bit15 0: Not inverted 1: Inverted	0x0	-	Real time
o3-46	0x532E	bit0 selection of bit-to-word module C	Same as o3-10	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-47	0x532F	bit1 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-48	0x5330	bit2 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-49	0x5331	bit3 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-50	0x5332	bit4 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-51	0x5333	bit5 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-52	0x5334	bit6 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-53	0x5335	bit7 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-54	0x5336	bit8 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-55	0x5337	bit9 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-56	0x5338	bit10 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-57	0x5339	bit11 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-58	0x533A	bit12 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-59	0x533B	bit13 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-60	0x533C	bit14 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-61	0x533D	bit15 selection of bit-to-word module C	Same as o3-10	0	-	Real time
o3-62	0x533E	Bit-to-word module D enable	0: Disable 1: Enable	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-63	0x533F	Positive and negative logic of bit-to-word module D	bit0: bit00 0: Not inverted 1: Inverted bit1: bit01 0: Not inverted 1: Inverted bit2: bit02 0: Not inverted 1: Inverted bit3: bit03 0: Not inverted 1: Inverted bit4: bit04 0: Not inverted 1: Inverted bit5: bit05 0: Not inverted 1: Inverted bit6: bit06 0: Not inverted 1: Inverted bit7: bit07 0: Not inverted 1: Inverted bit8: bit08 0: Not inverted 1: Inverted bit9: bit09 0: Not inverted 1: Inverted bit10: bit10 0: Not inverted 1: Inverted bit11: bit11 0: Not inverted 1: Inverted bit12: bit12 0: Not inverted 1: Inverted bit13: bit13 0: Not inverted 1: Inverted bit14: bit14 0: Not inverted 1: Inverted bit15: bit15 0: Not inverted 1: Inverted	0x0	-	Real time
o3-64	0x5340	bit0 selection of bit-to-word module D	Same as o3-10	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o3-65	0x5341	bit1 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-66	0x5342	bit2 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-67	0x5343	bit3 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-68	0x5344	bit4 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-69	0x5345	bit5 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-70	0x5346	bit6 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-71	0x5347	bit7 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-72	0x5348	bit8 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-73	0x5349	bit9 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-74	0x534A	bit10 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-75	0x534B	bit11 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-76	0x534C	bit12 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-77	0x534D	bit13 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-78	0x534E	bit14 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o3-79	0x534F	bit15 selection of bit-to-word module D	Same as o3-10	0	-	Real time
o5-00	0x5500	Low word of word-to-double-word module A	0: Value 0 Other: K connector	0	-	Real time
o5-01	0x5501	High word of word-to-double-word module A	0: Disable Other: K connector	0	-	Real time
o5-02	0x5502	Low bit of the base value of word-to-double-word module A	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-03	0x5503	High bit of base value of word-to-double-word module A	0 to 65535	0	-	Real time
o5-04	0x5504	Low word of word-to-double-word module B	0: Value 0 Other: K connector	0	-	Real time
o5-05	0x5505	High word of word-to-double-word module B	0: Disable Other: K connector	0	-	Real time
o5-06	0x5506	Low bit of base value of word-to-double-word module B	0 to 65535	0	-	Real time
o5-07	0x5507	High bit of base value of word-to-double-word B	0 to 65535	0	-	Real time
o5-08	0x5508	Low word of word-to-double-word module C	0: Value 0 Other: K connector	0	-	Real time
o5-09	0x5509	High word of word-to-double-word module C	0: Disable Other: K connector	0	-	Real time
o5-10	0x550A	Low bit of base value of word-to-double-word module C	0 to 65535	0	-	Real time
o5-11	0x550B	High bit of base value of word-to-double-word module C	0 to 65535	0	-	Real time
o5-12	0x550C	Low word of word-to-double-word module D	0: Value 0 Other: K connector	0	-	Real time
o5-13	0x550D	High word of word-to-double-word module D	0: Disable Other: K connector	0	-	Real time
o5-14	0x550E	Low bit of base value of word-to-double-word module D	0 to 65535	0	-	Real time
o5-15	0x550F	High bit of base value of word-to-double-word module D	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-32	0x5520	Double-word-to-word module selection	0: Disable Other: K connector	0	-	Real time
o5-33	0x5521	Low bit of the base value of double-word-to-word module A	0 to 65535	0	-	Real time
o5-34	0x5522	High bit of base value of double-word-to-word module A	0 to 65535	0	-	Real time
o5-35	0x5523	Double-word-to-word module B selection	0: Disable Other: K connector	0	-	Real time
o5-36	0x5524	Low bit of base value of double-word-to-word module B	0 to 65535	0	-	Real time
o5-37	0x5525	High bit of base value of double-word-to-word module B	0 to 65535	0	-	Real time
o5-38	0x5526	Double-word-to-word module C selection	0: Disable Other: K connector	0	-	Real time
o5-39	0x5527	Low bit of base value of double-word-to-word module C	0 to 65535	0	-	Real time
o5-40	0x5528	High bit of base value of double-word-to-word module C	0 to 65535	0	-	Real time
o5-41	0x5529	Double-word-to-word module D selection	0: Disable Other: K connector	0	-	Real time
o5-42	0x552A	Low bit of base value of double-word-to-word module D	0 to 65535	0	-	Real time
o5-43	0x552B	High bit of base value of double-word-to-word module D	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-60	0x553C	Floating-point connector-to-monitoring parameter module A input	0: Disable Other: F connector	0	-	Real time
o5-61	0x553D	Number of decimal places of floating-point connector-to-monitoring parameter module A	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-62	0x553E	Floating-point connector-to-monitoring parameter module A coefficient (multiply)	0 to 65535	1	-	Real time
o5-63	0x553F	Floating-point concatenator-to-monitoring parameter module A coefficient (divide)	1 to 65535	1	-	Real time
o5-64	0x5540	Floating-point connector-to-monitoring parameter module B input	0: Disable Other: F connector	0	-	Real time
o5-65	0x5541	Number of decimal places for floating-point connector-to-monitoring parameter module B	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-66	0x5542	Floating-point connector-to-monitoring parameter module B coefficient (multiply)	0 to 65535	1	-	Real time
o5-67	0x5543	Floating-point connector-to-monitoring parameter module B coefficient (divide)	1 to 65535	1	-	Real time
o5-68	0x5544	Floating-point connector-to-monitoring parameter module C input	0: Disable Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-69	0x5545	Number of decimal places for floating-point connector-to-monitoring parameter module C	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-70	0x5546	Floating-point concatenator-to-monitoring parameter module C coefficient (multiply)	0 to 65535	1	-	Real time
o5-71	0x5547	Floating-point concatenator-to-monitoring parameter module C coefficient (divide)	1 to 65535	1	-	Real time
o5-72	0x5548	Floating-point connector-to-monitoring parameter module D input	0: Disable Other: F connector	0	-	Real time
o5-73	0x5549	Number of decimal places for floating-point connector-to-monitoring parameter module D	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-74	0x554A	Floating-point concatenator-to-monitoring parameter module D coefficient (multiply)	0 to 65535	1	-	Real time
o5-75	0x554B	Floating-point concatenator-to-monitoring parameter module D coefficient (divide)	1 to 65535	1	-	Real time
o5-76	0x554C	Floating-point connector-to-monitoring parameter module E input	0: Disable Other: F connector	0	-	Real time
o5-77	0x554D	Number of decimal places for floating-point connector-to-monitoring parameter module E	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-78	0x554E	Floating-point concatenator-to-monitoring parameter module E coefficient (multiply)	0 to 65535	1	-	Real time
o5-79	0x554F	Floating-point concatenator-to-monitoring parameter module E coefficient (divide)	1 to 65535	1	-	Real time
o5-80	0x5550	Floating-point connector-to-monitoring parameter module F input	0: Disable Other: F connector	0	-	Real time
o5-81	0x5551	Number of decimal places for floating-point connector-to-monitoring parameter module F	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-82	0x5552	Floating-point concatenator-to-monitoring parameter module F coefficient (multiply)	0 to 65535	1	-	Real time
o5-83	0x5553	Floating-point concatenator-to-monitoring parameter module F coefficient (divide)	1 to 65535	1	-	Real time
o5-84	0x5554	Floating-point connector-to-monitoring parameter module G input	0: Disable Other: F connector	0	-	Real time
o5-85	0x5555	Number of decimal places for floating-point connector-to-monitoring parameter module G	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-86	0x5556	Floating-point concatenator-to-monitoring parameter module G coefficient (multiply)	0 to 65535	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o5-87	0x5557	Floating-point concatenator-to-monitoring parameter module G coefficient (divide)	1 to 65535	1	-	Real time
o5-88	0x5558	Floating-point connector-to-monitoring parameter module H input	0: Disable Other: F connector	0	-	Real time
o5-89	0x5559	Number of decimal places for floating-point connector-to-monitoring parameter module H	0: No decimal places 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places	0	-	Real time
o5-90	0x555A	Floating-point concatenator-to-monitoring parameter module H coefficient (multiply)	0 to 65535	1	-	Real time
o5-91	0x555B	Floating-point concatenator-to-monitoring parameter module H coefficient (divide)	1 to 65535	1	-	Real time
o6-00	0x5600	Function of logic AND/OR module A	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-01	0x5601	Input 1 of logic AND/OR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
o6-02	0x5602	Input 2 of logic AND/OR module A	Same as o6-01	0	-	Real time
o6-03	0x5603	Input 3 of logic AND/OR module A	Same as o6-01	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-04	0x5604	Input 4 of logic AND/OR module A	Same as o6-01	0	-	Real time
o6-05	0x5605	Function of logic AND/OR module B	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-06	0x5606	Input 1 of logic AND/OR module B	Same as o6-01	0	-	Real time
o6-07	0x5607	Input 2 of logic AND/OR module B	Same as o6-01	0	-	Real time
o6-08	0x5608	Input 3 of logic AND/OR module B	Same as o6-01	0	-	Real time
o6-09	0x5609	Input 4 of logic AND/OR module B	Same as o6-01	0	-	Real time
o6-10	0x560A	Function of logic AND/OR module C	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-11	0x560B	Input 1 of logic AND/OR module C	Same as o6-01	0	-	Real time
o6-12	0x560C	Input 2 of logic AND/OR module C	Same as o6-01	0	-	Real time
o6-13	0x560D	Input 3 of logic AND/OR module C	Same as o6-01	0	-	Real time
o6-14	0x560E	Input 4 of logic AND/OR module C	Same as o6-01	0	-	Real time
o6-15	0x560F	Function of logic AND/OR module D	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-16	0x5610	Input 1 of logic AND/OR module D	Same as o6-01	0	-	Real time
o6-17	0x5611	Input 2 of logic AND/OR module D	Same as o6-01	0	-	Real time
o6-18	0x5612	Input 3 of logic AND/OR module D	Same as o6-01	0	-	Real time
o6-19	0x5613	Input 4 of logic AND/OR module D	Same as o6-01	0	-	Real time
o6-20	0x5614	Function of logic AND/OR module E	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-21	0x5615	Input 1 of logic AND/OR module E	Same as o6-01	0	-	Real time
o6-22	0x5616	Input 2 of logic AND/OR module E	Same as o6-01	0	-	Real time
o6-23	0x5617	Input 3 of logic AND/OR module E	Same as o6-01	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-24	0x5618	Function of logic AND/OR module F	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-25	0x5619	Input 1 of logic AND/OR module F	Same as o6-01	0	-	Real time
o6-26	0x561A	Input 2 of logic AND/OR module F	Same as o6-01	0	-	Real time
o6-27	0x561B	Input 3 of logic AND/OR module F	Same as o6-01	0	-	Real time
o6-28	0x561C	Function of logic AND/OR module G	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-29	0x561D	Input 1 of logic AND/OR module G	Same as o6-01	0	-	Real time
o6-30	0x561E	Input 2 of logic AND/OR module G	Same as o6-01	0	-	Real time
o6-31	0x561F	Input 3 of logic AND/OR module G	Same as o6-01	0	-	Real time
o6-32	0x5620	Function of logic AND/OR module H	0: Disable 1: Logic AND 2: Logic OR	0	-	Real time
o6-33	0x5621	Input 1 of logic AND/OR module H	Same as o6-01	0	-	Real time
o6-34	0x5622	Input 2 of logic AND/OR module H	Same as o6-01	0	-	Real time
o6-35	0x5623	Input 3 of logic AND/OR module H	Same as o6-01	0	-	Real time
o6-80	0x5650	Input of logic NOT module A	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
o6-81	0x5651	Input of logic NOT module B	Same as o6-80	0	-	Real time
o6-82	0x5652	Input of logic NOT module C	Same as o6-80	0	-	Real time
o6-83	0x5653	Input of logic NOT module D	Same as o6-80	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o6-84	0x5654	Input of logic NOT module E	Same as o6-80	0	-	Real time
o6-85	0x5655	Input of logic NOT module F	Same as o6-80	0	-	Real time
o6-86	0x5656	Input of logic NOT module G	Same as o6-80	0	-	Real time
o6-87	0x5657	Input of logic NOT module H	Same as o6-80	0	-	Real time
o7-00	0x5700	Function of logic XOR/XNOR module A	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-01	0x5701	Input 1 of logic XOR/ XNOR module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
o7-02	0x5702	Input 2 of logic XOR/ XNOR module A	Same as o7-01	0	-	Real time
o7-03	0x5703	Function of logic XOR/XNOR module B	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-04	0x5704	Input 1 of logic XOR/ XNOR module B	Same as o7-01	0	-	Real time
o7-05	0x5705	Input 2 of logic XOR/ XNOR module B	Same as o7-01	0	-	Real time
o7-06	0x5706	Function of logic XOR/XNOR module C	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-07	0x5707	Input 1 of logic XOR/ XNOR module C	Same as o7-01	0	-	Real time
o7-08	0x5708	Input 2 of logic XOR/ XNOR module C	Same as o7-01	0	-	Real time
o7-09	0x5709	Function of logic XOR/XNOR module D	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-10	0x570A	Input 1 of logic XOR/ XNOR module D	Same as o7-01	0	-	Real time
o7-11	0x570B	Input 2 of logic XOR/ XNOR module D	Same as o7-01	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o7-12	0x570C	Function of logic XOR/XNOR module E	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-13	0x570D	Input 1 of logic XOR/ XNOR module E	Same as o7-01	0	-	Real time
o7-14	0x570E	Input 2 of logic XOR/ XNOR module E	Same as o7-01	0	-	Real time
o7-15	0x570F	Function of logic XOR/XNOR module F	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-16	0x5710	Input 1 of logic XOR/ XNOR module F	Same as o7-01	0	-	Real time
o7-17	0x5711	Input 2 of logic XOR/ XNOR module F	Same as o7-01	0	-	Real time
o7-18	0x5712	Function of logic XOR/XNOR module G	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-19	0x5713	Input 1 of logic XOR/ XNOR module G	Same as o7-01	0	-	Real time
o7-20	0x5714	Input 2 of logic XOR/ XNOR module G	Same as o7-01	0	-	Real time
o7-21	0x5715	Function of logic XOR/XNOR module H	0: Disable 1: XOR 2: XNOR	0	-	Real time
o7-22	0x5716	Input 1 of logic XOR/ XNOR module H	Same as o7-01	0	-	Real time
o7-23	0x5717	Input 2 of logic XOR/ XNOR module H	Same as o7-01	0	-	Real time
o8-00	0x5800	Input 1 of addition/ subtraction module A	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o8-01	0x5801	Input 2 of addition/ subtraction module A (addition)	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o8-02	0x5802	Input 3 of addition/ subtraction module A (addition)	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-03	0x5803	Input 4 of addition/ subtraction module A (subtraction)	Same as o8-02	0	-	Real time
o8-04	0x5804	Input 1 of addition/ subtraction module B	Same as o8-02	0	-	Real time
o8-05	0x5805	Input 2 of addition/ subtraction module B (addition)	Same as o8-02	0	-	Real time
o8-06	0x5806	Input 3 of addition/ subtraction module B (addition)	Same as o8-02	0	-	Real time
o8-07	0x5807	Input 4 of addition/ subtraction module B (subtraction)	Same as o8-02	0	-	Real time
o8-08	0x5808	Input 1 of addition/ subtraction module C	Same as o8-02	0	-	Real time
o8-09	0x5809	Input 2 of addition/ subtraction module C (addition)	Same as o8-02	0	-	Real time
o8-10	0x580A	Input 3 of addition/ subtraction module C (addition)	Same as o8-02	0	-	Real time
o8-11	0x580B	Input 4 of addition/ subtraction module C (subtraction).	Same as o8-02	0	-	Real time
o8-12	0x580C	Input 1 of addition/ subtraction module D	Same as o8-02	0	-	Real time
o8-13	0x580D	Input 2 of addition/ subtraction module D (addition)	Same as o8-02	0	-	Real time
o8-14	0x580E	Input 3 of addition/ subtraction module D (addition)	Same as o8-02	0	-	Real time
o8-15	0x580F	Input 4 of addition/ subtraction module D (subtraction)	Same as o8-02	0	-	Real time
o8-16	0x5810	Input 1 of addition/ subtraction module E	Same as o8-02	0	-	Real time
o8-17	0x5811	Input 2 of addition/ subtraction module E (addition)	Same as o8-02	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-18	0x5812	Input 3 of addition/ subtraction module E (addition)	Same as o8-02	0	-	Real time
o8-19	0x5813	Input 4 of addition/ subtraction E (subtraction)	Same as o8-02	0	-	Real time
o8-20	0x5814	Input 1 of addition/ subtraction module F	Same as o8-02	0	-	Real time
o8-21	0x5815	Input 2 of addition/ subtraction module F (addition)	Same as o8-02	0	-	Real time
o8-22	0x5816	Input 3 of addition/ subtraction module F (addition)	Same as o8-02	0	-	Real time
o8-23	0x5817	Input 4 of addition/ subtraction module F (subtraction)	Same as o8-02	0	-	Real time
o8-24	0x5818	Input 1 of addition/ subtraction module G	Same as o8-02	0	-	Real time
o8-25	0x5819	Input 2 of addition/ subtraction module G (addition)	Same as o8-02	0	-	Real time
o8-26	0x581A	Input 3 of addition/ subtraction module G (addition)	Same as o8-02	0	-	Real time
o8-27	0x581B	Input 4 of addition/ subtraction module G (subtraction)	Same as o8-02	0	-	Real time
o8-28	0x581C	Input 1 of addition/ subtraction module H	Same as o8-02	0	-	Real time
o8-29	0x581D	Input 2 of addition/ subtraction module H (addition)	Same as o8-02	0	-	Real time
o8-30	0x581E	Input 3 of addition/ subtraction module H (addition)	Same as o8-02	0	-	Real time
o8-31	0x581F	Input 4 of addition/ subtraction module H (subtraction)	Same as o8-02	0	-	Real time
o8-48	0x5830	Input 1 of multiplication/ division module A	Same as o8-02	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-49	0x5831	Input 2 of multiplication/ division module A (multiplication)	Same as o8-02	0	-	Real time
o8-50	0x5832	Input 3 of multiplication/ division module A (division)	Same as o8-02	0	-	Real time
o8-51	0x5833	Input 1 of multiplication/ division module B	Same as o8-02	0	-	Real time
o8-52	0x5834	Input 2 of multiplication/ division module B (multiplication)	Same as o8-02	0	-	Real time
o8-53	0x5835	Input 3 of multiplication/ division module B (division)	Same as o8-02	0	-	Real time
o8-54	0x5836	Input 1 of multiplication/ division module C	Same as o8-02	0	-	Real time
o8-55	0x5837	Input 2 of multiplication/ division module C (multiplication)	Same as o8-02	0	-	Real time
o8-56	0x5838	Input 3 of multiplication/ division module C (division)	Same as o8-02	0	-	Real time
o8-57	0x5839	Input 1 of multiplication/ division module D	Same as o8-02	0	-	Real time
o8-58	0x583A	Input 2 of multiplication/ division module D (multiplication)	Same as o8-02	0	-	Real time
o8-59	0x583B	Input 3 of multiplication/ division module D (division)	Same as o8-02	0	-	Real time
o8-60	0x583C	Input 1 of multiplication/ division module E	Same as o8-02	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o8-61	0x583D	Input 2 of multiplication/ division module E (multiplication)	Same as o8-02	0	-	Real time
o8-62	0x583E	Input 3 of multiplication/ division module E (division)	Same as o8-02	0	-	Real time
o8-63	0x583F	Input 1 of multiplication/ division module F	Same as o8-02	0	-	Real time
o8-64	0x5840	Input 2 of multiplication/ division module F (multiplication)	Same as o8-02	0	-	Real time
o8-65	0x5841	Input 3 of multiplication/ division module F (division)	Same as o8-02	0	-	Real time
o8-66	0x5842	Input 1 of multiplication/ division module G	Same as o8-02	0	-	Real time
o8-67	0x5843	Input 2 of multiplication/ division module G (multiplication)	Same as o8-02	0	-	Real time
o8-68	0x5844	Input 3 of multiplication/ division module G (division)	Same as o8-02	0	-	Real time
o8-69	0x5845	Input 1 of multiplication/ division module H	Same as o8-02	0	-	Real time
o8-70	0x5846	Input 2 of multiplication/ division module H (multiplication)	Same as o8-02	0	-	Real time
o8-71	0x5847	Input 3 of multiplication/ division module H (division)	Same as o8-02	0	-	Real time
o9-00	0x5900	Input of absolute value module A	0: Module disabled 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-01	0x5901	Input of absolute value module B	Same as o9-00	0	-	Real time
o9-02	0x5902	Input of absolute value module C	Same as o9-00	0	-	Real time
o9-03	0x5903	Input of absolute value module D	Same as o9-00	0	-	Real time
o9-04	0x5904	Input of absolute value module E	Same as o9-00	0	-	Real time
o9-05	0x5905	Input of absolute value module F	Same as o9-00	0	-	Real time
o9-06	0x5906	Input of absolute value module G	Same as o9-00	0	-	Real time
o9-07	0x5907	Input of absolute value module H	Same as o9-00	0	-	Real time
o9-16	0x5910	Function of comparison module A	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-17	0x5911	Input 1 of comparison module A	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-18	0x5912	Input 2 of comparison module A	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-19	0x5913	Hysteresis input of comparison module A	0.00 to 655.35	0.00	%	Real time
o9-20	0x5914	Function of comparison module B	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-21	0x5915	Input 1 of comparison module B	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-22	0x5916	Input 2 of comparison module B	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-23	0x5917	Hysteresis input of comparison module B	0.00 to 655.35	0.00	%	Real time
o9-24	0x5918	Function of comparison module C	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-25	0x5919	Input 1 of comparison module C	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-26	0x591A	Input 2 of comparison module C	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-27	0x591B	Hysteresis input of comparison module C	0.00 to 655.35	0.00	%	Real time
o9-28	0x591C	Function of comparison module D	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-29	0x591D	Input 1 of comparison module D	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-30	0x591E	Input 2 of comparison module D	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-31	0x591F	Hysteresis input of comparison module D	0.00 to 655.35	0.00	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-32	0x5920	Function of comparison module E	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-33	0x5921	Input 1 of comparison module E	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-34	0x5922	Input 2 of comparison module E	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-35	0x5923	Hysteresis input of comparison module E	0.00 to 655.35	0.00	%	Real time
o9-36	0x5924	Function of comparison module F	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-37	0x5925	Input 1 of comparison module F	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-38	0x5926	Input 2 of comparison module F	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-39	0x5927	Hysteresis input of comparison module F	0.00 to 655.35	0.00	%	Real time
o9-40	0x5928	Function of comparison module G	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-41	0x5929	Input 1 of comparison module G	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
o9-42	0x592A	Input 2 of comparison module G	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-43	0x592B	Hysteresis input of comparison module G	0.00 to 655.35	0.00	%	Real time
o9-44	0x592C	Function of comparison module H	0: Module disabled 1: Input 1 > Input 2 2: Input 1 < Input 2 3: Input 1 = Input 2	0	-	Real time
o9-45	0x592D	Input 1 of comparison module H	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-46	0x592E	Input 2 of comparison module H	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
o9-47	0x592F	Hysteresis input of comparison module H	0.00 to 655.35	0.00	%	Real time
oA-00	0x5A00	Input selection for binary selector module A	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-01	0x5A01	Input 1 of binary selector module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
oA-02	0x5A02	Input 2 of binary selector module A	Same as oA-01	0	-	Real time
oA-03	0x5A03	Input selection of binary selector module B	Same as oA-00	0	-	Real time
oA-04	0x5A04	Input 1 of binary selector module B	Same as oA-01	0	-	Real time
oA-05	0x5A05	Input 2 of binary selector module B	Same as oA-01	0	-	Real time
oA-06	0x5A06	Input selection of binary selector module C	Same as oA-00	0	-	Real time
oA-07	0x5A07	Input 1 of binary selector module C	Same as oA-01	0	-	Real time
oA-08	0x5A08	Input 2 of binary selector module C	Same as oA-01	0	-	Real time
oA-09	0x5A09	Input selection of binary selector module D	Same as oA-00	0	-	Real time
oA-10	0x5A0A	Input 1 of binary selector module D	Same as oA-01	0	-	Real time
oA-11	0x5A0B	Input 2 of binary selector module D	Same as oA-01	0	-	Real time
oA-12	0x5A0C	Input selection of binary selector module E	Same as oA-00	0	-	Real time
oA-13	0x5A0D	Input 1 of binary selector module E	Same as oA-01	0	-	Real time
oA-14	0x5A0E	Input 2 of binary selector module E	Same as oA-01	0	-	Real time
oA-15	0x5A0F	Input selection of binary selector module F	Same as oA-00	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-16	0x5A10	Input 1 of binary selector module F	Same as oA-01	0	-	Real time
oA-17	0x5A11	Input 2 of binary selector module F	Same as oA-01	0	-	Real time
oA-18	0x5A12	Input selection of binary selector module G	Same as oA-00	0	-	Real time
oA-19	0x5A13	Input 1 of binary selector module G	Same as oA-01	0	-	Real time
oA-20	0x5A14	Input 2 of binary selector module G	Same as oA-01	0	-	Real time
oA-21	0x5A15	Input selection of binary selector module H	Same as oA-00	0	-	Real time
oA-22	0x5A16	Input 1 of binary selector module H	Same as oA-01	0	-	Real time
oA-23	0x5A17	Input 2 of binary selector module H	Same as oA-01	0	-	Real time
oA-24	0x5A18	Input selection of digital selector module A	Same as oA-00	0	-	Real time
oA-25	0x5A19	Input 1 of digital selector module A	0: Value 0 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oA-26	0x5A1A	Input 2 of digital selector module A	Same as oA-25	0	-	Real time
oA-27	0x5A1B	Input selection for digital selector module B	Same as oA-00	0	-	Real time
oA-28	0x5A1C	Input 1 of digital selector module B	Same as oA-25	0	-	Real time
oA-29	0x5A1D	Input 2 of digital selector module B	Same as oA-25	0	-	Real time
oA-30	0x5A1E	Input selection of digital selector module C	Same as oA-00	0	-	Real time
oA-31	0x5A1F	Input 1 of digital selector module C	Same as oA-25	0	-	Real time
oA-32	0x5A20	Input 2 of digital selector module C	Same as oA-25	0	-	Real time
oA-33	0x5A21	Input selection of digital selector module D	Same as oA-00	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oA-34	0x5A22	Input 1 of digital selector module D	Same as oA-25	0	-	Real time
oA-35	0x5A23	Input 2 of digital selector module D	Same as oA-25	0	-	Real time
oA-36	0x5A24	Input selection of digital selector module E	Same as oA-00	0	-	Real time
oA-37	0x5A25	Input 1 of digital selector module E	Same as oA-25	0	-	Real time
oA-38	0x5A26	Input 2 of digital selector module E	Same as oA-25	0	-	Real time
oA-39	0x5A27	Input selection of digital selector module F	Same as oA-00	0	-	Real time
oA-40	0x5A28	Input 1 of digital selector module F	Same as oA-25	0	-	Real time
oA-41	0x5A29	Input 2 of digital selector module F	Same as oA-25	0	-	Real time
oA-42	0x5A2A	Input selection of digital selector module G	Same as oA-00	0	-	Real time
oA-43	0x5A2B	Input 1 of digital selector module G	Same as oA-25	0	-	Real time
oA-44	0x5A2C	Input 2 of digital selector module G	Same as oA-25	0	-	Real time
oA-45	0x5A2D	Input selection of digital selector module H	Same as oA-00	0	-	Real time
oA-46	0x5A2E	Input 1 of digital selector module H	Same as oA-25	0	-	Real time
oA-47	0x5A2F	Input 2 of digital selector module H	Same as oA-25	0	-	Real time
ob-00	0x5B00	Function of filter module A	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
ob-01	0x5B01	Input of filter module A	Same as oA-25	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
ob-02	0x5B02	Filter time of filter module A	0.000 to 30.000	0.000	s	Real time
ob-03	0x5B03	Function of filter module B	Same as ob-00	0	-	Real time
ob-04	0x5B04	Input of filter module B	Same as oA-25	0	-	Real time
ob-05	0x5B05	Filter time of filter module B	0.000 to 30.000	0.000	s	Real time
ob-06	0x5B06	Function of filter module C	Same as ob-00	0	-	Real time
ob-07	0x5B07	Input of filter module C	Same as oA-25	0	-	Real time
ob-08	0x5B08	Filter time of filter module C	0.000 to 30.000	0.000	s	Real time
ob-09	0x5B09	Function of filter module D	Same as ob-00	0	-	Real time
ob-10	0x5B0A	Input of filter module D	Same as oA-25	0	-	Real time
ob-11	0x5B0B	Filter time of filter module D	0.000 to 30.000	0.000	s	Real time
ob-24	0x5B18	Function of level-to-pulse conversion module A	0: Disable 1: Level-to-pulse 2: Pulse-to-level	0	-	Real time
ob-25	0x5B19	Input of level-to-pulse module A	0: Logic 0 1: Logic 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
ob-26	0x5B1A	Pulse width of level-to-pulse conversion module A	0.00 to 655.35	0.00	s	Real time
ob-27	0x5B1B	Function of level-to-pulse conversion module B	0: Disable 1: Level-to-pulse 2: Pulse-to-level	0	-	Real time
ob-28	0x5B1C	Input of level-to-pulse module B	Same as ob-25	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
ob-29	0x5B1D	Pulse width of level-to-pulse conversion module B	0.00 to 655.35	0.00	s	Real time
ob-30	0x5B1E	Function of level-to-pulse conversion module C	0: Disable 1: Level-to-pulse 2: Pulse-to-level	0	-	Real time
ob-31	0x5B1F	Input of level-to-pulse module C	Same as ob-25	0	-	Real time
ob-32	0x5B20	Pulse width of level-to-pulse conversion module C	0.00 to 655.35	0.00	s	Real time
ob-33	0x5B21	Function of level-to-pulse conversion module D	0: Disable 1: Level-to-pulse 2: Pulse-to-level	0	-	Real time
ob-34	0x5B22	Input of level-to-pulse module D	Same as ob-25	0	-	Real time
ob-35	0x5B23	Pulse width of level-to-pulse conversion module D	0.00 to 655.35	0.00	s	Real time
oC-00	0x5C00	Input of limiter module A	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-01	0x5C01	Upper limit of limiter module A	0: Upper limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-02	0x5C02	Lower limit of limiter module A	0: Lower limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-03	0x5C03	Input of limiter module B	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-04	0x5C04	Upper limit of limiter module B	0: Upper limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-05	0x5C05	Lower limit of limiter module B	0: Lower limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-06	0x5C06	Input of limiter module C	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-07	0x5C07	Upper limit of limiter module C	0: Upper limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-08	0x5C08	Lower limit of limiter module C	0: Lower limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-09	0x5C09	Input of limiter module D	0: Disable 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-10	0x5C0A	Upper limit of limiter module D	0: Upper limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
oC-11	0x5C0B	Lower limit of limiter module D	0: Lower limit inactive 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-28	0x5C1C	Input of logic delay module A	0: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
oC-29	0x5C1D	Switch-on delay time of logic delay module A	0 to 65535	0	-	Real time
oC-30	0x5C1E	Switch-off delay time of logic delay module A	0 to 65535	0	-	Real time
oC-31	0x5C1F	Delay time unit of logic delay module A	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-32	0x5C20	Input of logic delay module B	Same as oC-28	0	-	Real time
oC-33	0x5C21	Switch-on delay of logic delay module B	0 to 65535	0	-	Real time
oC-34	0x5C22	Switch-off delay of logic delay module B	0 to 65535	0	-	Real time
oC-35	0x5C23	Delay time unit of logic delay module B	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-36	0x5C24	Input of logic delay module C	Same as oC-28	0	-	Real time
oC-37	0x5C25	Switch-on delay of logic delay module C	0 to 65535	0	-	Real time
oC-38	0x5C26	Switch-off delay of logic delay module C	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-39	0x5C27	Delay time unit of logic delay module C	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-40	0x5C28	Input of logic delay module D	Same as oC-28	0	-	Real time
oC-41	0x5C29	Switch-on delay time of logic delay module D	0 to 65535	0	-	Real time
oC-42	0x5C2A	Switch-off delay of logic delay module D	0 to 65535	0	-	Real time
oC-43	0x5C2B	Delay time unit of logic delay module D	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-44	0x5C2C	Input of logic delay module E	Same as oC-28	0	-	Real time
oC-45	0x5C2D	Switch-on delay time of logic delay module E	0 to 65535	0	-	Real time
oC-46	0x5C2E	Switch-off delay time of logic delay module E	0 to 65535	0	-	Real time
oC-47	0x5C2F	Delay time unit of logic delay module E	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-48	0x5C30	Input of logic delay module F	Same as oC-28	0	-	Real time
oC-49	0x5C31	Switch-on delay time of logic delay module F	0 to 65535	0	-	Real time
oC-50	0x5C32	Switch-off delay time of logic delay module F	0 to 65535	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
oC-51	0x5C33	Delay time unit of logic delay module F	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-52	0x5C34	Input of logic delay module G	Same as oC-28	0	-	Real time
oC-53	0x5C35	Switch-on delay time of logic delay module G	0 to 65535	0	-	Real time
oC-54	0x5C36	Switch-off delay time of logic delay module G	0 to 65535	0	-	Real time
oC-55	0x5C37	Delay time unit of logic delay module G	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
oC-56	0x5C38	Input of logic delay module H	Same as oC-28	0	-	Real time
oC-57	0x5C39	Switch-on delay time of logic delay module H	0 to 65535	0	-	Real time
oC-58	0x5C3A	Switch-off delay time of logic delay module H	0 to 65535	0	-	Real time
oC-59	0x5C3B	Delay time unit of logic delay module H	0: No delay 1: 10 ms 2: 100 ms 3: 1s 4: 10s 5: 1 min 6: 2 min	1	-	Real time
P0-06	0x6006	Jump frequency 1	0.0 to 800.0	0.0	Hz	Real time
P0-07	0x6007	Jump frequency 2	0.0 to 800.0	0.0	Hz	Real time
P0-08	0x6008	Jump frequency 3	0.0 to 800.0	0.0	Hz	Real time
P0-09	0x6009	Jump frequency 4	0.0 to 800.0	0.0	Hz	Real time
P0-10	0x600A	Jump frequency amplitude	0.0 to 800.0	0.0	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-11	0x600B	Operation mode when set frequency < frequency lower limit	0: Operating at frequency lower limit 1: Stop 2: Operating at zero speed 3: Coast to stop	0	-	Real time
P0-13	0x600D	Timer selection	0: Inactive 1: Active	0	-	At stop
P0-14	0x600E	Timed operation period source	0: P015 Other: F connector	0	-	At stop
P0-15	0x600F	Digital reference of timed operation period	0.0 to 6500.0	0.0	min	At stop
P0-16	0x6010	Power-on time threshold in hours	0 to 65535	0	h	Real time
P0-17	0x6011	Power-on time threshold in seconds	0 to 3599	0	s	Real time
P0-18	0x6012	Set operating time threshold in hours	0 to 65535	0	h	Real time
P0-19	0x6013	Set operating time threshold in seconds	0 to 3599	0	s	Real time
P0-20	0x6014	Current operating time threshold	0.0 to 6500.0	0.0	min	At stop
P0-21	0x6015	Startup protection	0: Disable 1: Enable	1	-	Real time
P0-22	0x6016	Wake-up frequency	P0-24 to A2-17	0.00	Hz	Real time
P0-23	0x6017	Wake-up delay	0.0 to 6500.0	0.0	s	Real time
P0-24	0x6018	Sleep frequency	0.00 to P0-22	0.00	Hz	Real time
P0-25	0x6019	Sleep delay	0.0 to 6500.0	0.0	s	Real time
P0-26	0x601A	Dead zone time of forward/reverse run switchover	0.0 to 3000.0	0.0	s	Real time
P0-29	0x601D	Automatic reset of STO status	0: Manual reset 1: Automatic reset	1	-	Real time
P0-30	0x601E	Detection time for inconsistent STO status	0.020 to 1.000	0.050	s	Real time
P0-33	0x6021	Drive temperature threshold	0 to 100	75	°C	Real time
P0-34	0x6022	Frequency detection value (FDT1)	0.00 to A2-17	50.00	Hz	Real time
P0-35	0x6023	Frequency detection hysteresis coefficient (FDT1)	0.0 to 100.0	5.0	%	Real time
P0-36	0x6024	Frequency detection value (FDT2)	0.00 to A2-17	50.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-37	0x6025	Frequency detection hysteresis coefficient (FDT2)	0.0 to 100.0	5.0	%	Real time
P0-38	0x6026	Frequency arrival detection window	0.0 to 100.0	0.0	%	Real time
P0-39	0x6027	Frequency arrival detection value 1	0.00 to A2-17	50.00	Hz	Real time
P0-40	0x6028	Frequency arrival detection amplitude 1	0.1 to 100.0	0.1	%	Real time
P0-41	0x6029	Frequency arrival detection value 2	0.00 to A2-17	50.00	Hz	Real time
P0-42	0x602A	Frequency arrival detection amplitude 2	0.1 to 100.0	0.1	%	Real time
P0-43	0x602B	Current arrival 1	0.0 to 300.0	100.0	%	Real time
P0-44	0x602C	Window of current arrival 1	0.0 to 300.0	0.0	%	Real time
P0-45	0x602D	Current arrival 2	0.0 to 300.0	100.0	%	Real time
P0-46	0x602E	Window of current arrival 2	0.0 to 300.0	0.0	%	Real time
P0-47	0x602F	Zero current detection level	0.0 to 300.0	5.0	%	Real time
P0-48	0x6030	Zero current detection delay	0.01 to 600.00	0.10	s	Real time
P0-49	0x6031	Output current threshold limit	0.0 to 300.0	200.0	%	Real time
P0-50	0x6032	Delay time for output current limit violation detection	0.00 to 600.00	0.00	s	Real time
P0-51	0x6033	Target speed arrival detection window	0.0 to 600.0	3.0	%	Real time
P0-52	0x6034	Target speed arrival time	0.00 to 100.00	3.00	s	Real time
P0-53	0x6035	Speed comparison arrival threshold 1	0.0 to 600.0	100.0	%	Real time
P0-54	0x6036	Speed comparison arrival hysteresis 1	0.0 to 600.0	3.0	%	Real time
P0-55	0x6037	Speed comparison arrival time 1	0.00 to 100.00	3.00	s	Real time
P0-56	0x6038	Speed comparison arrival threshold 2	0.0 to 600.0	100.0	%	Real time
P0-57	0x6039	Speed comparison arrival hysteresis 2	0.0 to 600.0	3.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-58	0x603A	Speed comparison arrival time 2	0.00 to 100.00	3.00	s	Real time
P0-59	0x603B	bit15 of system status word 1	0: Inactive 1: Set to 1 Other: B connector	0	-	Real time
P0-60	0x603C	bit15 of system status word 2	0: Inactive 1: Set to 1 Other: B connector	0	-	Real time
P0-61	0x603D	Threshold of undervoltage percentage for undervoltage storage	70 to 120	100	%	Real time
P0-62	0x603E	EEPROM operation count per unit time	0 to 100	0	-	Real time
P0-64	0x6040	Output power calibration factor	0.0 to 200.0	100.0	%	Real time
P0-66	0x6042	Load monitoring signal selection	0: Disable monitoring 1: Monitor the output current 2: Monitor the output torque 3: Monitor motor output power Other: F connector	0	-	Real time
P0-67	0x6043	Load monitoring signal state	0 to 65535	0	-	Read only
P0-68	0x6044	Overload response in load monitoring state	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/Fault	0	-	Real time
P0-69	0x6045	Load loss response in load monitoring state	0: No alarm/fault 1: Alarm 2: Fault 3: Alarm/Fault	0	-	Real time
P0-70	0x6046	X-coordinate point 1 in load monitoring state	0.0 to 600.0	0.0	%	Real time
P0-71	0x6047	X-coordinate point 2 in load monitoring state	0.0 to 600.0	0.0	%	Real time
P0-72	0x6048	X-coordinate point 3 in load monitoring state	0.0 to 600.0	0.0	%	Real time
P0-73	0x6049	X-coordinate point 4 in load monitoring state	0.0 to 600.0	0.0	%	Real time
P0-74	0x604A	X-coordinate 5 in load monitoring state	0.0 to 600.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-75	0x604B	Upper limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-76	0x604C	Upper limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-77	0x604D	Upper limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-78	0x604E	Upper limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-79	0x604F	Upper limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-80	0x6050	Lower limit 1 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-81	0x6051	Lower limit 2 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-82	0x6052	Lower limit 3 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-83	0x6053	Lower limit 4 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-84	0x6054	Lower limit 5 on load monitoring curve	0.0 to 400.0	0.0	%	Real time
P0-85	0x6055	Allowable overload time	0.0 to 6553.5	20.0	s	Real time
P0-86	0x6056	Allowable load loss time	0.0 to 6553.5	20.0	s	Real time
P0-87	0x6057	UP/DOWN base during operation	0: Operating frequency 1: Frequency reference	0	-	Real time
P0-88	0x6058	UP/DOWN retention upon stop	0: Disable 1: Enable	0	-	Real time
P0-89	0x6059	UP/DOWN retention upon power failure	0: Disable 1: Enable	0	-	Real time
P0-92	0x605C	Numerator of load speed display coefficient	1 to 32767	1	-	Real time
P0-93	0x605D	Denominator of load speed display coefficient	1 to 32767	1	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P0-99	0x6063	Hardware position limit function	0: Disable 1: Enabled	0	-	At stop
P1-00	0x6100	Simple PLC module	0: Disable 1: Enable	0	-	At stop
P1-01	0x6101	Simple PLC calculation enable source	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	36978	-	At stop
P1-02	0x6102	Simple PLC operation mode	0: Stop after operating for one cycle 1: Keep final values after operating for one cycle 2: Operating cyclically 3: Output 0 after operating for one cycle	0	-	Real time
P1-03	0x6103	Simple PLC function selection	Ones: Retention upon power failure 0: Non-retentive 1: Retentive Tens: Calculation configuration 0: Keep the current segment when function inactive, re-calculate when function inactive 1: Keep the current segment when function inactive and continue to run when function inactive Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
P1-04	0x6104	Simple PLC status reset	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	At stop
P1-05	0x6105	Current STEP of the simple PLC	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-06	0x6106	Current STEP operating time (in hours) of the simple PLC	0 to 65535	0	-	Read only
P1-07	0x6107	Current STEP operating time (in seconds) of the simple PLC	0.0 to 3599.9	0.0	-	Read only
P1-08	0x6108	Simple PLC operating time unit	0: s (seconds) 1: h (hours)	0	-	Real time
P1-09	0x6109	Multi-reference 0 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-10	0x610A	Operating time of multi-reference 0 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-11	0x610B	Ramp-up/down time of multi-reference 0 set by simple PLC	0: b7-04/b7-05 1: b7-10/b7-11 2: b7-16/b7-17 3: b7-22/b7-23	0	-	Real time
P1-12	0x610C	Multi-reference 1 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-13	0x610D	Operating time of multi-reference 1 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-14	0x610E	Ramp-up/down time of multi-reference 1 set by simple PLC	Same as P1-11	0	-	Real time
P1-15	0x610F	Multi-reference 2 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-16	0x6110	Operating time of multi-reference 2 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-17	0x6111	Ramp-up/down time of multi-reference 2 set by simple PLC	Same as P1-11	0	-	Real time
P1-18	0x6112	Multi-reference 3 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-19	0x6113	Operating time of multi-reference 3 set by simple PLC	0.0 to 6553.5	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-20	0x6114	Ramp-up/down time of multi-reference 3 set by simple PLC	Same as P1-11	0	-	Real time
P1-21	0x6115	Multi-reference 4 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-22	0x6116	Operating time of multi-reference 4 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-23	0x6117	Ramp-up/down time of multi-reference 4 set by simple PLC	Same as P1-11	0	-	Real time
P1-24	0x6118	Multi-reference 5 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-25	0x6119	Operating time of multi-reference 5 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-26	0x611A	Ramp-up/down time of multi-reference 5 set by simple PLC	Same as P1-11	0	-	Real time
P1-27	0x611B	Multi-reference 6 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-28	0x611C	Operating time of multi-reference 6 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-29	0x611D	Ramp-up/down time of multi-reference 6 set by simple PLC	Same as P1-11	0	-	Real time
P1-30	0x611E	Multi-reference 7 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-31	0x611F	Operating time of multi-reference 7 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-32	0x6120	Ramp-up/down time of multi-reference 7 set by simple PLC	Same as P1-11	0	-	Real time
P1-33	0x6121	Multi-reference 8 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-34	0x6122	Operating time of multi-reference 8 set by simple PLC	0.0 to 6553.5	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-35	0x6123	Ramp-up/down time of multi-reference 8 set by simple PLC	Same as P1-11	0	-	Real time
P1-36	0x6124	Multi-reference 9 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-37	0x6125	Operating time of multi-reference 9 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-38	0x6126	Ramp-up/down time of multi-reference 9 set by simple PLC	Same as P1-11	0	-	Real time
P1-39	0x6127	Multi-reference 10 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-40	0x6128	Operating time of multi-reference 10 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-41	0x6129	Ramp-up/down time of multi-reference 10 set by simple PLC	Same as P1-11	0	-	Real time
P1-42	0x612A	Multi-reference 11 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-43	0x612B	Operating time of multi-reference 11 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-44	0x612C	Ramp-up/down time of multi-reference 11 set by simple PLC	Same as P1-11	0	-	Real time
P1-45	0x612D	Multi-reference 12 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-46	0x612E	Operating time of multi-reference 12 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-47	0x612F	Ramp-up/down time of multi-reference 12 set by simple PLC	Same as P1-11	0	-	Real time
P1-48	0x6130	Multi-reference 13 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-49	0x6131	Operating time of multi-reference 13 set by simple PLC	0.0 to 6553.5	0.0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P1-50	0x6132	Ramp-up/down time of multi-reference 13 set by simple PLC	Same as P1-11	0	-	Real time
P1-51	0x6133	Multi-reference 14 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-52	0x6134	Operating time of multi-reference 14 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-53	0x6135	Ramp-up/down time of multi-reference 14 set by simple PLC	Same as P1-11	0	-	Real time
P1-54	0x6136	Multi-reference 15 set by simple PLC	-800.0 to +800.0	0.0	%	Real time
P1-55	0x6137	Operating time of multi-reference 15 set by simple PLC	0.0 to 6553.5	0.0	-	Real time
P1-56	0x6138	Ramp-up/down time of multi-reference 15 set by simple PLC	Same as P1-11	0	-	Real time
P2-00	0x6200	Process PID	0: Disable 1: Enable Other: B connector	0	-	Real time
P2-01	0x6201	PID action direction	0: Direct acting 1: Reverse acting Other: B connector	0	-	Real time
P2-02	0x6202	PID reference source	0: PID reference 5: Multi-reference value 6: Simple PLC 8: Communication Other: F connector	0	-	Real time
P2-03	0x6203	PID value reference	0.0 to 800.0	50.0	%	Real time
P2-04	0x6204	PID feedback source	5: Communication Other: F connector	5	-	Real time
P2-05	0x6205	PID reference feedback range	0 to 65535	1000	-	Real time
P2-06	0x6206	PID reference change time	0.00 to 650.00	0.00	s	Real time
P2-07	0x6207	PID feedback filter time	0.00 to 60.00	0.00	s	Real time
P2-08	0x6208	PID output filter time	0.00 to 60.00	0.00	s	Real time
P2-09	0x6209	PID inversion cutoff frequency	0.00 to A2-17	2.00	Hz	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P2-11	0x620B	PID parameter switchover condition	0: Not switched, PID parameter 1 by default 1: Switched by DI 2: Switched automatically based on deviation 3: Switched automatically based on the operating frequency	0	-	Real time
P2-12	0x620C	PID parameter switchover deviation 1	0.0 to P2-13	20.0	%	Real time
P2-13	0x620D	PID parameter switchover deviation 2	P2-12 to 800.0	80.0	%	Real time
P2-14	0x620E	Proportional gain Kp1 of PID parameter 1	0.0 to 1000.0	20.0	-	Real time
P2-15	0x620F	Integral time Ti1 of PID parameter 1	0.01 to 10.00	2.00	s	Real time
P2-16	0x6210	Derivative time Td1 of PID parameter 1	0.000 to 10.000	0.000	s	Real time
P2-17	0x6211	Proportional gain Kp2 of PID parameter 2	0.0 to 1000.0	20.0	-	Real time
P2-18	0x6212	Integral time Ti2 of PID parameter 2	0.01 to 10.00	2.00	s	Real time
P2-19	0x6213	Derivative time Td2 of PID parameter 2	0.000 to 10.000	0.000	s	Real time
P2-20	0x6214	PID initial value	0.0 to 800.0	0.0	%	Real time
P2-21	0x6215	Hold time of PID initial value	0.00 to 650.00	0.00	s	Real time
P2-22	0x6216	PID deviation dead zone	0.0 to 800.0	0.0	%	Real time
P2-23	0x6217	PID derivative limit	0.00 to 600.00	0.10	%	Real time
P2-26	0x621A	Source of maximum PID output	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
P2-27	0x621B	Source of minimum PID output	0: 100% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P2-28	0x621C	Force value of PID output	0: 0% 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
P2-29	0x621D	Force value assignment of PID output	0: Inactive 1: Set Other: B connector	0	-	Real time
P2-30	0x621E	Upper limit for PID feedback loss detection	P2-31 to 800.0	100.0	%	Real time
P2-31	0x621F	Lower limit for PID feedback loss detection	0.0 to P2-30	0.0	%	Real time
P2-32	0x6220	PID feedback loss detection time	0.0 to 20.0	0.0	s	Real time
P2-33	0x6221	Selection of PID operation at stop	0: Disable 1: Enable Other: B connector	0	-	Real time
P2-34	0x6222	PID integral property	Ones: Integral operation paused/separated 0: Inactive 1: Active Tens: Whether to stop integral operation when the output limit reached 0: Continue integral operation 1: Stop integral operation Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	Real time
P2-36	0x6224	PID operation during jogging	0: Disable 1: Enable Others: B connector	0	-	Real time
P2-37	0x6225	PID execution interval	0 to 20	1	-	At stop
P2-38	0x6226	Active mode for PID ramp reference	0: Active PID enabled 1: Active when PID operation starts Other: B connector	0	-	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P3-00	0x6300	Motorized potentiometer enable selection	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
P3-01	0x6301	Retention of motorized potentiometer upon power failure	0: Disable 1: Enable	0	-	Real time
P3-02	0x6302	Initial value of motorized potentiometer	-600.0 to +600.0	0.0	%	Real time
P3-03	0x6303	Time base for motorized potentiometer ramp-up	0.00 to 655.35	20.00	s	Real time
P3-04	0x6304	Time base for motorized potentiometer ramp-down	0.00 to 655.35	20.00	s	Real time
P3-05	0x6305	Source of motorized potentiometer ramp-up command	0: Inactive 1: Active 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	0	-	Real time
P3-06	0x6306	Source of motorized potentiometer ramp-down command	Same as P3-05	0	-	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P3-07	0x6307	Maximum value of motorized potentiometer output	P3-08 to 600.0	600.0	%	Real time
P3-08	0x6308	Minimum value of motorized potentiometer output	-600.0 to P3-07	-600.0	%	Real time
P3-09	0x6309	Source 1 of motorized potentiometer pause command	Same as P3-05	0	-	Real time
P3-10	0x630A	Source 2 of motorized potentiometer pause command	Same as P3-05	0	-	Real time
P3-11	0x630B	Source 1 of motorized potentiometer reset command	Same as P3-05	0	-	Real time
P3-12	0x630C	Source 2 of motorized potentiometer reset command	Same as P3-05	0	-	Real time
P3-13	0x630D	Reset value source of motorized potentiometer	0: Digital reference 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
P3-14	0x630E	Digital reference of motorized potentiometer reset value	-600.0 to +600.0	0.0	%	Real time
P3-15	0x630F	Source of motorized potentiometer forced command	Same as P3-05	0	-	Real time
P3-16	0x6310	Forced value source of motorized potentiometer	0: Digital reference 6: Multi-reference value 7: Simple PLC 8: PID 9: Communication Other: F connector	0	-	Real time
P3-17	0x6311	Digital reference of motorized potentiometer forced value	-600.0 to +600.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-00	0x6400	Brake function selection	0: No brake 1: With brake but without detection information 2: With brake and detection information	0	-	At stop
P4-01	0x6401	Brake release actuation time	0.00 to 5.00	0.30	s	Real time
P4-02	0x6402	Brake apply actuation time	0.00 to 5.00	0.30	s	Real time
P4-03	0x6403	Brake feedback point source	0: Inactive 1: Active 2: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector (reserved)	0	-	Real time
P4-04	0x6404	Brake feedback fault delay	0.00 to 30.00	2.00	s	Real time
P4-05	0x6405	Starting torque direction	0: Torque direction always positive 1: Consistent with motor operating direction	0	-	At stop
P4-06	0x6406	Starting torque source in vector control	0: Disable 1: Retentive torque value 2: Digital reference of starting torque Others: F connector	0	-	Real time
P4-07	0x6407	Digital reference of starting torque	0.0 to 200.0	0.0	%	Real time
P4-08	0x6408	Retentive starting torque gain factor	0.0 to 300.0	100.0	%	Real time
P4-09	0x6409	Starting speed source	0: Disable 1: Digital reference of starting speed (positive speed direction) 2: Digital reference of starting speed consistent with the motor operating direction	0	-	Real time
P4-10	0x640A	Digital reference of starting speed	0.0 to 30.0	0.0	%	Real time

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-11	0x640B	Source of forced brake apply command	0: Inactive 1: Active 2: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector (reserved)	0	-	Real time
P4-14	0x640E	Speed monitoring threshold for brake apply	0.0 to 100.0	4.0	%	Real time
P4-15	0x640F	Speed monitoring time for brake apply	0.00 to 60.00	0.00	s	Real time
P4-16	0x6410	Brake release permission source	0: Inactive 1: Active 2: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 8: DI6 9: DI7 10: DI8 11: DI9 12: DI10 Other: B connector	1	-	Real time
P4-17	0x6411	Comparison value source of brake release	0: Disable 1: Output torque (L3130) (inhibited in V/f mode) 2: Speed reference (L3014) 3: Output current (L3117)	0	-	Real time
P4-18	0x6412	Comparison threshold for brake release	0.0 to 300.0	0.0	%	Real time
P4-19	0x6413	Brake release delay	0.00 to 30.00	0.20	s	Real time
P4-20	0x6414	Starting torque ramp-up time	0.00 to 5.00	0.30	s	At stop

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
P4-21	0x6415	Brake auxiliary function selection	bit0 to bit2: Reserved bit3: Brake release in performance dynamic parameter auto-tuning 0: Not allowed 1: Allowed bit4 to bit15: Reserved	0	-	At stop
P4-22	0x6416	Brake release timeout period	0.00 to 655.35	2.00	s	At stop
L00-00	0x9000	Logic 0	0 to 1	0	-	Read only
L00-01	0x9001	Logic 1	0 to 1	0	-	Read only
L00-02	0x9002	DI1	0 to 1	0	-	Read only
L00-03	0x9003	DI2	0 to 1	0	-	Read only
L00-04	0x9004	DI3	0 to 1	0	-	Read only
L00-05	0x9005	DI4	0 to 1	0	-	Read only
L00-06	0x9006	DI5	0 to 1	0	-	Read only
L00-07	0x9007	DI6	0 to 1	0	-	Read only
L00-08	0x9008	DI7	0 to 1	0	-	Read only
L00-09	0x9009	DI8	0 to 1	0	-	Read only
L00-10	0x900A	DI9	0 to 1	0	-	Read only
L00-11	0x900B	DI10	0 to 1	0	-	Read only
L00-12	0x900C	VDI1	0 to 1	0	-	Read only
L00-13	0x900D	VDI2	0 to 1	0	-	Read only
L00-14	0x900E	VDI3	0 to 1	0	-	Read only
L00-15	0x900F	VDI4	0 to 1	0	-	Read only
L00-16	0x9010	VDI5	0 to 1	0	-	Read only
L00-17	0x9011	VDI6	0 to 1	0	-	Read only
L00-18	0x9012	DI1 inversion	0 to 1	0	-	Read only
L00-19	0x9013	DI2 inversion	0 to 1	0	-	Read only
L00-28	0x901C	VDI1 inversion	0 to 1	0	-	Read only
L00-29	0x901D	VDI2 inversion	0 to 1	0	-	Read only
L00-30	0x901E	VDI3 inversion	0 to 1	0	-	Read only
L00-31	0x901F	VDI4 inversion	0 to 1	0	-	Read only
L00-32	0x9020	VDI5 inversion	0 to 1	0	-	Read only
L00-33	0x9021	VDI6 inversion	0 to 1	0	-	Read only
L00-34	0x9022	RO	0 to 1	0	-	Read only
L00-35	0x9023	DO1	0 to 1	0	-	Read only
L00-36	0x9024	DO2	0 to 1	0	-	Read only
L00-37	0x9025	DO3	0 to 1	0	-	Read only
L00-38	0x9026	DO4	0 to 1	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L00-39	0x9027	DO5	0 to 1	0	-	Read only
L00-40	0x9028	DO6	0 to 1	0	-	Read only
L00-44	0x902C	VDO1	0 to 1	0	-	Read only
L00-45	0x902D	VDO2	0 to 1	0	-	Read only
L00-46	0x902E	VDO3	0 to 1	0	-	Read only
L00-47	0x902F	VDO4	0 to 1	0	-	Read only
L00-48	0x9030	VDO5	0 to 1	0	-	Read only
L00-49	0x9031	VDO6	0 to 1	0	-	Read only
L00-57	0x9039	Motor temperature arrival	0: Temperature not reached 1: Temperature reached	0	-	Read only
L00-58	0x903A	Motor overtemperature fault	0: Overtemperature not occur 1: Overtemperature occurred	0	-	Read only
L00-59	0x903B	Motor overtemperature pre-alarm	0: Overtemperature pre-alarm not reported 1: Overtemperature pre-alarm reported	0	-	Read only
L01-00	0x9064	Ready for switch-on	0: Not ready 1: Ready	0	-	Read only
L01-01	0x9065	Ready to run	0: Not ready 1: Ready	0	-	Read only
L01-02	0x9066	Operation state	0: Not in operation 1: In operation	0	-	Read only
L01-03	0x9067	Fault activation	0: Not activated 1: Activated	0	-	Read only
L01-04	0x9068	OFF2 (coast to stop) flag	0: Active 1: Inactive	0	-	Read only
L01-05	0x9069	OFF3 (quick stop) flag	0: Active 1: Inactive	0	-	Read only
L01-06	0x906A	Startup lockout	0: Not apply 1: Apply	0	-	Read only
L01-07	0x906B	Alarm/Minor fault activation	0: Not activated 1: Activated	0	-	Read only
L01-08	0x906C	Actual speed following the speed reference	0: No 1: Yes	0	-	Read only
L01-09	0x906D	Local/Remote	0: Local 1: Remote	0	-	Read only
L01-10	0x906E	Target speed arrival	0: Not reached 1: Reached	0	-	Read only
L01-11	0x906F	Torque limit arrival	0: Yes 1: No	0	-	Read only
L01-12	0x9070	Positive speed	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L01-13	0x9071	Negative speed	0: Inactive 1: Active	0	-	Read only
L01-14	0x9072	Motor operation flag	0: Stop 1: Operation (pulsing)	0	-	Read only
L01-16	0x9074	Low bit of current motor parameter set	0: Logic 0 1: Logic 1	0	-	Read only
L01-17	0x9075	High bit of current motor parameter set	0: Logic 0 1: Logic 1	0	-	Read only
L01-18	0x9076	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Read only
L01-19	0x9077	Current setting channel	0: Setting channel 1 1: Setting channel 2	0	-	Read only
L01-20	0x9078	Active terminal start/stop module	0: Terminal start/stop module A 1: Terminal start/stop module B	0	-	Read only
L01-21	0x9079	Terminal control state	0: Inactive 1: Active	0	-	Read only
L01-22	0x907A	Torque control selection	0: Inactive 1: Active	0	-	Read only
L01-23	0x907B	Speed control selection	0: Inactive 1: Active	0	-	Read only
L01-24	0x907C	Position control state	0: Inactive 1: Active	0	-	Read only
L01-25	0x907D	V/f decoupled mode	0: Inactive 1: Active	0	-	Read only
L01-26	0x907E	RFG function selection	0: Disable 1: Enable	0	-	Read only
L01-27	0x907F	RFG operation	0: Stop 1: Run	0	-	Read only
L01-32	0x9084	Error output	0: No error 1: Error occurred	0	-	Read only
L01-33	0x9085	Error output (excluding undervoltage fault)	0: No error 1: Error occurred	0	-	Read only
L01-34	0x9086	Fault output	0: A fault occurs and the relay is inactive during automatic reset. 1: A fault occurs and the relay is inactive during automatic reset.	0	-	Read only
L01-35	0x9087	Stop at fault	0: Inactive 1: Active	0	-	Read only
L01-36	0x9088	Normal operation	0: Abnormal operation 1: Normal operation	0	-	Read only
L01-37	0x9089	Jog	0: Non-jog 1: Jog	0	-	Read only
L01-38	0x908A	Decelerate-to-stop state	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L01-41	0x908D	Self-test state	0: Inactive 1: Active	0	-	Read only
L01-42	0x908E	Auto-tuning state	0: Inactive 1: Active	0	-	Read only
L01-52	0x9098	Operating at zero speed (inactive at stop)	0: Inactive 1: Active	0	-	Read only
L01-53	0x9099	Operating at zero speed (inactive at stop)	0: Inactive 1: Active	0	-	Read only
L01-56	0x909C	Reverse run	0: Inactive 1: Active	0	-	Read only
L01-58	0x909E	Torque limit	0: Not limited 1: Limited	0	-	Read only
L01-59	0x909F	Positive motor speed	0: Reverse direction 1: Forward direction	0	-	Read only
L01-60	0x90A0	Negative motor speed	0: Forward direction 1: Reverse direction	0	-	Read only
L01-61	0x90A1	Forced RFG on starting frequency	0: Inactive 1: Active	0	-	Read only
L01-62	0x90A2	Stop at frequencies lower than lower limit/starting frequency	0: Inactive 1: Active	0	-	Read only
L01-63	0x90A3	Coast to stop at frequencies lower than the lower limit	0: Inactive 1: Active	0	-	Read only
L01-64	0x90A4	Decelerate and clear upon power dip ride-through	0: Inactive 1: Active	0	-	Read only
L01-65	0x90A5	Decelerate to stop upon power dip ride-through	0: Inactive 1: Active	0	-	Read only
L01-74	0x90AE	Bus voltage state	0: Abnormal bus voltage 1: Normal bus voltage	0	-	Read only
L01-75	0x90AF	Excessive speed deviation	0: Inactive 1: Active	0	-	Read only
L01-76	0x90B0	Motor overspeed	0: Inactive 1: Active	0	-	Read only
L01-77	0x90B1	Overcurrent fault	0: Inactive 1: Active	0	-	Read only
L01-78	0x90B2	Bus overvoltage fault	0: Inactive 1: Active	0	-	Read only
L01-79	0x90B3	Bus undervoltage fault	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L01-80	0x90B4	Motor pre-overload	0: Inactive 1: Active	0	-	Read only
L01-81	0x90B5	Motor overload fault	0: Inactive 1: Active	0	-	Read only
L01-82	0x90B6	Drive pre-overload	0: Inactive 1: Active	0	-	Read only
L01-83	0x90B7	Drive overload fault	0: Inactive 1: Active	0	-	Read only
L01-85	0x90B9	Motor overtemperature fault	0: Inactive 1: Active	0	-	Read only
L01-86	0x90BA	Drive pre-overtemperature	0: Inactive 1: Active	0	-	Read only
L01-87	0x90BB	Drive overtemperature fault	0: Inactive 1: Active	0	-	Read only
L01-88	0x90BC	Input phase loss fault	0: Inactive 1: Active	0	-	Read only
L01-89	0x90BD	Output phase loss fault	0: Inactive 1: Active	0	-	Read only
L01-90	0x90BE	Motor stall fault	0: Inactive 1: Active	0	-	Read only
L01-92	0x90C0	Motor disconnection fault	0: Inactive 1: Active	0	-	Read only
L01-95	0x90C3	External fault 1	0: Inactive 1: Active	0	-	Read only
L01-96	0x90C4	External fault 2	0: Inactive 1: Active	0	-	Read only
L01-97	0x90C5	User-defined fault 1	0: Inactive 1: Active	0	-	Read only
L01-98	0x90C6	User-defined fault 2	0: Inactive 1: Active	0	-	Read only
L02-00	0x90C8	STO output	0: Inactive 1: Active	0	-	Read only
L02-44	0x90F4	Power-on time arrival	0: Not reached 1: Reached	0	-	Read only
L02-45	0x90F5	Operating time arrival	0: Not reached 1: Reached	0	-	Read only
L02-46	0x90F6	Timed operation arrival	0: Not reached 1: Reached	0	-	Read only
L02-47	0x90F7	Current Operating Time Arrival	0: Not reached 1: Reached	0	-	Read only
L02-50	0x90FA	Sleep state	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L02-51	0x90FB	Individual stop command of simple PLC	0: Inactive 1: Active	0	-	Read only
L02-52	0x90FC	Individual operation of simple PLC	0: Not completed 1: Completed	0	-	Read only
L02-53	0x90FD	Cyclic operation of simple PLC	0: Not completed 1: Completed	0	-	Read only
L02-58	0x9102	Current 1 arrival	0: Not reached 1: Reached	0	-	Read only
L02-59	0x9103	Current 2 arrival	0: Not reached 1: Reached	0	-	Read only
L02-60	0x9104	Zero current state	0: Inactive 1: Active	0	-	Read only
L02-61	0x9105	Output Current Limit Violation	0: Inactive 1: Active	0	-	Read only
L02-62	0x9106	Frequency level detection 1	0: Inactive 1: Active	0	-	Read only
L02-63	0x9107	Frequency level detection 2	0: Inactive 1: Active	0	-	Read only
L02-64	0x9108	Frequency arrival	0: Not reached 1: Reached	0	-	Read only
L02-65	0x9109	Frequency arrival 1	0: Not reached 1: Reached	0	-	Read only
L02-66	0x910A	Frequency arrival 2	0: Not reached 1: Reached	0	-	Read only
L02-67	0x910B	Frequency upper limit arrival	0: Not reached 1: Reached	0	-	Read only
L02-68	0x910C	Frequency lower limit arrival (no output at stop)	0: Not reached 1: Reached	0	-	Read only
L02-69	0x910D	Frequency lower limit arrival (output generated even at stop)	0: Not reached 1: Reached	0	-	Read only
L02-70	0x910E	Speed comparison arrival 1	0: Not reached 1: Reached	0	-	Read only
L02-71	0x910F	Speed comparison arrival 2	0: Not reached 1: Reached	0	-	Read only
L02-79	0x9117	Heatsink temperature arrival	0: Not reached 1: Reached	0	-	Read only
L03-04	0x9130	bit0 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-05	0x9131	bit1 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L03-06	0x9132	bit2 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-07	0x9133	bit3 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-08	0x9134	bit4 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-09	0x9135	bit5 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-10	0x9136	bit6 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-11	0x9137	bit7 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-12	0x9138	bit8 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-13	0x9139	bit9 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-14	0x913A	bit10 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-15	0x913B	bit11 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-16	0x913C	bit12 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-17	0x913D	bit13 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-18	0x913E	bit14 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-19	0x913F	bit15 of word-to-bit module A output	0: Inactive 1: Active	0	-	Read only
L03-20	0x9140	bit0 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-21	0x9141	bit1 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-22	0x9142	bit2 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-23	0x9143	bit3 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-24	0x9144	bit4 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-25	0x9145	bit5 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-26	0x9146	bit6 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L03-27	0x9147	bit7 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-28	0x9148	bit8 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-29	0x9149	bit9 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-30	0x914A	bit10 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-31	0x914B	bit11 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-32	0x914C	bit12 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-33	0x914D	bit13 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-34	0x914E	bit14 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-35	0x914F	bit15 of word-to-bit module B output	0: Inactive 1: Active	0	-	Read only
L03-36	0x9150	bit0 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-37	0x9151	bit1 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-38	0x9152	bit2 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-39	0x9153	bit3 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-40	0x9154	bit4 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-41	0x9155	bit5 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-42	0x9156	bit6 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-43	0x9157	bit7 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-44	0x9158	bit8 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-45	0x9159	bit9 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-46	0x915A	bit10 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-47	0x915B	bit11 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L03-48	0x915C	bit12 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-49	0x915D	bit13 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-50	0x915E	bit14 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-51	0x915F	bit15 of word-to-bit module C output	0: Inactive 1: Active	0	-	Read only
L03-52	0x9160	bit0 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-53	0x9161	bit1 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-54	0x9162	bit2 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-55	0x9163	bit3 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-56	0x9164	bit4 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-57	0x9165	bit5 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-58	0x9166	bit6 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-59	0x9167	bit7 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-60	0x9168	bit8 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-61	0x9169	bit9 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-62	0x916A	bit10 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-63	0x916B	bit11 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-64	0x916C	bit12 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-65	0x916D	bit13 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-66	0x916E	bit14 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-67	0x916F	bit15 of word-to-bit module D output	0: Inactive 1: Active	0	-	Read only
L03-68	0x9170	Output of binary selector module A	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L03-69	0x9171	Output of binary selector module B	0: Inactive 1: Active	0	-	Read only
L03-70	0x9172	Output of binary selector module C	0: Inactive 1: Active	0	-	Read only
L03-71	0x9173	Output of binary selector module D	0: Inactive 1: Active	0	-	Read only
L03-72	0x9174	Output of binary selector module E	0: Inactive 1: Active	0	-	Read only
L03-73	0x9175	Output of binary selector module F	0: Inactive 1: Active	0	-	Read only
L03-74	0x9176	Output of binary selector module G	0: Inactive 1: Active	0	-	Read only
L03-75	0x9177	Output of binary selector module H	0: Inactive 1: Active	0	-	Read only
L03-76	0x9178	Output of logic AND/OR module A	0: Inactive 1: Active	0	-	Read only
L03-77	0x9179	Output of logic AND/OR module B	0: Inactive 1: Active	0	-	Read only
L03-78	0x917A	Output of logic AND/OR module C	0: Inactive 1: Active	0	-	Read only
L03-79	0x917B	Output of logic AND/OR module D	0: Inactive 1: Active	0	-	Read only
L03-80	0x917C	Output of logic AND/OR module E	0: Inactive 1: Active	0	-	Read only
L03-81	0x917D	Output of logic AND/OR module F	0: Inactive 1: Active	0	-	Read only
L03-82	0x917E	Output of logic AND/OR module G	0: Inactive 1: Active	0	-	Read only
L03-83	0x917F	Output of logic AND/OR module H	0: Inactive 1: Active	0	-	Read only
L03-84	0x9180	Output of logic NOT module A	0: Inactive 1: Active	0	-	Read only
L03-85	0x9181	Output of Logic NOT module B	0: Inactive 1: Active	0	-	Read only
L03-86	0x9182	Output of logic NOT module C	0: Inactive 1: Active	0	-	Read only
L03-87	0x9183	Output of logic NOT module D	0: Inactive 1: Active	0	-	Read only
L03-88	0x9184	Output of logic NOT module E	0: Inactive 1: Active	0	-	Read only
L03-89	0x9185	Output of logic NOT module F	0: Inactive 1: Active	0	-	Read only
L03-90	0x9186	Output of logic NOT module G	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L03-91	0x9187	Output of logic NOT module H	0: Inactive 1: Active	0	-	Read only
L03-92	0x9188	Output of logic XOR/ XNOR module A	0: Inactive 1: Active	0	-	Read only
L03-93	0x9189	Output of logic XOR/ XNOR module B	0: Inactive 1: Active	0	-	Read only
L03-94	0x918A	Output of logic XOR/ XNOR module C	0: Inactive 1: Active	0	-	Read only
L03-95	0x918B	Output of logic XOR/ XNOR module D	0: Inactive 1: Active	0	-	Read only
L03-96	0x918C	Output of logic XOR/ XNOR module E	0: Inactive 1: Active	0	-	Read only
L03-97	0x918D	Output of logic XOR/ XNOR module F	0: Inactive 1: Active	0	-	Read only
L03-98	0x918E	Output of logic XOR/ XNOR module G	0: Inactive 1: Active	0	-	Read only
L03-99	0x918F	Output of logic XOR/ XNOR module H	0: Inactive 1: Active	0	-	Read only
L04-00	0x9190	Output of comparison module A	0: Inactive 1: Active	0	-	Read only
L04-01	0x9191	Output of comparison module B	0: Inactive 1: Active	0	-	Read only
L04-02	0x9192	Output of comparison module C	0: Inactive 1: Active	0	-	Read only
L04-03	0x9193	Output of comparison module D	0: Inactive 1: Active	0	-	Read only
L04-04	0x9194	Output of comparison module E	0: Inactive 1: Active	0	-	Read only
L04-05	0x9195	Output of comparison module F	0: Inactive 1: Active	0	-	Read only
L04-06	0x9196	Output of comparison module G	0: Inactive 1: Active	0	-	Read only
L04-07	0x9197	Output of comparison module H	0: Inactive 1: Active	0	-	Read only
L04-08	0x9198	Output of level-to-pulse module A	0: Inactive 1: Active	0	-	Read only
L04-09	0x9199	Output of level-to-pulse module B	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L04-10	0x919A	Output of level-to-pulse module C	0: Inactive 1: Active	0	-	Read only
L04-11	0x919B	Output of level-to-pulse module D	0: Inactive 1: Active	0	-	Read only
L04-12	0x919C	Divide-by-zero flag of multiplication/ division module A	0: Non-zero 1: Zero	0	-	Read only
L04-13	0x919D	Divide-by-zero flag of multiplication/ division module B	0: Non-zero 1: Zero	0	-	Read only
L04-14	0x919E	Divide-by-zero flag of multiplication/ division module C	0: Non-zero 1: Zero	0	-	Read only
L04-15	0x919F	Divide-by-zero flag of multiplication/ division module D	0: Non-zero 1: Zero	0	-	Read only
L04-16	0x91A0	Divide-by-zero flag of multiplication/ division module E	0: Non-zero 1: Zero	0	-	Read only
L04-17	0x91A1	Divide-by-zero flag of multiplication/ division module F	0: Non-zero 1: Zero	0	-	Read only
L04-18	0x91A2	Divide-by-zero flag of multiplication/ division module G	0: Non-zero 1: Zero	0	-	Read only
L04-19	0x91A3	Divide-by-zero flag of multiplication/ division module H	0: Non-zero 1: Zero	0	-	Read only
L04-20	0x91A4	Negative input flag of absolute value module A	0: Non-negative 1: Negative	0	-	Read only
L04-21	0x91A5	Negative input flag of absolute value module B	0: Non-negative 1: Negative	0	-	Read only
L04-22	0x91A6	Negative input flag of absolute value module C	0: Non-negative 1: Negative	0	-	Read only
L04-23	0x91A7	Negative input flag of absolute value module D	0: Non-negative 1: Negative	0	-	Read only
L04-24	0x91A8	Negative input flag of absolute value module E	0: Non-negative 1: Negative	0	-	Read only
L04-25	0x91A9	Negative input flag of absolute value module F	0: Non-negative 1: Negative	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L04-26	0x91AA	Negative input flag of absolute value module G	0: Non-negative 1: Negative	0	-	Read only
L04-27	0x91AB	Negative input flag of absolute value module H	0: Non-negative 1: Negative	0	-	Read only
L04-28	0x91AC	Lower limit flag of limiter module A	0: Inactive 1: Active	0	-	Read only
L04-29	0x91AD	Upper limit flag of limiter module A	0: Inactive 1: Active	0	-	Read only
L04-30	0x91AE	Lower limit flag of limiter module B	0: Inactive 1: Active	0	-	Read only
L04-31	0x91AF	Upper limit flag of limiter module B	0: Inactive 1: Active	0	-	Read only
L04-32	0x91B0	Lower limit flag of limiter module C	0: Inactive 1: Active	0	-	Read only
L04-33	0x91B1	Upper limit flag of limiter module C	0: Inactive 1: Active	0	-	Read only
L04-34	0x91B2	Lower limit flag of limiter module D	0: Inactive 1: Active	0	-	Read only
L04-35	0x91B3	Upper limit flag of limiter module D	0: Inactive 1: Active	0	-	Read only
L04-56	0x91C8	Output of logic delay module A	0: Inactive 1: Active	0	-	Read only
L04-57	0x91C9	Output of logic delay module B	0: Inactive 1: Active	0	-	Read only
L04-58	0x91CA	Output of logic delay module C	0: Inactive 1: Active	0	-	Read only
L04-59	0x91CB	Output of logic delay module D	0: Inactive 1: Active	0	-	Read only
L04-60	0x91CC	Output of logic delay module E	0: Inactive 1: Active	0	-	Read only
L04-61	0x91CD	Output of logic delay module F	0: Inactive 1: Active	0	-	Read only
L04-62	0x91CE	Output of logic delay module G	0: Inactive 1: Active	0	-	Read only
L04-63	0x91CF	Output of logic delay module H	0: Inactive 1: Active	0	-	Read only
L04-84	0x91E4	DI1 (modified by E0-00 forcibly)	0 to 1	0	-	Read only
L04-85	0x91E5	DI2 (modified by E0-01 forcibly)	0 to 1	0	-	Read only
L04-86	0x91E6	DI3 (modified by E0-02 forcibly)	0 to 1	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L04-87	0x91E7	DI4 (modified by E0-03 forcibly)	0 to 1	0	-	Read only
L04-88	0x91E8	DI5 (modified by E0-04 forcibly)	0 to 1	0	-	Read only
L04-89	0x91E9	DI6 (modified by E0-05 forcibly)	0 to 1	0	-	Read only
L04-90	0x91EA	DI7 (modified by E0-06 forcibly)	0 to 1	0	-	Read only
L04-91	0x91EB	DI8 (modified by E0-07 forcibly)	0 to 1	0	-	Read only
L04-92	0x91EC	DI9 (modified by E0-08 forcibly)	0 to 1	0	-	Read only
L04-93	0x91ED	DI10 (modified by E0-09 forcibly)	0 to 1	0	-	Read only
L04-94	0x91EE	VDI1 (modified by E0-10 forcibly)	0 to 1	0	-	Read only
L04-95	0x91EF	VDI2 (modified by E0-11 forcibly)	0 to 1	0	-	Read only
L04-96	0x91F0	VDI3 (modified by E0-12 forcibly)	0 to 1	0	-	Read only
L04-97	0x91F1	VDI4 (modified by E0-13 forcibly)	0 to 1	0	-	Read only
L04-98	0x91F2	VDI5 (modified by E0-14 forcibly)	0 to 1	0	-	Read only
L04-99	0x91F3	VDI6 (modified by E0-15 forcibly)	0 to 1	0	-	Read only
L10-00	0x93E8	Current state of the system state machine	0: Initializing 1: Switch-on inhibited 2: Switch-on allowed 3: Operation allowed 4: Start 5: Run 6: Stop 7: Self-test 8: Parameter auto-tuning	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-01	0x93E9	Switchover command of system state machine	bit0: Start state 0: Inactive 1: Active bit1: Stop state 0: Inactive 1: Active bit2: OFF2 (coast to stop) stop 0: Inactive 1: Active bit3: OFF3 (quick stop) stop 0: Inactive 1: Active bit4: Operation permission (non-sleep state) 0: Inactive 1: Active bit5: Operation inhibition 0: Inactive 1: Active bit6: Stop at fault 0: Inactive 1: Active bit7 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-02	0x93EA	System status word 1	bit0: Ready for switch-on 0: Inactive 1: Active bit1: Ready for operation 0: Inactive 1: Active bit2: Run 0: Inactive 1: Active bit3: Fault 0: Inactive 1: Active bit4: OFF2 (coast to stop) stop 0: Inactive 1: Active bit5: OFF3 (quick stop) stop 0: Inactive 1: Active bit6: Startup lockout 0: Inactive 1: Active bit7: Alarm/Limited operation 0: Inactive 1: Active bit8: No speed deviation 0: Inactive 1: Active bit9: Local/Remote 0: Local 1: Remote bit10: Target speed arrival 0: Inactive 1: Active bit11: Torque limit 0: Inactive 1: Active bit12: Positive speed 0: Inactive 1: Active bit13: Negative speed 0: Inactive 1: Active bit14: Run (pulsing) 0: Inactive 1: Active bit15: User setting state 0 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-03	0x93EB	System status word 2	bit0: Self-test 0: Inactive 1: Active bit1: Parameter auto-tuning 0: Inactive 1: Active bit2: Minor fault state 0: Inactive 1: Active bit3: Alarm state 0: Inactive 1: Active bit4: Speed mode 0: Inactive 1: Active bit5: Torque mode 0: Inactive 1: Active bit6: Position mode (reserved) 0: Inactive 1: Active bit7: RFG enable 0: Inactive 1: Active bit8: RFG operation 0: Inactive 1: Active bit9: Stop at fault 0: Inactive 1: Active bit10: Normal operation 0: Inactive 1: Active bit11: Jog 0: Inactive 1: Active bit12: Decelerate to stop 0: Inactive 1: Active bit13: Brake (reserved) 0: Inactive 1: Active bit14: Terminal control 0: Inactive 1: Active bit15: User setting state 1 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-04	0x93EC	System status word 3	bit0: Control channel selection 0: Control channel 1 1: Control channel 2 bit1: Setting channel selection 0: Setting channel 1 1: Setting channel 2 bit2: Motor selection bit0 0: Logic 0 1: Logic 1 bit3: Motor selection bit1 0: Logic 0 1: Logic 1 bit4: Error (Fault/Alarm) 0: No fault 1: Error (Fault) occurred bit5: EEPROM idle 0: EEPROM idled 1: EEPROM in use bit6: Communication control 0: Inactive 1: Active bit7: Relay action during automatic fault reset 0: Inactive 1: Active bit8: IGBT pulsing state 0: Stop 1: Run bit9: System command direction 0: Forward 1: Reverse bit10: IGBT pulsing state with delay 0: Stop 1: Run bit11: Internal parameter processing flag 0: Not processed 1: Processing bit12: Internal voltage state 0: Undervoltage or initialization not done 1: Normal bit13: Reserved 0: Inactive 1: Active bit14 to bit15: Power board initialization state 0: Not initialized 1: Initializing 2: Done 3: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-05	0x93ED	System status word 4	bit0: Operating at zero speed (inactive at stop) 0: Inactive 1: Active bit1: Operating at zero speed (inactive at stop) 0: Inactive 1: Active bit2: Frequency level detection 1 0: Inactive 1: Active bit3: Frequency level detection 2 0: Inactive 1: Active bit4: Reserved bit5: Simple PLC cycle completed 0: Not completed 1: Completed bit6: Reference set through communication 0: Inactive 1: Active bit7: Reserved bit8: Current 1 arrival 0: Inactive 1: Active bit9: Current 2 arrival 0: Inactive 1: Active bit10: Zero current state 0: Inactive 1: Active bit11: Output current overlimit 0: Inactive 1: Active bit12: Motor overload pre-alarm 0: Inactive 1: Active bit13: AC drive overload pre-alarm 0: Inactive 1: Active bit14: Undervoltage 0: Inactive 1: Active bit15: Three-phase loss 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-06	0x93EE	AC drive main status word	bit0/bit1: Operation state 0: Initializing 1: Sampling preparation 2: Undervoltage 3: Ready bit2: Hardware information state 0: Not ready 1: Ready bit3: Stop state 0: Stop 1: Run bit4: Output blocked upon fault 0: Inactive 1: Active bit5: Bus undervoltage state 0: Inactive 1: Active bit6 to bit15: Reserved	0x0	-	Read only
L10-09	0x93F1	Main status word of motor	bit0 to bit3: Operation mode 0: Stop 1: Normal operation 2: Special operation 3: Auto-tuning 4: Self-test bit4 to bit6: Control mdoe 0: SVC 1: FVC 2: V/f bit7/bit8: Control target 0: Speed 1: Torque 2: Position (reserved) bit9: Motor information state 0: Not ready 1: Ready bit10: Motor operation permission 0: Not ready 1: Ready bit11: Speed mode applied forcibly 0: Inactive 1: Active bit12: Decelerated operation applied forcibly 0: Inactive 1: Active bit13: Motor encoder state (reserved) 0: Not ready 1: Ready bit14 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-10	0x93F2	Auxiliary status word 1 of motor	bit0: Speed tracking in progress 0: Inactive 1: Active bit1: Speed tracking completed 0: Inactive 1: Active bit2: Pre-excitation in progress 0: Inactive 1: Active bit3: Pre-excitation completed 0: Inactive 1: Active bit4: DC braking in progress 0: Inactive 1: Active bit5 and bit6: DC braking complted 0: Not completed 1: DC braking at start completed 2: DC braking at stop completed bit7: I/F control in progress 0: Inactive 1: Active bit8: Short braking in progress 0: Inactive 1: Active bit9: Short braking completed 0: Inactive 1: Active bit10: Initial magnetic pole position auto-tuning completed 0: Inactive 1: Active bit11: Power-on inductance calculation done 0: Inactive 1: Active bit12: Quick encoder zero position auto-tuning 0: Inactive 1: Active bit13: Synchronous motor speed tracking completion 0: Inactive 1: Active bit14: Pre-positioning completion 0: Inactive 1: Active bit15: Table generation of synchronous motor in progress 0: Not in progress 1: In progress	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-11	0x93F3	Auxiliary status word 2 of motor	bit0: Motor zero speed arrival 0: Inactive 1: Zero speed allowed bit1: Motor DC output in progress 0: No output 1: Output in progress bit2 and bit3: Switching from FVC to SVC 0: Not switched 1: Switched to SVC actively 2: Switched to SVC passively bit4: Follow control target 0: Target followed 1: Target not followed bit5: VdcMin control 0: VdcMin not performed 1: VdcMin in progress bit6: VdcMax control 0: VdcMax not performed 1: VdcMax in progress bit7: Minimum torque arrival 0: Not reached 1: Reached bit8: Maximum torque arrival 0: Not reached 1: Reached bit9: Motoring/Generating flag 0: Motoring 1: Generating bit10: Stator resistance auto-tuning before start 0: Inactive 1: Active bit11 and bit12: Pre-charge flag 0: Not performed 1: In progress 2: Done bit13: Resistance auto-tuning 0: Stator resistance auto-tuning before start inactive 1: Stator resistance auto-tuning before start inactive bit14: Saturation model auto-tuning 0: Inactive 1: Active bit15: Motor synchronous frequency zero speed arrival 0: Zero speed not reached 1: Zero speed reached	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-12	0x93F4	AC drive protection status word	bit0: Pulse-by-pulse protection state 0: Inactive 1: Active bit1: Pulse-by-pulse current limit inhibited 0: Inactive 1: Active bit2: Input phase loss 0: Inactive 1: Active bit3: Output phase loss 0: Inactive 1: Active bit4: Pre-charge resistor error 0: Inactive 1: Active bit5: AC drive overload 0: Inactive 1: Active bit6: AC drive pre-overload 0: Inactive 1: Active bit7: Bus overvoltage 0: Inactive 1: Active bit8: Bus undervoltage 0: Inactive 1: Active bit9: Output overcurrent 0: Inactive 1: Active bit10: AC drive overtemperature 0: Inactive 1: Active bit11: AC drive pre-overtemperature 0: Inactive 1: Active bit12: Current leakage protection 0: Inactive 1: Active bit13: Current control error 0: Inactive 1: Active bit14: Software overcurrent 0: Inactive 1: Active bit15: Ground fault (reserved) 0: Inactive 1: Active	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-13	0x93F5	Modulation module status word	bit0: Overmodulation range 0: No overmodulation 1: Overmodulation bit1 to bit3: CDPWM 0: 7-segment pulsing 1: 5-segment pulsing bit4: Narrow pulse state 0: Inactive 1: Active bit5: Dead zone compensation 0: Inactive 1: Active bit6: Random PWM 0: Inactive 1: Active bit7/bit8: Modulation mode 0: Asynchronous modulation 1: Quasi-synchronous modulation bit9: Forced pulsing 0: Carrier frequency deactivated forcibly 1: Carrier frequency activated forcibly bit10/bit11: High frequency state 0: Normal carrier frequency 1: High frequency waiting for acknowledgement 3: High carrier frequency inactive bit12: Reserved bit13 to bit15: Reserved	0x0	-	Read only
L10-14	0x93F6	Sampling status word	bit0 to bit2: (Reserved) bit3: (Reserved) bit4: Excessive zero drift 0: Inactive 1: Active bit5: ADC calibration state flag (Reserved) 0: Inactive 1: Active bit6: Zero drift detection state flag 0: In progress 1: Completed bit7: Braking circuit zero drift detection status flag 0: In progress 1: Completed bit8: Excessive zero drift fault flag of the braking transistor 0: Inactive 1: Active bit9 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-15	0x93F7	Motor protection status word	bit0: Motor overload state 0: Inactive 1: Active bit1: Motor pre-overload state 0: Inactive 1: Active bit2: Three-phase loss state (reserved) 0: Inactive 1: Active bit3: Motor overtemperature (reserved) 0: Inactive 1: Active bit4: PG detection fault (reserved) 0: Inactive 1: Active bit5: Current control error 0: Inactive 1: Active bit6: Motor stall 0: Inactive 1: Active bit7: Motor disconnected or two/three-phase loss 0: Inactive 1: Active bit8: Excessive motor load at constant current (reserved) 0: Inactive 1: Active bit9: VC operation step loss due to motor flux error 0: Inactive 1: Active bit10: Speed measurement fluctuation error (reserved) 0: Inactive 1: Active bit11: Motor parameter setting error (reserved) 0: Inactive 1: Active bit12: HSVM sampling card disconnected or phase error (reserved) 0: Inactive 1: Active bit13: Synchronous motor overcurrent (reserved) 0: Inactive 1: Active (To be continued)	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-15	0x93F7	Motor protection status word	(Continued) bit14: Synchronous output voltage error (reserved) 0: Inactive 1: Active bit15: Encoder disconnected (reserved) 0: Inactive 1: Active	0x0	-	Read only
L10-16	0x93F8	Speed controller status word	bit0: Speed loop enable 0: Inactive 1: Active bit1: Actual state of integral mode 0: Inactive 1: Active bit2 to bit5: Reserved bit6: Integral kept active 0: Inactive 1: Active bit7: Exit integral quickly 0: Inactive 1: Active bit8: Load disturbance resistance 0: Inactive 1: Active bit9 to bit15: Reserved	0x0	-	Read only
L10-17	0x93F9	Vector Vdc status word	bit0: Undervoltage suppression 0: Inactive 1: Active bit1: Overvoltage suppression 0: Inactive 1: Active bit2: Low frequency lower limit applied upon undervoltage suppression 0: Inactive 1: Active bit3 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-18	0x93FA	Excitation module status word	bit0: Inversely proportional field weakening flag 0: Inactive 1: Active bit1: Field weakening flag of adjustment method 0: Inactive 1: Active bit2: Pre-excitation completion flag 0: Inactive 1: Active bit3: Field weakening flag 0: Inactive 1: Active bit4: Energy-saving control flag 0: Inactive 1: Active bit5: No field weakening flag 0: Inactive 1: Active bit6 to bit15: Reserved	0x0	-	Read only
L10-19	0x93FB	Motor model status word	0x0 to 0xFFFF	0x0	-	Read only
L10-20	0x93FC	Motor current loop status word	bit0: Current loop output voltage saturation flag bit: 0: Inactive 1: Active bit1: Current loop feedforward control flag bit 0: Inactive 1: Active bit2: Current loop decoupling control flag bit 0: Inactive 1: Active bit3: Current loop Kp adjusted with load 0: Not adjusted 1: Adjusted bit4: Current loop D-axis open loop state flag bit 0: D-axis closed loop 1: D-axis open loop bit5: ImCsr activation mode 0: Active in low speed mode 1: Active in high speed mode bit6: PI regulator voltage 0: Limit value not exceeded 1: Limit value exceeded bit7: Flux linkage limit amplitude value 0: Normal 1: Distorted bit8 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-21	0x93FD	Motor V/f control status word	bit0: Energy-saving control 0: Inactive 1: Active bit1: Overcurrent suppression 0: Inactive 1: Active bit2: Over-excitation state 0: Inactive 1: Active bit3: Overvoltage suppression 0: Inactive 1: Active bit4: Undervoltage suppression 0: Inactive 1: Active bit5 to bit15: Reserved	0x0	-	Read only
L10-22	0x93FE	Motor torque limit status word	bit0/bit1: Upper limit selection 0: Leakage inductance limit 1: Current limit 2: Torque limit 3: Power limit bit2 to bit3: Lower limit selection 0: Leakage inductance limit 1: Current limit 2: Torque limit 3: Power limit bit4: Positive speed limit 0: Inactive 1: Active bit5: Negative speed limit 0: Inactive 1: Active bit6: Forced external torque limit 0: Inactive 1: Active bit7 to bit15: Reserved	0x0	-	Read only
L10-30	0x9406	Active control mode	0: Speed control 1: Torque control 2: Position control (reserved)	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-44	0x9414	User-defined command word of control channel 1	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Inactive 1: Active bit5: JOG1 0: Inactive 1: Active bit6: JOG2 0: Inactive 1: Active bit7: Speed inversion 0: Inactive1 : Active bit8 to bit15: Reserved	0x0	-	Read only
L10-45	0x9415	User-defined command word of control channel 2	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Inactive 1: Active bit5: JOG1 0: Inactive 1: Active bit6: JOG2 0: Inactive 1: Active bit7: Speed inversion 0: Inactive1 : Active bit8 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-46	0x9416	Auxiliary command word of control channel 1	bit0: OFF2 (coast to stop) stop 2 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 3 0: Stop 1: Run bit2: OFF3 (quick stop) stop 2 0: Stop 1: Run bit3: OFF3 (quick stop) stop 3 0: Disable 1: Enable bit4: Reset command 2 0: Inactive 1: Active bit5: Reset command 3 0: Inactive 1: Active bit6: RFG inhibition 0: Active 1: Inactive bit7: RFG pause 0: Active 1: Inactive bit8: Forced RFG 0: Active 1: Inactive bit9 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-47	0x9417	Auxiliary command word of control channel 2	bit0: OFF2 (coast to stop) stop 2 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 3 0: Stop 1: Run bit2: OFF3 (quick stop) stop 2 0: Stop 1: Run bit3: OFF3 (quick stop) stop 3 0: Disable 1: Enable bit4: Reset command 2 0: Inactive 1: Active bit5: Reset command 3 0: Inactive 1: Active bit6: RFG inhibition 0: Active 1: Inactive bit7: RFG pause 0: Active 1: Inactive bit8: Forced RFG 0: Active 1: Inactive bit9 to bit15: Reserved	0x0	-	Read only
L10-50	0x941A	STO output status word	0x0 to 0xFFFF	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-51	0x941B	LED control word	bit0: Start 0: Inactive 1: Active bit1: Stop 0: Inactive 1: Active bit2: Jog 1 0: Inactive 1: Active bit3: Local control 0: Inactive 1: Active bit4: Reset 0: Inactive 1: Active bit5: Jog 2 0: Inactive 1: Active bit6: Direction switchover 0: Inactive 1: Active bit7 to bit15: Reserved	0x0	-	Read only
L10-52	0x941C	IDS control word	bit0: Start 0: Inactive 1: Active bit1: Stop 0: Inactive 1: Active bit2: Jog 1 0: Inactive 1: Active bit3: Jog 2 0: Inactive 1: Active bit4: Reset 0: Inactive 1: Active bit5: Forward 0: Inactive 1: Active bit6: Reverse 0: Inactive 1: Active bit7: Parameter auto-tuning 0: Inactive 1: Active bit8: Self-test 0: Inactive 1: Active bit9 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-53	0x941D	SOP control word	bit0: Start 0: Inactive 1: Active bit1: Stop 0: Inactive 1: Active bit2: Jog 1 0: Inactive 1: Active bit3: Jog 2 0: Inactive 1: Active bit4: Reset 0: Inactive 1: Active bit5: Forward 0: Inactive 1: Active bit6: Reverse 0: Inactive 1: Active bit7: Parameter auto-tuning 0: Inactive 1: Active bit8: Self-test 0: Inactive 1: Active bit9 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-54	0x941E	Command channel control word	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Activated 1: Normal bit2: OFF3 (quick stop) stop 0: Activated 1: Normal bit3: Operation permission 0: Operation not allowed 1: Operation allowed bit4: RFG output set to 0 forcibly 0: Normal 1: RFG output set to 0 forcibly bit5: RFG pause 0: Normal 1: RFG pause bit6: RFG input set to 0 forcibly 0: Normal 1: RFG input set to 0 forcibly bit7: Fault reset 0: Inactive 1: Active bit8: Jog 1 0: Inactive 1: Active bit9: Jog 2 0: Inactive 1: Active bit10: Remote control (reserved) 0: Inactive 1: Active bit11: Speed inversion 0: Speed not inverted 1: Speed inverted bit12: Start signal 0: Inactive 1: Active bit13: Internal start command 0: Inactive 1: Active bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-55	0x941F	Control word set through communication	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Inactive 1: Active bit5: JOG1 0: Inactive 1: Active bit6: JOG2 0: Inactive 1: Active bit7: Speed inversion 0: Inactive1 : Active bit8 to bit15: Reserved	0x0	-	Read only
L10-56	0x9420	Software tool control flag	0: Not controlled 1: Controlled	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-57	0x9421	Terminal module control word	bit0: ON_OFF1 (start/stop) stop 0: Stop 1: Run bit1: OFF2 (coast to stop) stop 0: Stop 1: Run bit2: OFF3 (quick stop) stop 0: Stop 1: Run bit3: Operation permission 0: Disable 1: Enable bit4: Reset command 0: Inactive 1: Active bit5: JOG1 0: Inactive 1: Active bit6: JOG2 0: Inactive 1: Active bit7: Speed inversion 0: Inactive 1: Active bit8: Reserved bit9: Reserved bit10: Reserved bit11: Reserved bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-58	0x9422	Terminal module A input state	bit0: ON_OFF1 (start/stop) stop 0: Inactive 1: Active bit1: Reverse run (Rev) 0: Inactive 1: Active bit2: Operation permission (Enable) 0: Inactive 1: Active bit3: Reset command (Reset) 0: Inactive 1: Active bit4: JOG1 0: Inactive 1: Active bit5: JOG2 0: Inactive 1: Active bit6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal function input IN1 0: Inactive 1: Active bit8: Terminal function input IN2 0: Inactive 1: Active bit9: Terminal function input In3 0: Inactive 1: Active bit10 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-59	0x9423	Terminal module B input state	bit0: ON_OFF1 (start/stop) stop 0: Inactive 1: Active bit1: Reverse run (Rev) 0: Inactive 1: Active bit2: Operation permission (Enable) 0: Inactive 1: Active bit3: Reset command (Reset) 0: Inactive 1: Active bit4: JOG1 0: Inactive 1: Active bit5: JOG2 0: Inactive 1: Active bit6: Reserved (Rsvd1) 0: Inactive 1: Active bit7: Terminal function input IN1 0: Inactive 1: Active bit8: Terminal function input IN2 0: Inactive 1: Active bit9: Terminal function input In3 0: Inactive 1: Active bit10 to bit15: Reserved	0x0	-	Read only
L10-60	0x9424	Active external command source	0: Operating panel 1: Terminal 2: Communication 3: User-defined	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-62	0x9426	RFG status word	bit0/bit1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit2/bit3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit4 to bit7: Reserved bit8/bit9: Acceleration/Deceleration state in last cycle 0: Reserved 1: Constant speed 2: Accelerate 3: Decelerate bit10/bit11: Arc state in last cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment bit12 to bit15: Reserved	0x0	-	Read only
L10-63	0x9427	RFG command word	bit0: Calculation 0: Inhibited 1: Enabled bit1: Forced output 0: Inhibited 1: Enabled bit2: Calculation pause 0: Inhibited 1: Pause bit3: Bypass 0: Inhibited 1: bypass bit4: Reserved bit5: Arc type 0: Continuous arc 1: Non-continuous arc bit6 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-65	0x9429	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L10-68	0x942C	DO state	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
L11-00	0x944C	Base value of speed per-unit value	0 to 65535	0	rpm	Read only
L11-01	0x944D	Base value of frequency per-unit value	0.0 to 6553.5	0.0	Hz	Read only
L11-02	0x944E	Base value of voltage per-unit value	0.0 to 6553.5	0.0	V	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L11-03	0x944F	Base value of current per-unit value	0.0 to 6553.5	0.0	A	Read only
L11-04	0x9450	Base value of power per-unit value	0.00 to 655.35	0.00	kW	Read only
L11-05	0x9451	Base value of torque per-unit value	0.00 to 655.35	0.00	N·m	Read only
L11-06	0x9452	Base value of DC bus voltage per-unit value	0 to 65535	0	V	Read only
L11-72	0x9494	Limit protection flag	0 to 65535	0	-	Read only
L12-00	0x94B0	Constant setpoint 1 (word)	-32768 to +32767	0	-	Read only
L12-01	0x94B1	Constant setpoint 2 (word)	-32768 to +32767	0	-	Read only
L12-02	0x94B2	Constant setpoint 3 (word)	-32768 to +32767	0	-	Read only
L12-03	0x94B3	Constant setpoint 4 (word)	-32768 to +32767	0	-	Read only
L12-04	0x94B4	Constant setpoint 5 (word)	-32768 to +32767	0	-	Read only
L12-05	0x94B5	Constant setpoint 6 (word)	-32768 to +32767	0	-	Read only
L12-06	0x94B6	Constant setpoint 7 (word)	-32768 to +32767	0	-	Read only
L12-07	0x94B7	Constant setpoint 8 (word)	-32768 to +32767	0	-	Read only
L12-08	0x94B8	Output of bit-to-word module A	0x0 to 0xFFFF	0x0	-	Read only
L12-09	0x94B9	Output of bit-to-word module B	0x0 to 0xFFFF	0x0	-	Read only
L12-10	0x94BA	Output of bit-to-word module C	0x0 to 0xFFFF	0x0	-	Read only
L12-11	0x94BB	Output of bit-to-word module D	0x0 to 0xFFFF	0x0	-	Read only
L12-12	0x94BC	High word of double-word-to-word module A output	0 to 65535	0	-	Read only
L12-13	0x94BD	Low word of double-word-to-word module A output	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L12-14	0x94BE	High word of double-word-to-word module B output	0 to 65535	0	-	Read only
L12-15	0x94BF	Low word of double-word-to-word module B output	0 to 65535	0	-	Read only
L12-16	0x94C0	High word of double-word-to-word module C output	0 to 65535	0	-	Read only
L12-17	0x94C1	Low word of double-word-to-word module C output	0 to 65535	0	-	Read only
L12-18	0x94C2	High word of double-word-to-word module D output	0 to 65535	0	-	Read only
L12-19	0x94C3	Low word of double-word-to-word module D output	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L12-34	0x94D2	Input selection state of binary selector module	bit0: Module A 0: Input 1 1: Input 2 bit1: Module B 0: Input 1 1: Input 2 bit2: Module C 0: Input 1 1: Input 2 bit3: Module D 0: Input 1 1: Input 2 bit4: Module E 0: Input 1 1: Input 2 bit5: Module F 0: Input 1 1: Input 2 bit6: Module G 0: Input 1 1: Input 2 bit7: Module H 0: Input 1 1: Input 2 bit8 to bit15: Reserved	0x0	-	Read only
L12-35	0x94D3	Input selection state of digital selector module	bit0: Module A 0: Input 1 1: Input 2 bit1: Module B 0: Input 1 1: Input 2 bit2: Module C 0: Input 1 1: Input 2 bit3: Module D 0: Input 1 1: Input 2 bit4: Module E 0: Input 1 1: Input 2 bit5: Module F 0: Input 1 1: Input 2 bit6: Module G 0: Input 1 1: Input 2 bit7: Module H 0: Input 1 1: Input 2 bit8 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L12-36	0x94D4	16-bit parameter monitoring address 1	0 to 65535	0	-	Read only
L12-37	0x94D5	16-bit parameter monitoring address 2	0 to 65535	0	-	Read only
L12-38	0x94D6	16-bit parameter monitoring address 3	0 to 65535	0	-	Read only
L12-39	0x94D7	16-bit parameter monitoring address 4	0 to 65535	0	-	Read only
L12-40	0x94D8	16-bit parameter monitoring address 5	0 to 65535	0	-	Read only
L12-50	0x94E2	Output of monitored internal variable 1	32767 to 32767	0	-	Read only
L12-51	0x94E3	Output of monitored internal variable 2	32767 to 32767	0	-	Read only
L12-52	0x94E4	Output of monitored internal variable 3	32767 to 32767	0	-	Read only
L12-53	0x94E5	Output of monitored internal variable 4	32767 to 32767	0	-	Read only
L12-54	0x94E6	Output of monitored internal variable 5	32767 to 32767	0	-	Read only
L12-55	0x94E7	Output of monitored internal variable 6	32767 to 32767	0	-	Read only
L12-56	0x94E8	Output of monitored internal variable 7	32767 to 32767	0	-	Read only
L12-57	0x94E9	Output of monitored internal variable 8	32767 to 32767	0	-	Read only
L20-00	0x97D0	Output of word-to-double-word module A	0x0 to 0xFFFFFFFF	0x0	-	Read only
L20-02	0x97D2	Output of word-to-double-word module B	0x0 to 0xFFFFFFFF	0x0	-	Read only
L20-04	0x97D4	Output of word-to-double-word module C	0x0 to 0xFFFFFFFF	0x0	-	Read only
L20-06	0x97D6	Output of word-to-double-word module D	0x0 to 0xFFFFFFFF	0x0	-	Read only
L22-00	0x9898	Output frequency	8 to 8	0.0	-	Read only
L22-02	0x989A	Motor speed	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L22-04	0x989C	Output current	8 to 8	0.0	-	Read only
L22-06	0x989E	Output voltage	8 to 8	0.0	-	Read only
L22-08	0x98A0	Output power	8 to 8	0.0	-	Read only
L22-10	0x98A2	Output torque	8 to 8	0.0	-	Read only
L22-58	0x98D2	Per-unit current value based on 1000 A at maximum	8 to 8	0.0	-	Read only
L22-60	0x98D4	Per-unit voltage value based on 1000 V at maximum	8 to 8	0.0	-	Read only
L23-00	0x98FC	Fixed value 0%	8 to 8	0.0	-	Read only
L23-02	0x98FE	Fixed value 100%	8 to 8	0.0	-	Read only
L23-04	0x9900	Fixed value 200%	8 to 8	0.0	-	Read only
L23-06	0x9902	Fixed value 400%	8 to 8	0.0	-	Read only
L23-08	0x9904	Fixed value 600%	8 to 8	0.0	-	Read only
L23-10	0x9906	Fixed value -100%	8 to 8	0.0	-	Read only
L23-12	0x9908	Fixed value -200%	8 to 8	0.0	-	Read only
L23-14	0x990A	Fixed value -400%	8 to 8	0.0	-	Read only
L23-16	0x990C	Fixed value -600%	8 to 8	0.0	-	Read only
L23-18	0x990E	Multi-reference selection output	8 to 8	0.0	-	Read only
L23-20	0x9910	Output corresponding to multi-reference 0	8 to 8	0.0	-	Read only
L23-22	0x9912	Multi-reference 1 output	8 to 8	0.0	-	Read only
L23-24	0x9914	Multi-reference 2 output	8 to 8	0.0	-	Read only
L23-26	0x9916	Multi-reference 3 output	8 to 8	0.0	-	Read only
L23-28	0x9918	Multi-reference 4 output	8 to 8	0.0	-	Read only
L23-30	0x991A	Multi-reference 5 output	8 to 8	0.0	-	Read only
L23-32	0x991C	Multi-reference 6 output	8 to 8	0.0	-	Read only
L23-34	0x991E	Multi-reference 7 output	8 to 8	0.0	-	Read only
L23-36	0x9920	Multi-reference 8 output	8 to 8	0.0	-	Read only
L23-38	0x9922	Multi-reference 9 output	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L23-40	0x9924	Multi-reference 10 output	8 to 8	0.0	-	Read only
L23-42	0x9926	Multi-reference 11 output	8 to 8	0.0	-	Read only
L23-44	0x9928	Multi-reference 12 output	8 to 8	0.0	-	Read only
L23-46	0x992A	Multi-reference 13 output	8 to 8	0.0	-	Read only
L23-48	0x992C	Multi-reference 14 output	8 to 8	0.0	-	Read only
L23-50	0x992E	Multi-reference 15 output	8 to 8	0.0	-	Read only
L23-52	0x9930	Constant setpoint 1 (per-unit value)	8 to 8	0.0	-	Read only
L23-54	0x9932	Constant setpoint 2 (per-unit value)	8 to 8	0.0	-	Read only
L23-56	0x9934	Constant setpoint 3 (per-unit value)	8 to 8	0.0	-	Read only
L23-58	0x9936	Constant setpoint 4 (per-unit value)	8 to 8	0.0	-	Read only
L23-60	0x9938	Constant setpoint 5 (per-unit value)	8 to 8	0.0	-	Read only
L23-62	0x993A	Constant setpoint 6 (per-unit value)	8 to 8	0.0	-	Read only
L23-64	0x993C	Constant setpoint 7 (per-unit value)	8 to 8	0.0	-	Read only
L23-66	0x993E	Constant setpoint 8 (per-unit value)	8 to 8	0.0	-	Read only
L23-68	0x9940	Output of addition/ subtraction module A	8 to 8	0.0	-	Read only
L23-70	0x9942	Output of addition/ subtraction module B	8 to 8	0.0	-	Read only
L23-72	0x9944	Output of addition/ subtraction module C	8 to 8	0.0	-	Read only
L23-74	0x9946	Output of addition/ subtraction module D	8 to 8	0.0	-	Read only
L23-76	0x9948	Output of addition/ subtraction module E	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L23-78	0x994A	Output of addition/ subtraction module F	8 to 8	0.0	-	Read only
L23-80	0x994C	Output of addition/ subtraction module G	8 to 8	0.0	-	Read only
L23-82	0x994E	Output of addition/ subtraction module H	8 to 8	0.0	-	Read only
L23-84	0x9950	Output of multiplication/ division module A	8 to 8	0.0	-	Read only
L23-86	0x9952	Output of multiplication/ division module B	8 to 8	0.0	-	Read only
L23-88	0x9954	Output of multiplication/ division module C	8 to 8	0.0	-	Read only
L23-90	0x9956	Output of multiplication/ division module D	8 to 8	0.0	-	Read only
L23-92	0x9958	Output of multiplication/ division module E	8 to 8	0.0	-	Read only
L23-94	0x995A	Output of multiplication/ division module F	8 to 8	0.0	-	Read only
L23-96	0x995C	Output of multiplication/ division module G	8 to 8	0.0	-	Read only
L23-98	0x995E	Output of multiplication/ division module H	8 to 8	0.0	-	Read only
L24-00	0x9960	Output of absolute module A	8 to 8	0.0	-	Read only
L24-02	0x9962	Output of absolute module B	8 to 8	0.0	-	Read only
L24-04	0x9964	Output of absolute module C	8 to 8	0.0	-	Read only
L24-06	0x9966	Output of absolute module D	8 to 8	0.0	-	Read only
L24-08	0x9968	Output of absolute module E	8 to 8	0.0	-	Read only
L24-10	0x996A	Output of absolute module F	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L24-12	0x996C	Output of absolute module G	8 to 8	0.0	-	Read only
L24-14	0x996E	Output of absolute module H	8 to 8	0.0	-	Read only
L24-16	0x9970	Output of digital selector A	8 to 8	0.0	-	Read only
L24-18	0x9972	Output of digital selector B	8 to 8	0.0	-	Read only
L24-20	0x9974	Output of digital selector C	8 to 8	0.0	-	Read only
L24-22	0x9976	Output of digital selector D	8 to 8	0.0	-	Read only
L24-24	0x9978	Output of digital selector E	8 to 8	0.0	-	Read only
L24-26	0x997A	Output of digital selector F	8 to 8	0.0	-	Read only
L24-28	0x997C	Output of digital selector G	8 to 8	0.0	-	Read only
L24-30	0x997E	Output of digital selector H	8 to 8	0.0	-	Read only
L24-32	0x9980	Output of limiter module A	8 to 8	0.0	-	Read only
L24-34	0x9982	Output of limiter module B	8 to 8	0.0	-	Read only
L24-36	0x9984	Output of limiter module C	8 to 8	0.0	-	Read only
L24-38	0x9986	Output of limiter module D	8 to 8	0.0	-	Read only
L24-40	0x9988	Output of filter module A	8 to 8	0.0	-	Read only
L24-42	0x998A	Output of filter module B	8 to 8	0.0	-	Read only
L24-44	0x998C	Output of filter module C	8 to 8	0.0	-	Read only
L24-46	0x998E	Output of filter module D	8 to 8	0.0	-	Read only
L24-48	0x9990	Output of multi-point curve A	8 to 8	0.0	-	Read only
L24-50	0x9992	Output of multi-point curve B	8 to 8	0.0	-	Read only
L24-52	0x9994	Digital reference of motorized potentiometer forced value	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L24-54	0x9996	Reset value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-56	0x9998	Maximum value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-58	0x999A	Minimum value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-60	0x999C	Initial value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-62	0x999E	Process operation value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-64	0x99A0	Final output value of motorized potentiometer	8 to 8	0.0	-	Read only
L24-66	0x99A2	General PID output	8 to 8	0.0	-	Read only
L24-68	0x99A4	General PID error	8 to 8	0.0	-	Read only
L24-70	0x99A6	General PID reference	8 to 8	0.0	-	Read only
L24-72	0x99A8	General PID feedback	8 to 8	0.0	-	Read only
L24-74	0x99AA	General PID proportional output	8 to 8	0.0	-	Read only
L24-76	0x99AC	General PID integral output	8 to 8	0.0	-	Read only
L24-78	0x99AE	General PID derivative output	8 to 8	0.0	-	Read only
L24-80	0x99B0	General PID inversion cutoff output	8 to 8	0.0	-	Read only
L24-82	0x99B2	Per-unit value of simple PLC step	8 to 8	0.0	-	Read only
L25-00	0x99C4	Word-to-floating-point module A output	8 to 8	0.00	-	Read only
L25-02	0x99C6	Word-to-floating-point module B output	8 to 8	0.00	-	Read only
L25-04	0x99C8	Word-to-floating-point module C output	8 to 8	0.00	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L25-06	0x99CA	Word-to-floating-point module D output	8 to 8	0.00	-	Read only
L25-08	0x99CC	Double-word-to-floating-point module A output	8 to 8	0.00	-	Read only
L25-10	0x99CE	Double-word-to-floating-point module B output	8 to 8	0.00	-	Read only
L25-12	0x99D0	Double-word-to-floating-point module C output	8 to 8	0.00	-	Read only
L25-14	0x99D2	Double-word-to-floating-point module D output	8 to 8	0.00	-	Read only
L30-00	0x9BB8	Actual motor speed	8 to 8	0.0	-	Read only
L30-02	0x9BBA	Final motor speed reference	8 to 8	0.0	-	Read only
L30-06	0x9BBE	Target frequency	8 to 8	0.0	-	Read only
L30-08	0x9BC0	Operating frequency	8 to 8	0.0	-	Read only
L30-10	0x9BC2	Target frequency of the channel	8 to 8	0.0	-	Read only
L30-12	0x9BC4	Additional frequency of the channel	8 to 8	0.0	-	Read only
L30-14	0x9BC6	Additional frequency reference	8 to 8	0.0	-	Read only
L30-16	0x9BC8	Jog 1 frequency	8 to 8	0.0	-	Read only
L30-18	0x9BCA	Jog 2 frequency	8 to 8	0.0	-	Read only
L30-26	0x9BD2	Main frequency reference after gain processing	8 to 8	0.0	-	Read only
L30-28	0x9BD4	Auxiliary frequency reference after gain processing	8 to 8	0.0	-	Read only
L30-30	0x9BD6	Frequency reference after direction inversion	8 to 8	0.0	-	Read only
L30-32	0x9BD8	Frequency reference after speed limit	8 to 8	0.0	-	Read only
L30-34	0x9BDA	Frequency reference after offset set by UP/DOWN key	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L30-36	0x9BDC	Frequency reference after direction limit	8 to 8	0.0	-	Read only
L30-38	0x9BDE	Frequency reference after limit	8 to 8	0.0	-	Read only
L30-40	0x9BE0	Frequency reference after frequency jump	8 to 8	0.0	-	Read only
L30-42	0x9BE2	Frequency reference after ramp change	8 to 8	0.0	-	Read only
L30-46	0x9BE6	RFG reference input	8 to 8	0.0	-	Read only
L30-48	0x9BE8	RFG calculation input	8 to 8	0.0	-	Read only
L30-50	0x9BEA	Actual RFG target	8 to 8	0.0	-	Read only
L30-52	0x9BEC	RFG calculation output	8 to 8	0.0	-	Read only
L30-54	0x9BEE	RFG acceleration	8 to 8	0.0	-	Read only
L30-56	0x9BF0	RFG forced value of starting frequency function	8 to 8	0.0	-	Read only
L30-58	0x9BF2	Offset of frequency adjusted by UP/ DOWN key	8 to 8	0.0	-	Read only
L30-60	0x9BF4	Upper limit of frequency adjusted by UP/DOWN key	8 to 8	0.0	-	Read only
L30-62	0x9BF6	Lower limit of frequency adjusted by UP/DOWN key	8 to 8	0.0	-	Read only
L30-64	0x9BF8	Speed reference set through communication	8 to 8	0.0	-	Read only
L30-66	0x9BFA	Communication (0x1000H)	8 to 8	0.0	-	Read only
L30-68	0x9BFC	Maximum positive frequency	8 to 8	0.0	-	Read only
L30-70	0x9BFE	Minimum positive frequency	8 to 8	0.0	-	Read only
L30-72	0x9C00	Maximum negative frequency	8 to 8	0.0	-	Read only
L30-74	0x9C02	Minimum negative frequency	8 to 8	0.0	-	Read only
L30-76	0x9C04	Positive frequency limit with additional frequency applied	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L30-78	0x9C06	Negative frequency limit with additional frequency applied	8 to 8	0.0	-	Read only
L31-00	0x9C1C	Torque reference	8 to 8	0.0	-	Read only
L31-02	0x9C1E	Additional torque	8 to 8	0.0	-	Read only
L31-04	0x9C20	Filtered torque reference	8 to 8	0.0	-	Read only
L31-06	0x9C22	Target torque reference	8 to 8	0.0	-	Read only
L31-08	0x9C24	Speed limit in torque control	8 to 8	0.0	-	Read only
L31-10	0x9C26	Frequency offset in torque control	8 to 8	0.0	-	Read only
L31-12	0x9C28	Maximum positive torque	8 to 8	0.0	-	Read only
L31-14	0x9C2A	Maximum negative torque	8 to 8	0.0	-	Read only
L31-20	0x9C30	Target voltage in V/f decoupled mode	8 to 8	0.0	-	Read only
L31-22	0x9C32	Voltage output in V/f decoupled mode	8 to 8	0.0	-	Read only
L32-08	0x9C88	Cumulative drive overload value	8 to 8	0.0	-	Read only
L32-10	0x9C8A	Cumulative motor overload value	8 to 8	0.0	-	Read only
L32-12	0x9C8C	Synchronous frequency	8 to 8	0.0	-	Read only
L32-14	0x9C8E	Synchronous rotating angle	8 to 8	0.0	-	Read only
L32-16	0x9C90	Torque reference control	8 to 8	0.0	-	Read only
L32-18	0x9C92	Flux reference control	8 to 8	0.0	-	Read only
L32-20	0x9C94	Excitation current reference	8 to 8	0.0	-	Read only
L32-22	0x9C96	Torque current reference	8 to 8	0.0	-	Read only
L32-24	0x9C98	Actual excitation current	8 to 8	0.0	-	Read only
L32-26	0x9C9A	Actual torque current	8 to 8	0.0	-	Read only
L32-28	0x9C9C	Phase U current (instantaneous value)	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L32-30	0x9C9E	Phase V current (instantaneous value)	8 to 8	0.0	-	Read only
L32-32	0x9CA0	Phase W current (instantaneous value)	8 to 8	0.0	-	Read only
L32-34	0x9CA2	Output current amplitude	8 to 8	0.0	-	Read only
L32-36	0x9CA4	Output current phase	8 to 8	0.0	-	Read only
L32-38	0x9CA6	Output voltage amplitude	8 to 8	0.0	-	Read only
L32-40	0x9CA8	Output voltage phase	8 to 8	0.0	-	Read only
L32-42	0x9CAA	Phase U voltage (instantaneous value)	8 to 8	0.0	-	Read only
L32-44	0x9CAC	Phase V voltage (instantaneous value)	8 to 8	0.0	-	Read only
L32-46	0x9CAE	Phase W voltage (instantaneous value)	8 to 8	0.0	-	Read only
L32-48	0x9CB0	Drive bus voltage	0.0 to 6553.5	0.0	V	Read only
L32-50	0x9CB2	Final voltage reference control	8 to 8	0.0	-	Read only
L32-52	0x9CB4	Unlimited output voltage	8 to 8	0.0	-	Read only
L32-54	0x9CB6	Voltage phase angle	8 to 8	0.0	-	Read only
L32-56	0x9CB8	Maximum output voltage	8 to 8	0.0	-	Read only
L32-58	0x9CBA	Current loop saturation voltage	8 to 8	0.0	-	Read only
L32-60	0x9CBC	Output torque	8 to 8	0.0	-	Read only
L32-62	0x9CBE	Flux amplitude	8 to 8	0.0	-	Read only
L32-64	0x9CC0	Flux angle	8 to 8	0.0	-	Read only
L32-66	0x9CC2	Motor output power	8 to 8	0.0	-	Read only
L32-68	0x9CC4	Output power	8 to 8	0.0	-	Read only
L32-70	0x9CC6	Power factor angle	8 to 8	0.0	-	Read only
L32-72	0x9CC8	Phase U comparison value	8 to 8	0.0	-	Read only
L32-74	0x9CCA	Phase V comparison value	8 to 8	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L32-76	0x9CCC	Phase W comparison value	8 to 8	0.0	-	Read only
L32-78	0x9CCE	Compensation value 1	8 to 8	0.0	-	Read only
L32-80	0x9CD0	Compensation value 2	8 to 8	0.0	-	Read only
L32-82	0x9CD2	Compensation value 3	8 to 8	0.0	-	Read only
L32-84	0x9CD4	Bandwidth test feedback signal amplitude	8 to 8	0.0	-	Read only
L32-92	0x9CDC	Ambient air inlet temperature	0.00 to 655.35	0.00	-	Read only
L32-94	0x9CDE	Heatsink point 1 temperature	0.00 to 655.35	0.00	-	Read only
L32-96	0x9CE0	Heatsink point 2 temperature	0.00 to 655.35	0.00	-	Read only
L32-98	0x9CE2	Ambient air outlet temperature	0.00 to 655.35	0.00	-	Read only
L33-00	0x9CE4	Case temperature of the upper IGBT of phase U	0.00 to 655.35	0.00	-	Read only
L33-02	0x9CE6	Junction temperature of the upper IGBT of phase U	0.00 to 655.35	0.00	-	Read only
L33-04	0x9CE8	Case temperature of the lower IGBT of phase W	0.00 to 655.35	0.00	-	Read only
L33-06	0x9CEA	Junction temperature of the lower IGBT of phase W	0.00 to 655.35	0.00	-	Read only
L33-08	0x9CEC	Average heating power in group VW	0.00 to 655.35	0.00	-	Read only
L33-10	0x9CEE	Average heating power in group Ubr	0.00 to 655.35	0.00	-	Read only
L33-12	0x9CF0	Average heating power in group Rec	0.00 to 655.35	0.00	-	Read only
L33-38	0x9D0A	Motor shutdown duration	0 to 65535	0	s	Read only
L33-40	0x9D0C	Motor operation duration	0 to 65535	0	s	Read only
L33-46	0x9D12	d-axis feedback in TLC control	-3276.8 to +3276.7	0.0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
L33-48	0x9D14	q-axis feedback in TLC control	-3276.8 to +3276.7	0.0	-	Read only
L33-80	0x9D34	Monitoring variable 0	8 to 8	0.0	-	Read only
L33-82	0x9D36	Monitoring variable 1	8 to 8	0.0	-	Read only
L33-84	0x9D38	Monitoring variable 2	8 to 8	0.0	-	Read only
L33-86	0x9D3A	Monitoring variable 3	8 to 8	0.0	-	Read only
L33-88	0x9D3C	Monitoring variable 4	8 to 8	0.0	-	Read only
L33-90	0x9D3E	Monitoring variable 5	8 to 8	0.0	-	Read only
L33-92	0x9D40	Monitoring variable 6	8 to 8	0.0	-	Read only
L33-94	0x9D42	Monitoring variable 7	8 to 8	0.0	-	Read only
L33-96	0x9D44	Monitoring variable 8	8 to 8	0.0	-	Read only
L33-98	0x9D46	Monitoring variable 9	8 to 8	0.0	-	Read only
U0-00	0x7000	Operating frequency	0.00 to 600.00	0.00	Hz	Read only
U0-01	0x7001	Frequency reference	0.00 to 600.00	0.00	Hz	Read only
U0-02	0x7002	Bus voltage	0.0 to 6553.5	0.0	V	Read only
U0-03	0x7003	Output voltage	0 to 65535	0	V	Read only
U0-04	0x7004	Output current	0.00 to 655.35	0.00	A	Read only
U0-05	0x7005	Output power	-3276.8 to +3276.7	0.0	kW	Read only
U0-06	0x7006	Output torque	-3276.8 to +3276.7	0.0	%	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-07	0x7007	DI state	bit0: DI1 state 0: Low level 1: High level bit1: DI2 state 0: Low level 1: High level bit2: DI3 state 0: Low level 1: High level bit3: DI4 state 0: Low level 1: High level bit4: DI5 state 0: Low level 1: High level bit5: DI6 state 0: Low level 1: High level bit6: DI7 state 0: Low level 1: High level bit7: DI8 state 0: Low level 1: High level bit8: DI9 state 0: Low level 1: High level bit9: DI10 state 0: Low level 1: High level bit10: VDI1 state 0: Low level 1: High level bit11: VDI2 state 0: Low level 1: High level bit12: VDI3 state 0: Low level 1: High level bit13: VDI4 state 0: Low level 1: High level bit14: VDI5 state 0: Low level 1: High level bit15: VDI6 state 0: Low level 1: High level	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-08	0x7008	DO state	bit0: RO state 0: Low level 1: High level bit1: DO1 state 0: Low level 1: High level bit2: DO2 state 0: Low level 1: High level bit3: DO3 state 0: Low level 1: High level bit4: DO4 state 0: Low level 1: High level bit5: DO5 state 0: Low level 1: High level bit6: DO6 state 0: Low level 1: High level bit7: Reserved bit8: Reserved bit9: Reserved bit10: VDO1 state 0: Low level 1: High level bit11: VDO2 state 0: Low level 1: High level bit12: VDO3 state 0: Low level 1: High level bit13: VDO4 state 0: Low level 1: High level bit14: VDO5 state 0: Low level 1: High level bit15: VDO6 state 0: Low level 1: High level	0x0	-	Read only
U0-14	0x700E	Load speed display	0 to 65535	0	rpm	Read only
U0-15	0x700F	PID setting	0 to 65535	0	-	Read only
U0-16	0x7010	PID feedback	0 to 65535	0	-	Read only
U0-17	0x7011	PLC phase	0 to 65535	0	-	Read only
U0-19	0x7013	Actual motor frequency	-327.68 to +327.67	0.00	Hz	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-20	0x7014	Remaining time for timing operation	0.0 to 6553.5	0.0	min	Read only
U0-24	0x7018	Actual motor speed	0 to 65535	0	rpm	Read only
U0-25	0x7019	Current power-on time	0 to 65535	0	min	Read only
U0-26	0x701A	Current operating time	0.0 to 6553.5	0.0	min	Read only
U0-28	0x701C	Reference value set through communication	-327.68 to +327.67	0.00	%	Read only
U0-30	0x701E	Main frequency reference	-327.68 to +327.67	0.00	Hz	Read only
U0-31	0x701F	Auxiliary frequency reference	-327.68 to +327.67	0.00	Hz	Read only
U0-35	0x7023	Target torque	-200.0 to +200.0	0.0	%	Read only
U0-37	0x7025	Power factor angle	-3276.8 to +3276.7	0.0	°	Read only
U0-39	0x7027	Target voltage in V/f decoupled mode	0 to 65535	0	V	Read only
U0-40	0x7028	Output voltage in V/f decoupled mode	0 to 65535	0	V	Read only
U0-45	0x702D	Fault code	0.0 to 6553.5	0.0	-	Read only
U0-46	0x702E	Minor fault code	0.0 to 6553.5	0.0	-	Read only
U0-47	0x702F	Alarm code	0.0 to 6553.5	0.0	-	Read only
U0-48	0x7030	Prompt code	0.0 to 6553.5	0.0	-	Read only
U0-51	0x7033	Output of UP/DOWN key	-327.68 to +327.67	0.00	Hz	Read only
U0-59	0x703B	Frequency reference (%)	-3276.8 to +3276.7	0.0	%	Read only
U0-60	0x703C	Operating frequency (%)	-3276.8 to +3276.7	0.0	%	Read only
U0-61	0x703D	Drive status 1	1: Forward run 2: Reverse run 3: Stopped 4: Motor auto-tuning 5: Fault	3	-	Read only
U0-65	0x7041	Torque upper limit	-200.0 to +200.0	0.0	%	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-68	0x7044	Drive state 2	bit0: Operating state 0: Stop 1: Run bit1: Operating direction 0: Forward 1: Reverse bit2: Fault state 0: No fault 1: Fault bit3: Frequency arrival 0: Not reached 1: Reached bit4: Reserved bit5: Reserved bit6/bit7: Reserved bit8 to bit15: Fault code	0x0	-	Read only
U0-69	0x7045	Actual motor frequency (signed)	-327.67 to +327.67	0.00	Hz	Read only
U0-70	0x7046	Actual motor speed (signed)	-32767 to +32768	0	rpm	Read only
U0-71	0x7047	Output current (one decimal place)	0.0 to 6553.5	0.0	A	Read only
U0-75	0x704B	Actual motor frequency (unsigned)	0.00 to 655.35	0.00	Hz	Read only
U0-76	0x704C	Low bits of cumulative power consumption	0.0 to 6553.5	0.0	kWh	Read only
U0-77	0x704D	High bits of cumulative power consumption	0 to 65535	0	kWh	Read only
U0-82	0x7052	Heatsink temperature	-20.0 to +120.0	0.0	°C	Read only
U0-83	0x7053	Drive chamber temperature	-20.0 to +120.0	0.0	°C	Read only
U0-84	0x7054	Load type display	0: High-load application 1: Low-load application	0	-	Read only
U0-85	0x7055	Auto-tuning and self-test procedure	0 to 65535	0	-	Read only
U0-86	0x7056	Proportional coefficient of the speed loop	0.00 to 655.35	0.00	-	Read only
U0-87	0x7057	Integral coefficient of the speed loop	0.00 to 655.35	0.00	-	Read only
U0-90	0x705A	Motor temperature	-50 to +300	0	°C	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U0-91	0x705B	SEW general status word	0x0 to 0xFFFF	0x0	-	Read only
U0-92	0x705C	SEW state word 1	0x0 to 0xFFFF	0x0	-	Read only
U0-93	0x705D	SEW actual current value	0.0 to 300.0	0.0	%	Read only
U0-94	0x705E	SEW state word 2	0 to 65535	0	-	Read only
U0-97	0x7061	Phase U current (unit: 0.01%)	0.00 to 655.35	0.00	%	Read only
U0-98	0x7062	Effective value of phase V current (unit: 0.01%)	0.00 to 655.35	0.00	%	Read only
U0-99	0x7063	Effective value of phase W current (unit: 0.01%)	0.00 to 655.35	0.00	%	Read only
U1-00	0x7100	Current state of brake control	0: Initializing 1: Inhibited 2: Applying 3: Applied 4: Waiting for switch-on 5: Switching on 6: Switched on 7: Waiting for switch-off	0	-	Read only
U1-01	0x7101	Brake module control word	0 to 65535	0	-	Read only
U1-02	0x7102	Brake module status word	0 to 65535	0	-	Read only
U1-03	0x7103	Status word for brake release not done	0 to 65535	0	-	Read only
U1-04	0x7104	Status word for brake apply not done	0 to 65535	0	-	Read only
U1-05	0x7105	Starting frequency state of brake module	0 to 65535	0	-	Read only
U1-06	0x7106	Starting torque state of brake module	0 to 65535	0	-	Read only
U1-17	0x7111	Brake released	0 to 1	0	-	Read only
U1-18	0x7112	Brake applied	0 to 1	0	-	Read only
U2-01	0x7201	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Read only
U2-02	0x7202	Current setting channel	0: Reference 1 1: Reference channel 2	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-03	0x7203	Current stop mode	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop	0	-	Read only
U2-05	0x7205	Current multi-reference selection	0 to 65535	0	-	Read only
U2-06	0x7206	Effective value of active multi-reference	-3276.7 to +3276.7	0.0	%	Read only
U2-07	0x7207	Current operation mode	0: Normal operation 1: Jog	0	-	Read only
U2-08	0x7208	Current jog source	0: Jog source 1 1: Jog source 2	0	-	Read only
U2-09	0x7209	Current control mode	0: Speed control mode 1: Torque control mode 2: Position control mode (reserved)	0	-	Read only
U2-10	0x720A	Active carrier frequency	0 to 65535	0	Hz	Read only
U2-11	0x720B	Local/Remote	0: Remote 1: Local	0	-	Read only
U2-12	0x720C	DO hardware fault status	bit0: DO1 fault 0: Normal 1: Fault bit1: DO2 fault 0: Normal 1:fault bit2: DO3 fault 0: Normal 1:fault bit3: DO4 fault 0: Normal 1:fault bit4: DO5 fault 0: Normal 1:fault bit5: DO6 fault 0: Normal 1: Fault	0	-	Read only
U2-13	0x720D	24 V power supply status	bit0: 24 V power supply 1 fault 0: Normal 1: Fault bit1: 24 V safety power supply 1 fault 0: Normal 1: Fault bit2: 24 V safety power supply 2 fault 0: Normal 1: Fault	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-14	0x720E	Operating panel board error status	0: No error 1: SD card not exist 2: Parameter copy file creation failed 3: Failed to write parameter copy data 4: Failed to read parameter copy data through communication 5: Parameter copy file tail creation failed 6: Failed to write parameter copy data through communication 7: Failed to read parameter copy data 8: Parameter file not exist 9: SD card memory insufficient 10: H723 parameter copy terminated 11: Failed to write data to SD card in fixture test 12: Failed to read data from SD card in fixture test	0	-	Read only
U2-15	0x720F	Parameter copy status of SD card	1: Idle 2: Copying parameters 3: Parameter copy done 4: Parameter copy failed	1	-	Read only
U2-16	0x7210	SD card insertion status	0: Inactive 1: Inserted 2: Removed	0	-	Read only
U2-18	0x7212	Jump frequency flag bit	0 to 65535	0	-	Read only
U2-19	0x7213	Self-test/Auto-tuning pre-state	0: Inactive 1: Wait for auto-tuning 2: Wait for self-test 3: Forced DC braking	0	-	Read only
U2-20	0x7214	Self-test/Auto-tuning request	0 to 65535	0	-	Read only
U2-21	0x7215	Self-test/Auto-tuning completion	0 to 65535	0	-	Read only
U2-22	0x7216	Self-test upon power-on/Auto-tuning of current item	0 to 65535	0	-	Read only
U2-23	0x7217	Decelerate to stop/ DC braking state	0 to 65535	0	-	Read only
U2-24	0x7218	Immediate DC braking of DI	0: Inactive 1: Immediate DC braking 2: Decelerate to DC braking	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-25	0x7219	Fault and limit level	bit0: Coast to stop 0: Inactive 1: Active bit1: Stop at maximum capacity 0: Inactive 1: Active bit2: Quick stop 0: Inactive 1: Active bit3: Decelerate to stop 0: Inactive 1: Active bit4: Reserved 0: Inactive 1: Active bit5: Reserved 0: Inactive 1: Active bit6: Reserved 0: Inactive 1: Active bit7: Reserved 0: Inactive 1: Active bit8: Reserved 0: Inactive 1: Active bit9: Limited operation 0: Inactive 1: Active bit10: Alarm 0: Inactive 1: Active bit11: Prompt 0: Inactive 1: Active bit12: Reserved bit13: Reserved bit14: Reserved bit15: Reserved	0x0	-	Read only
U2-26	0x721A	View of reset/restart procedure upon fault	0 to 65535	0	-	Read only
U2-27	0x721B	Automatic reset command flag for communication fault	0: Inactive 1: Active	0	-	Read only
U2-35	0x7223	Undervoltage fault flag bit	0: Inactive 1: Active	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U2-36	0x7224	Fault restart clear command	0 to 65535	0	-	Read only
U2-37	0x7225	Frequency offset mode in torque control	0 to 65535	0	-	Read only
U2-38	0x7226	RFG clear command in V/f decoupled mode	0: Inactive 1: Active	0	-	Read only
U2-39	0x7227	V/f decoupled mode enable	0: Inactive 1: Active	0	-	Read only
U2-40	0x7228	Stop frequency enable in V/f decoupled mode	0: Inactive 1: Active	0	-	Read only
U2-41	0x7229	RFG performance enabled forcibly	0: Inactive 1: Active	0	-	Read only
U2-42	0x722A	RFG acceleration/ deceleration state	0 to 65535	0	-	Read only
U2-43	0x722B	RFG arc state	0 to 65535	0	-	Read only
U2-44	0x722C	Active RFG selection	0: Ramp 1 1: Ramp 2 2: Ramp 3 3: Ramp 4	0	-	Read only
U2-45	0x722D	State of current additional torque 2	bit0: Setting channel 1 0: Inactive 1: Active bit1: Setting channel 2 0: Inactive 1: Active bit2 to bit15: Reserved	0x0	-	Read only
U2-46	0x722E	10 V reference voltage of PTC	0.00 to 20.00	0.00	V	Read only
U2-49	0x7231	Remaining time of timed operation	0.0 to 6553.5	0.0	min	Read only
U2-50	0x7232	Flag for decimal place changing with power parameter	0.0 to 6553.5	0.0	-	Read only
U3-00	0x7300	LCD command word	0x0 to 0xFFFF	0x0	-	Read only
U3-02	0x7302	IDS command word	0x0 to 0xFFFF	0x0	-	Read only
U3-03	0x7303	Command for software tool to get control permissions	0 to 65535	0	-	Read only
U3-07	0x7307	LED control word	0x0 to 0xFFFF	0x0	-	Read only
U3-08	0x7308	Software tool control word	0x0 to 0xFFFF	0x0	-	Read only
U3-09	0x7309	SOP control word	0x0 to 0xFFFF	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-10	0x730A	Key value	0 to 65535	0	-	Read only
U3-11	0x730B	LED command clear flag	0 to 65535	0	-	Read only
U3-12	0x730C	SOP command clear flag	0 to 65535	0	-	Read only
U3-13	0x730D	IDS command clear flag	0 to 65535	0	-	Read only
U3-14	0x730E	Automatic reset command flag for communication fault	0 to 65535	0	-	Read only
U3-16	0x7310	Speed reference 2 set through communication (0x7310)	0.00 to 655.35	0.00	-	Read only
U3-17	0x7311	Control word 2 set through communication (0x7311)	0x0 to 0xFFFF	0x0	-	Read only
U3-18	0x7312	DO state setting (DO function source: communication)	0 to 65535	0	-	Read only
U3-23	0x7317	Monitoring of speed reference 1 set through communication (0x1000)	-32768 to +32767	0	-	Read only
U3-24	0x7318	0x1000H decimal place set through communication	0 to 65535	0	-	Read only
U3-25	0x7319	SEW control word	0 to 65535	0	-	Read only
U3-26	0x731A	SEW speed reference	32767 to 32767	0	-	Read only
U3-27	0x731B	SEW acceleration/ deceleration time	0.0 to 6553.0	0.0	s	Read only
U3-28	0x731C	Communication status word	0x0 to 0xFFFF	0x0	-	Read only
U3-29	0x731D	Communication error reset enable	0 to 65535	0	-	Read only
U3-33	0x7321	Control word 1 set through communication (0x7321)	0x0 to 0xFFFF	0x0	-	Read only
U3-37	0x7325	Software tool control flag	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-38	0x7326	Command channel command (last cycle)	0 to 65535	0	-	Read only
U3-41	0x7329	Communication command clear flag	0 to 65535	0	-	Read only
U3-50	0x7332	Read fault code	0 to 65535	0	-	Read only
U3-51	0x7333	Read fault sub-code	0 to 65535	0	-	Read only
U3-52	0x7334	Read minor fault code	0 to 65535	0	-	Read only
U3-53	0x7335	Read minor fault sub-code	0 to 65535	0	-	Read only
U3-54	0x7336	Read alarm code	0 to 65535	0	-	Read only
U3-55	0x7337	Read alarm sub-code	0 to 65535	0	-	Read only
U3-56	0x7338	Read prompt code	0 to 65535	0	-	Read only
U3-57	0x7339	Read prompt sub-code	0 to 65535	0	-	Read only
U3-58	0x733A	AB control word	0x0 to 0xFFFF	0x0	-	Read only
U3-59	0x733B	AB frequency setting	-500.0 to +500.0	0.0	Hz	Read only
U3-60	0x733C	AB state word	0x0 to 0xFFFF	0x0	-	Read only
U3-61	0x733D	AB output frequency	-500.0 to +500.0	0.0	Hz	Read only
U3-62	0x733E	DI status of AB	0x0 to 0xFFFF	0x0	-	Read only
U3-63	0x733F	AB output current	-100.00 to +100.00	0.00	A	Read only
U3-64	0x7340	AB fault status	0x0 to 0xFFFF	0x0	-	Read only
U3-90	0x735A	Floating-point connector-to-monitoring parameter module A output	-32768 to +32767	0	-	Read only
U3-91	0x735B	Floating-point connector-to-monitoring parameter module B output	-32768 to +32767	0	-	Read only
U3-92	0x735C	Floating-point connector-to-monitoring parameter module C output	-32768 to +32767	0	-	Read only
U3-93	0x735D	Floating-point connector-to-monitoring parameter module D output	-32768 to +32767	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U3-94	0x735E	Floating-point connector-to-monitoring parameter module E output	-32768 to +32767	0	-	Read only
U3-95	0x735F	Floating-point connector-to-monitoring parameter module F output	-32768 to +32767	0	-	Read only
U3-96	0x7360	Floating-point connector-to-monitoring parameter module G output	-32768 to +32767	0	-	Read only
U3-97	0x7361	Floating-point connector-to-monitoring parameter module H output	-32768 to +32767	0	-	Read only
U4-00	0x7400	Supported mode (high bits of 6502H)	0x0 to 0xFFFF	0x0	-	Read only
U4-01	0x7401	Supported mode (low bits of 6502H)	0x0 to 0xFFFF	0x0	-	Read only
U4-02	0x7402	Fault code (603FH)	0x0 to 0xFFFF	0x0	-	Read only
U4-03	0x7403	Control word (6040H)	0x0 to 0xFFFF	0x0	-	Read only
U4-04	0x7404	Status word (6041H)	0x0 to 0xFFFF	0x0	-	Read only
U4-05	0x7405	Target speed (6042H)	-32768 to +32767	0	-	Read only
U4-06	0x7406	Speed reference (6043H)	-32768 to +32767	0	-	Read only
U4-07	0x7407	Actual operating speed (6044H)	-32768 to +32767	0	-	Read only
U4-08	0x7408	Minimum speed (high bits of 6046H-1)	0 to 65535	0	-	Read only
U4-09	0x7409	Minimum speed (low bits of 6046H-1)	0 to 65535	0	-	Read only
U4-10	0x740A	Maximum speed (high bits of 6046H-2)	0 to 65535	0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U4-11	0x740B	Maximum speed (low bits of 6046H-2)	0 to 65535	0	-	Read only
U4-12	0x740C	Acceleration setting (high bits of 6048H-1)	0 to 65535	0	-	Read only
U4-13	0x740D	Acceleration setting (low bits of 6048H-1)	0 to 65535	0	-	Read only
U4-14	0x740E	Acceleration time (6048H-2)	0 to 65535	0	-	Read only
U4-15	0x740F	Deceleration setting (high bits of 6049H-1)	0 to 65535	0	-	Read only
U4-16	0x7410	Deceleration setting (low bits of 6049H-1)	0 to 65535	0	-	Read only
U4-17	0x7411	Deceleration time (6049H-2)	0 to 65535	0	-	Read only
U4-18	0x7412	Emergency stop option code (605AH)	-32768 to +32767	0	-	Read only
U4-19	0x7413	Shutdown option code (605BH)	-32768 to +32767	0	-	Read only
U4-20	0x7414	Stop mode upon S-OFF (605CH)	-32768 to +32767	0	-	Read only
U4-23	0x7417	Modes of operation (6060H)	-32768 to +32767	0	-	Read only
U4-24	0x7418	Modes of operation display (6061H)	-32768 to +32767	0	-	Read only
U4-36	0x7424	Actual speed (high bit of 606CH)	0x0 to 0xFFFF	0x0	-	Read only
U4-37	0x7425	Actual speed (low bit of 606CH)	0x0 to 0xFFFF	0x0	-	Read only
U4-79	0x744F	Speed offset (high bit of 60B1H)	0x0 to 0xFFFF	0x0	-	Read only
U4-80	0x7450	Speed offset (low bit of 60B1H)	0x0 to 0xFFFF	0x0	-	Read only
U4-89	0x7459	DI status (high bit of 60FDH)	0x0 to 0xFFFF	0x0	-	Read only
U4-90	0x745A	DI status (low bit of 60FDH)	0x0 to 0xFFFF	0x0	-	Read only
U4-95	0x745F	Target speed (high bit of 60FFH)	0x0 to 0xFFFF	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U4-96	0x7460	Target speed (low bit of 60FFH)	0x0 to 0xFFFF	0x0	-	Read only
U4-97	0x7461	VL - Acceleration time	0 to 65535	0	-	Read only
U4-98	0x7462	VL - Deceleration time	0 to 65535	0	s	Read only
U6-00	0x7600	Actual motor speed	-32768.0 to +32767.0	0.0	%	Read only
U6-01	0x7601	Final motor speed reference	-32768.0 to +32767.0	0.0	%	Read only
U6-02	0x7602	RFG reference input	-32768.0 to +32767.0	0.0	%	Read only
U6-03	0x7603	RFG calculation input	-32768.0 to +32767.0	0.0	%	Read only
U6-04	0x7604	Actual RFG target	-32768.0 to +32767.0	0.0	%	Read only
U6-05	0x7605	RFG calculation output	-32768.0 to +32767.0	0.0	%	Read only
U6-06	0x7606	RFG acceleration	-32768.0 to +32767.0	0.0	%	Read only
U6-07	0x7607	Maximum positive frequency	-32768.0 to +32767.0	0.0	%	Read only
U6-08	0x7608	Minimum positive frequency	-32768.0 to +32767.0	0.0	%	Read only
U6-09	0x7609	Maximum negative frequency	-32768.0 to +32767.0	0.0	%	Read only
U6-10	0x760A	Minimum negative frequency	-32768.0 to +32767.0	0.0	%	Read only
U6-11	0x760B	Torque reference	-32768.0 to +32767.0	0.0	%	Read only
U6-12	0x760C	Additional torque	-32768.0 to +32767.0	0.0	%	Read only
U6-13	0x760D	Target torque reference	-32768.0 to +32767.0	0.0	%	Read only
U6-14	0x760E	Maximum positive torque	-32768.0 to +32767.0	0.0	%	Read only
U6-15	0x760F	Maximum negative torque	-32768.0 to +32767.0	0.0	%	Read only
U6-16	0x7610	Cumulative drive overload value	-32768.0 to +32767.0	0.0	%	Read only
U6-17	0x7611	Cumulative motor overload value	-32768.0 to +32767.0	0.0	%	Read only
U6-18	0x7612	Synchronous frequency	-32768.0 to +32767.0	0.0	%	Read only
U6-19	0x7613	Synchronous rotating angle	-32768.0 to +32767.0	0.0	%	Read only
U6-20	0x7614	Torque reference control	-32768.0 to +32767.0	0.0	%	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U6-21	0x7615	Flux reference control	-32768.0 to +32767.0	0.0	%	Read only
U6-22	0x7616	Excitation current reference	-32768.0 to +32767.0	0.0	%	Read only
U6-23	0x7617	Torque current reference	-32768.0 to +32767.0	0.0	%	Read only
U6-24	0x7618	Actual excitation current	-32768.0 to +32767.0	0.0	%	Read only
U6-25	0x7619	Actual torque current	-32768.0 to +32767.0	0.0	%	Read only
U6-26	0x761A	Phase U current (instantaneous value)	-32768.0 to +32767.0	0.0	%	Read only
U6-27	0x761B	Phase V current (instantaneous value)	-32768.0 to +32767.0	0.0	%	Read only
U6-28	0x761C	Phase W current (instantaneous value)	-32768.0 to +32767.0	0.0	%	Read only
U6-29	0x761D	Output current amplitude	-32768.0 to +32767.0	0.0	%	Read only
U6-30	0x761E	Output current phase	-32768.0 to +32767.0	0.0	%	Read only
U6-31	0x761F	Output voltage amplitude	-32768.0 to +32767.0	0.0	%	Read only
U6-32	0x7620	Output voltage phase	-32768.0 to +32767.0	0.0	%	Read only
U6-33	0x7621	Drive bus voltage	-32768.0 to +32767.0	0.0	V	Read only
U6-34	0x7622	Maximum output voltage	-32768.0 to +32767.0	0.0	%	Read only
U6-35	0x7623	Output torque	-32768.0 to +32767.0	0.0	%	Read only
U6-36	0x7624	Flux amplitude	-32768.0 to +32767.0	0.0	%	Read only
U6-37	0x7625	Flux angle	-32768.0 to +32767.0	0.0	%	Read only
U6-38	0x7626	Motor output power	-32768.0 to +32767.0	0.0	%	Read only
U6-39	0x7627	Output power	-32768.0 to +32767.0	0.0	%	Read only
U6-40	0x7628	Power factor angle	-32768.0 to +32767.0	0.0	%	Read only
U6-41	0x7629	Monitoring variable 0	-32768.0 to +32767.0	0.0	%	Read only
U6-42	0x762A	Monitoring variable 1	-32768.0 to +32767.0	0.0	%	Read only
U6-43	0x762B	Monitoring variable 2	-32768.0 to +32767.0	0.0	%	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U6-44	0x762C	Monitoring variable 3	-32768.0 to +32767.0	0.0	%	Read only
U6-45	0x762D	Monitoring variable 4	-32768.0 to +32767.0	0.0	%	Read only
U6-46	0x762E	Monitoring variable 5	-32768.0 to +32767.0	0.0	%	Read only
U6-47	0x762F	Monitoring variable 6	-32768.0 to +32767.0	0.0	%	Read only
U6-48	0x7630	Monitoring variable 7	-32768.0 to +32767.0	0.0	%	Read only
U6-49	0x7631	Monitoring variable 8	-32768.0 to +32767.0	0.0	%	Read only
U6-50	0x7632	Monitoring variable 9	-32768.0 to +32767.0	0.0	%	Read only
U6-60	0x763C	High 16 bits of STO_ CRC calculation	0x0 to 0xFFFF	0x0	-	Read only
U6-61	0x763D	Low 16 bits of STO_ CRC calculation	0x0 to 0xFFFF	0x0	-	Read only
U6-63	0x763F	STO initialization flag	0 to 1	0	-	Read only
U6-64	0x7640	STO status monitoring word	0 to 65535	0	-	Read only
U6-65	0x7641	STO model	0 to 65535	0	-	Read only
U6-66	0x7642	STO_1.2 V_AD sampling value	0 to 65535	0	-	Read only
U6-67	0x7643	STO_5 V_AD sampling value	0 to 65535	0	-	Read only
U6-68	0x7644	Input voltage Urs	0.0 to 1000.0	0.0	V	Read only
U6-69	0x7645	Input voltage Urt	0.0 to 1000.0	0.0	V	Read only
U6-70	0x7646	Power-off time display	0 to 65535	0	-	Read only
U6-71	0x7647	Address mapping enable state	0: Inactive 1: Active	0	-	Read only
U6-72	0x7648	User load curve enable	0: Inactive 1: Active	0	-	Read only
U6-73	0x7649	User load curve setting error flag	0 to 65535	0	-	Read only
U6-74	0x764A	Multi-point curve setting error flag	bit0: Multi-point curve A 0: No error 1: Error bit1: Multi-point curve B 0: No error 1: Error bit2 to bit15: Reserved	0x0	-	Read only

Param.	Comm. address	Name	Range	Default value	Unit	Change mode
U6-76	0x764C	Power-on initialization completion flag	0 to 65535	0	-	Read only
U6-77	0x764D	Model-related parameter update flag	0 to 65535	0	-	Read only
U6-79	0x764F	Internal index address of 16-bit parameter error	0 to 65535	0	-	Read only
U6-80	0x7650	Index menu address of 16-bit parameter error	0x0 to 0xFFFF	0x0	-	Read only
U6-81	0x7651	16-bit parameter type error	0 to 65535	0	-	Read only
U6-82	0x7652	Incorrect internal index address of 32-bit parameter	0x0 to 0xFFFF	0x0	-	Read only
U6-83	0x7653	32-bit parameter error type	0 to 65535	0	-	Read only
U6-84	0x7654	Parameter setting error prompt	0 to 65535	0	-	Read only
U6-86	0x7656	Flag for inactive backup parameter recovery	0 to 65535	0	-	Read only

16 Troubleshooting

16.1 Troubleshooting

See the following table for the troubleshooting procedure.

No.	Description
Step 1	Check the following items before troubleshooting. a. Input and output status b. Device actions (such as stop/run/vibration) c. Parameter d. Wiring status e. DIP switch status
Step 2	Check the operating panel or iFA. Check whether the software tool displays any error messages. If yes, rectify the fault based on *"16.7 Solutions To Common Faults" on page 1164* and *"16.8 List of Fault Codes" on page 1179*.
Step 3	Reset according to *"16.5 Fault Reset Methods" on page 1159*. If the fault cannot be reset, perform a restart.
Step 4	If the fault persists, contact the technical support.

16.2 Fault Type and Fault Level

16.2.1 Fault Type

The drive enters the fault state when certain limits are reached. Faults can be classified into four types, ranked from most severe to least severe as: Fault (E) > Minor fault (L) > Alarm (A) > Prompt (N). See the table below for description of each fault type.

Fault type	Display format	Description
Fault (E)	Example: E015.1	1 . Indicates a system fault has occurred, and continued operation is not allowed. 2 . What can happen after a fault occurs?The drive stops immediately and waits for the fault to be rectified. 3 .How to clear the fault? a. Rectify the causes. b. Reset the fault. c. If the fault persists, contact the technical support.
Minor fault (L)	Example: L015.1	1 . Indicates a minor fault has occurred, and continued operation is allowed after derating. However, the operational results may deviate from the control settings. 2 . What can happen after a minor fault occurs?The drive may operate at limited speed, power, current, or torque as defined by the user. 3 . How to clear the minor fault? a. Rectify the causes. A minor fault can be automatically reset, without need to reset the minor fault manually. b. If the minor fault persists, contact the technical support.
Alarm (A)	Example: A015.1	1 . Indicates an alarm occurred, and continued operation is allowed. You can configure output signals for alarms through output terminals. 2 . What can happen after an alarm occurs?An alarm does not affect the operation of the drive. Actions for alarms are user-defined. 3 . How to clear the alarm? a. Rectify the causes. Alarms can be reset automatically. b. If the alarm persists, contact the technical support.
Prompt (N)	Example: N015.1	1 . Indicates a prompt occurs, which is only displayed on the operating panel or the software tool, without affecting operation of the drive. Prompts cannot be configured with an output signal through the output terminal [Note 1]. 2 . What can happen after a prompt occurs?A prompt does not affect the operation of the drive. Actions for prompts are user-defined. 3 . How to clear the prompt? a. Rectify the causes. Prompts can be reset automatically. b. If the prompt persists, contact the technical support.

Note

[Note 1] The output terminal signal of a issue can be configured by E1-04 (DO1 output function selection):

- E1-04 = 2 (output upon a fault): When the AC drive stops due to a fault (coast-to-stop, maximum-capability stop, quick stop, or decelerate-to-stop), the terminal outputs an active signal.
- E1-04 = 38 (output upon a fault/light fault/alarm): When the AC drive encounters a fault, a light fault, or an alarm, the terminal outputs an active signal.
- E1-04 = 41 (output upon an issue excluding undervoltage): When the AC drive encounters a fault, a light fault, or an alarm (excluding undervoltage), the terminal outputs an active signal.
- E1-04 = 43 (output upon a light fault/alarm): When the AC drive encounters a light fault or an alarm, the terminal outputs an active signal.

16.2.2 Fault Levels

The drive can be set with 11 fault levels, allowing the drive to act accordingly upon fault.

Ranked from most severe to least severe, the fault levels can be divided into: coast to stop > stop with maximum capacity > quick stop > decelerate to stop > limited operation (operating with limited speed, power, current, and torque) > alarm > prompt > ignore. For details, see the following table.

Fault level	Description
Coast to stop	The drive stops output and the load coasts to stop upon fault.
Stop with maximum capability	The drive stops the load as quick as possible with maximum output capability upon fault. The ramp-down time during stop with maximum capability is fixed to 50 ms.
Quick stop	After a fault occurs, the drive stops according to the quick stop time defined by b7-34 [Quick stop ramp-down time].
Decelerate to stop	The drive stops according to the set ramp-down time upon fault. The following parameters are involved, which may vary in actual applications based on the ramp-down time defined by the user. b7-05 [Ramp-down time of ramp 1] b7-11 [Ramp-down time of ramp 2] b7-17 [Ramp-down time of ramp 3] b7-23 [Ramp-down time of ramp 4]
Operating at limited speed	After a fault occurs, the drive continues operating based on the operation mode defined by H1-60 [Operating at limited speed] and the setpoints of parameters associated to H1-60. The associated parameters are as follows. H1-61 [Designated safe operating frequency] H1-62 [Maximum positive frequency limit] H1-63 [Maximum negative frequency limit]
Operating at limited power	After a fault occurs, the drive continues operating, but the power output cannot exceed the power limits defined by H1-64 [Maximum motoring power limit] and H1-65 [Maximum regenerative power limit].
Operating at limited current	After a fault occurs, the drive continues operating, but the maximum output current cannot exceed the current limit defined by H1-68.
Operating at limited torque	After a fault occurs, the drive continues operating, but the maximum output torque cannot exceed the torque limits defined by H1-66 [Maximum positive torque limit] and H1-67 [Maximum negative torque limit].
Alarm	After a fault occurs, the drive displays an alarm code, without interrupting operation.
Prompt	After a fault occurs, the drive displays a prompt code, without interrupting operation.
Ignore	This fault is masked.

Caution

- When an ignorable issue occurs, no prompts will be displayed. Therefore, this setting must be used with caution.
- For the fault codes set, you can modify the fault level and the corresponding action as needed to keep the drive in the expected state upon fault. See details in *"16.2.4 Modifying Fault Level" on page 1153*. Not all faults can be set with any fault level. The drive automatically determines whether the configured fault level is active.

16.2.3 Correspondence Between Fault Types and Fault Levels

See the table below for the correspondence between fault type and fault level (action).

Table 16–1 Correspondence between fault type and fault level

Fault type	Fault level
Fault	Coast to stop
	Stop with maximum capability
	Quick stop
	Decelerate to stop
Minor fault	Operating at limited speed
	Operating at limited power
	Operating at limited current
	Operating at limited torque
Alarm	Alarm
Prompt	Prompt
-	Ignore

16.2.4 Modifying Fault Level

[Application scenario]

You can modify the fault level and the corresponding action as needed to keep the drive in the expected state upon fault.

- If the drive needs to stop when a fault occurs, set the fault action to "coast to stop", "stop with maximum capability", or "quick stop".
- If the drive needs to operate with limited conditions upon fault, set the fault action to "operating at limited speed", "operating at limited power", or "operating at limited torque".
- If the drive needs to continue operation after a fault occurs, set the fault action to "alarm", "prompt", or "ignore".

[Switchover method]

There are two switchover methods: modifying the fault level of the fault code, or modifying the fault level of an individual fault code.

1. Modifying the fault level of the fault code

You can set the levels of all the subcodes under the fault code through H1-00 to H1-18. With this method, for the same fault code, all subcodes under it can only be set to the same level; different levels cannot be assigned to individual subcodes.

For example, you can set the fault level of all the subcodes (E021.X) under E021 through the hundreds of H1-03 (as shown below). Note: With this method, all subcodes under E021 must be set to the same level. For example, you cannot set the fault level of a certain subcodes (such as E021.1) to "coast to stop" while setting another subcode (such as E021.2) to "decelerate to stop".

Param.	Name	Default value	Value range
H1-03	Protective action selection 3 upon fault	0	Ones: Parameter auto-tuning error (E019) 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: EEPROM fault (E021) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop Thousands: Power unit EEPROM fault (E186) 0: Coast to stop 1: Stop with maximum capability 2: Quick stop 3: Decelerate to stop F: Ignore

2. Modifying the fault level of an individual fault code

   You can set the fault level of an individual fault code through H1-30 (1st set of fault codes) to H1-49 (10th set of fault codes).

   For example, you can set the fault level of E021.1 to "0: Coast to stop" through H1-30 (1st set of fault codes) and H1-31 (1st set of fault level), or set the fault level of E021.2 to "2: Quick stop" through H1-32 (2nd set of fault code) and H1-33 (2nd set of fault level), as shown below.

   - H1-30 = 21.1
   - H1-31 = 0: Coast to stop
   - H1-32 = 21.2
   - H1-33 = 2: Quick stop

Note:

- When modifying the fault level of an individual fault code, the setting must be within the allowable range of the fault code.
  For example, if only four options (0 [Coast to stop], 1 [Stop with maximum capability], 2 [Quick stop], 3 [Decelerate to stop]) are available for the hundreds of H1-03, you can only set the fault level to one of these options.
- When the fault level set for an individual fault code through H1-30 (1st set of fault codes) to H1-49 [10th set of fault codes] is not consistent with the fault level defined by H1-00 (Protective

action selection 0 upon fault) to H1-18 (Protective action selection 18 upon fault), the former prevails (the prerequisite is that the fault level configured in the former falls within the configurable fault level range of the latter).

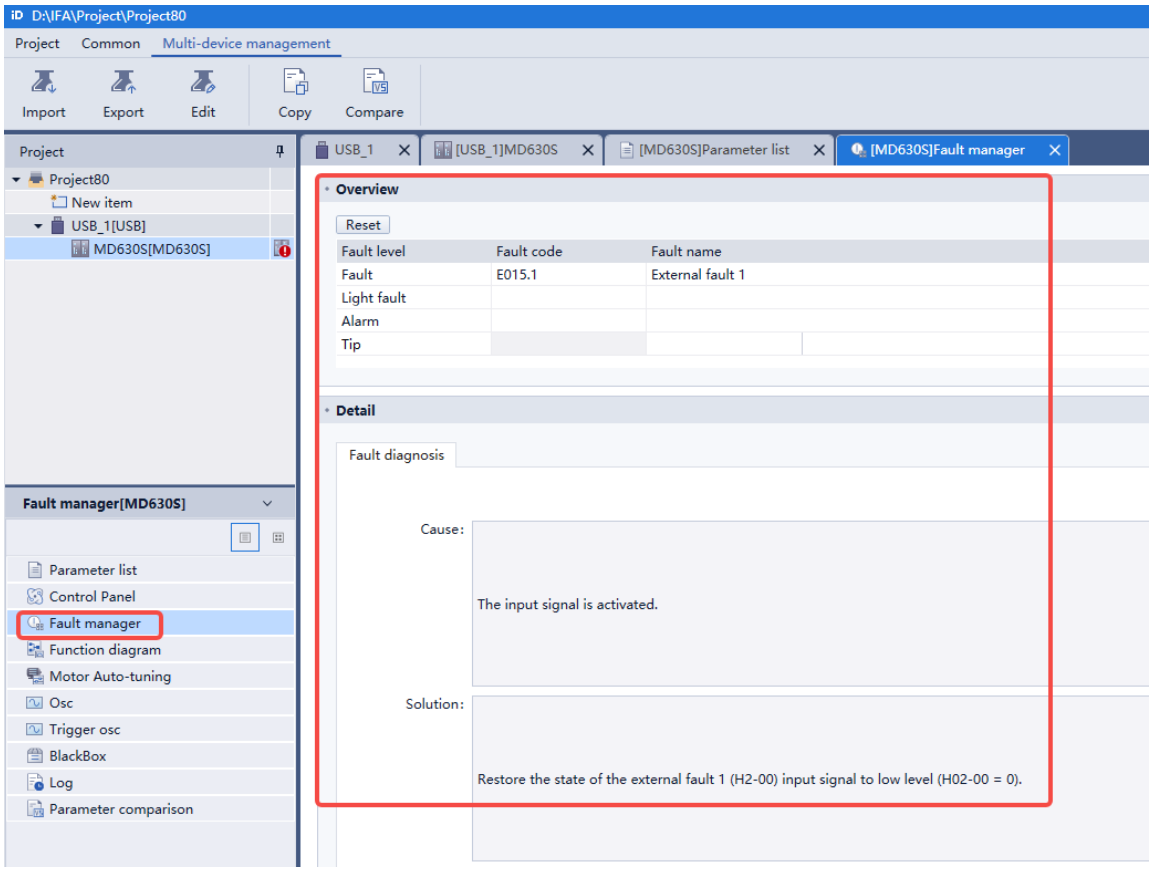
Modifying the fault level of the fault code	Modifying the fault level of an individual fault code	Fault level
Set the hundreds of H1-03 (EEPROM fault E021) to "0: Coast to stop".	H1-30 = 021.1 H1-31 = "2: Quick stop" Note: "2: Quick stop" is within the range of fault levels available for the hundreds of H1-03 (0 to 3).	The fault level of E021.1 is "2: Quick stop". The fault level of other subcodes under E021 is "0: Coast to stop".
	H1-30 = 021.1 H1-31 = "9: Operating at limited speed" Note: "9: Operating at limited speed" is outside the range of fault levels available for the hundreds of H1-03 (0 to 3).	The fault level of E021.1 and other subcodes under E021 is "0: Coast to stop".

16.3 Fault Display

The fault protection action defined by parameters in group H1 will be executed when a fault occurs on the drive. Meanwhile, the operating panel displays the corresponding fault code. When a fault (error) occurs, the drive cuts off the output, and the contact of the fault replay acts (provided that the relay contact function is selected as fault output). In this case, the fault indicator on the operating panel turns on. As shown in the following figure, E015.1 (External fault 1) is displayed.



The fault code can also be displayed on the iFA Drive commissioning software, as shown in the following figure.

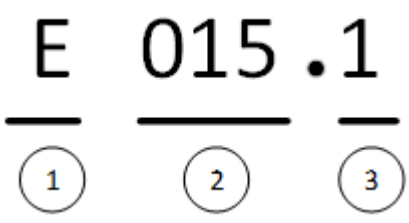


[Display logic]

1. When multiple faults occur, the operating panel displays the fault occurred first. When this fault is reset, the operating panel displays the fault occurred first among the remaining faults.
2. When multiple types of faults occur simultaneously, the operating panel displays the fault with the highest severity. For example, when faults and alarms occur simultaneously, the operating panel only displays the fault code. Only when all faults are reset will the operating panel display the alarm code.

[Display format of fault code]

An fault code is displayed in three segments, representing fault type, fault code, and fault subcode, as shown in the following figure.



① indicates the fault type. "E" for a fault, "L" for a light fault, "A" for an alarm, and "N" for a prompt.

② indicates the fault code with three digits.

③ indicates the fault subcode with one digit. Each fault code supports a maximum of nine subcodes (1 to 9).

16.4 Fault Log Inquiry and Clear

Faults are divided into active faults and historical faults.

- Active faults: Faults that have occurred but not rectified yet
- Historical faults: Faults that have occurred and rectified

Active fault log inquiry

The drive can record up to six active faults of the same type. When more than six faults occur simultaneously, subsequent faults will not be recorded.

There are two methods to check the active fault log: check through the parameters in group A1 or through the operation panel.

- Method 1: View the active faults through parameters in group A1.

Table 16–2 Parameter table corresponding to active fault information

Fault type		Parameter corresponding to code	Parameter corresponding to additional information
Fault	Active fault 1	A1-00	A1-01
	Active fault 2	A1-02	A1-03
	Active fault 3	A1-04	A1-05
	Active fault 4	A1-06	A1-07
	Active fault 5	A1-08	A1-09
	Active fault 6	A1-10	A1-11
Minor fault	Active minor fault 1	A1-12	A1-13
	Active minor fault 2	A1-14	A1-15
	Active minor fault 3	A1-16	A1-17
	Active minor fault 4	A1-18	A1-19
	Active minor fault 5	A1-20	A1-21
	Active minor fault 6	A1-22	A1-23
Alarm	Active alarm 1	A1-24	A1-25
	Active alarm 2	A1-26	A1-27
	Active alarm 3	A1-28	A1-29
	Active alarm 4	A1-30	A1-31
	Active alarm 5	A1-32	A1-33
	Active alarm 6	A1-34	A1-35
Prompt	Active prompt 1	A1-36	A1-37
	Active prompt 2	A1-38	A1-39
	Active prompt 3	A1-40	A1-41
	Active prompt 4	A1-42	A1-43
	Active prompt 5	A1-44	A1-45
	Active prompt 6	A1-46	A1-47

- Method 2: View the active faults by pressing  and  on the operating panel under the fault menu. The following show how to view active faults.

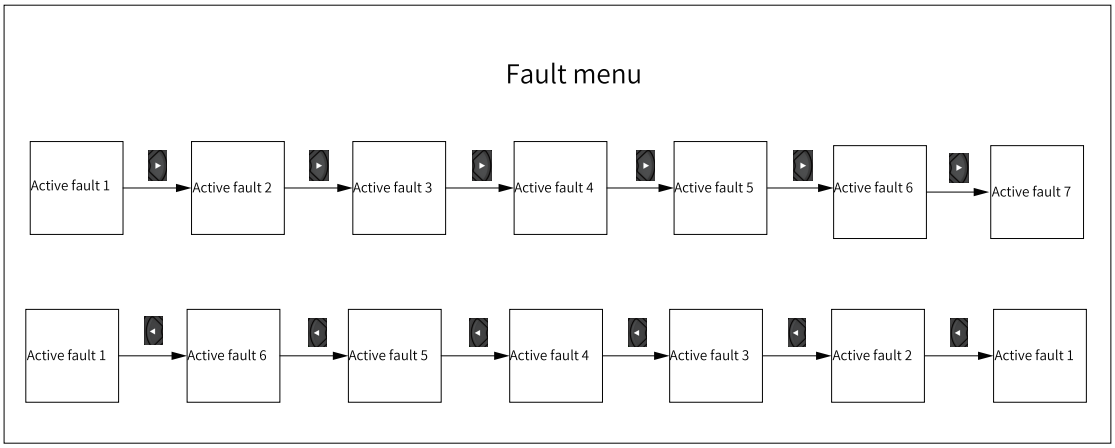


Figure 16-1 Viewing active faults

Historical fault log inquiry

You can view six historical faults and related drive information upon occurrence of the fault. When more than 6 historical faults have occurred, only the most recent 6 faults will be recorded. You can view historical faults through parameters in groups H6 (Historical fault log 1) to Hb (Historical fault log 6), as shown below.

Table 16–3 Parameters related to historical fault codes

Parameter group	Name	Description
H6	Historical fault log 1	Records the code and related information of historical fault 1.
H7	Historical fault log 2	Records the code and related information of historical fault 2.
H8	Historical fault log 3	Records the code and related information of historical fault 3.
H9	Historical fault log 4	Records the code and related information of historical fault 4.
HA	Historical fault log 5	Records the code and related information of historical fault 5.
Hb	Historical fault log 6	Records the code and related information of historical fault 6.

Clearing fault log

You can clear the historical fault information in groups H6 to Hb through A0-00 [Parameter initialization]. Setting A0-00 to 2, 5, or 503 clears the historical fault information. The differences among these methods are as follows.

- A0-00 = 2 (Clear log information): Fault log information, cumulative operating time, cumulative power-on time, and cumulative power consumption are cleared.
- A0-00 = 5 (Clear fault information): The fault log information in groups H6 to Hb are cleared.
- A0-00 = 503 (Restore default parameters (including motor parameters) and clear log information): Except for specific parameters that cannot be restored, all other function parameters, including motor parameters and log information, are restored to default values.

Note

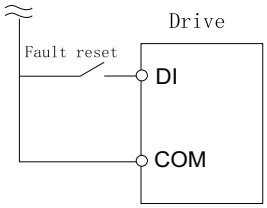
With the above-mentioned methods, the records of the current and historical issues can be cleared.

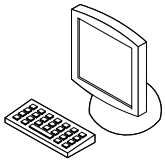
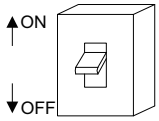
16.5 Fault Reset Methods

After rectifying fault causes, reset the fault to exit the drive from the error state. The fault types and solutions are shown below.

- For minor faults, alarms, or prompts, the drive performs a reset operation automatically.
- For faults, the drive keeps in the fault state after the fault causes are rectified, requiring a manual reset operation, which means the fault can be cleared after an external reset command is received by the drive.
- For special faults, the fault can be cleared only after the drive is restarted when fault causes are rectified.

Manual reset applies to all fault codes. The method for manual reset is shown in the table below.

No.	Manual reset methods	Description	Applicable scenario
1	Reset through the operating panel	In the stop state, you can press the stop key to reset the fault. 	This method can be applied when direct access to the operating panel is convenient.
2	Reset through terminals	Assign function 9 (Fault reset) to any DI. You can reset the fault by activating this DI signal. 	This method applies when terminal control is used in multi-speed operation.

No.	Manual reset methods	Description	Applicable scenario
3	Reset through communication	When the current main command source (channel 1 is F0-03/b1-00, channel 2 is b3-00) is set to communication (option 2), the fault can be reset by writing the reset command to the communication control word address through the host controller (for example, in Modbus-RTU communication, write the fault reset command 7 to address 7311H). 	This method applies when the drive is difficult to access and located far from the host controller.
4	Reset through user-defined reset signal	In the current control channels, the corresponding user-defined fault reset source 1 (b1-05 or b3-05), source 2 (b2-04 or b4-04), and source 3 (b2-05 or b4-05) can be configured as the source for user-defined fault reset signal. The fault can be reset by setting the user-defined reset signal. The user-defined fault reset source 1 is valid only when the main command source (set by F0-03/b1-00 for channel 1 or b3-00 for channel 2) is set to 3 (User-defined).	The reset signal source can be configured to a user-defined signal source.
5	Reset through iFA Drive software	Click the fault reset button in the "Fault management" or "Control panel" of iFA Drive software to reset the fault.	This method applies when the drive is commissioned through iFA Drive software.
6	Reset through restart	Disconnect the main circuit power supply. Wait until the fault code disappears, and then connect the power supply again. 	When the fault cannot be reset through the preceding methods, try restarting the drive.

Caution

The manual reset command is effective only on the rising edge of the reset signal. Do not keep it at high level.

16.6 Automatic Fault Reset

In certain applications, a limited number of automatic fault resets can be set to ensure continuous operation when a fault occurs.

Note

Fault code E009.1 has independent automatic reset function property.

For the following fault codes, set n0-16 to 1 (default) to enable automatic reset function.

- Standard version: E160.1, E161, E162, E164
- Bus version: E165, E166, E167, E168, E169

The automatic fault reset function is disabled by default. To enable the automatic fault reset, configure the following parameters.

- Set H3-00 [Automatic fault reset] = 1 [Enable].
- Set H3-01 [Automatic fault reset count] based on specific application conditions and requirements.
- Set H3-02 [Automatic Fault Reset Interval Time], which defines the time interval between fault occurrence and automatic fault reset. You can set an appropriate time interval based on actual application requirements.

Most of the fault codes can be reset automatically except the following.

- Fault codes that cannot be reset automatically are E032.8, E032.9, E047.5, E060.1, E177.1, and E177.2.
- You can set ten sets of fault codes that inhibit automatic reset through H3-13 to H3-22. These fault codes cannot be reset even if automatic reset function is enabled.

Related parameters

Table 16–4 Parameters related to automatic fault reset

Param.	Name	Default value	Value range	Description
H3-00	Automatic fault reset selection	1	0: Disable 1: Enable	Defines whether to enable automatic fault reset. Value description: 0: Disable - Automatic fault reset is disabled. 1: Enable - Automatic fault reset is enabled.
H3-01	Number of automatic fault resets	0	0 to 100	Defines the number of automatic fault resets. Note: If the number of reset times exceeds the value of this parameter, the drive stays in the fault state.

Param.	Name	Default value	Value range	Description
H3-02	Interval time of automatic fault reset	1	0.1 to 600	Defines the interval time between automatic fault resets. Note: This parameter defines the time between fault occurrence and automatic reset.
H3-03	Automatic reset disabled upon manual reset	1	0: Automatic reset deactivated 1: Automatic reset continued	Defines whether automatic reset can be terminated by manual reset during automatic reset. Value description: 0: Automatic reset deactivated - Automatic reset is terminated upon manual reset. 1: Automatic reset continued - Automatic reset continues after manual reset.
H3-04	Waiting time for restoring the number of automatic fault resets	10	0 to 6000	Defines the waiting time for restoring the number of automatic fault resets. Note: When it is set to a non-zero value, the automatic fault reset count is restored after the time defined by H3-04 elapses. When it is set to 0, the automatic fault reset count can be restored continuously.
H3-05	Cumulative number of fault resets	0	0 to 65525	Displays the cumulative number of fault resets, which cannot be modified. This parameter is cleared automatically when the number of manual resets and automatic resets are reached.
H3-06	Action when automatic fault reset count exhausted	0	0: Restore automatic fault reset count 1: Not restore automatic fault reset count	Defines the action when the number of fault resets is exhausted. Value description: 0: Restore automatic fault reset count - When the automatic fault reset count is exhausted and waiting time for restoring the number of automatic fault resets elapses, the automatic fault reset count can be restored automatically. 1: Not restore automatic fault reset count - The automatic fault reset count will not be restored automatically when expired.

Param.	Name	Default value	Value range	Description
H3-07	Fault flag output selection	0	0: Not output during automatic fault reset 1: Output during automatic fault reset	Sets whether there is output during automatic fault reset. Value description: 0: Not output during automatic fault reset - The fault flag is not output during automatic reset. 1: Output during automatic fault reset - The fault flag is output during automatic reset.
H3-13	Fault code 1 that inhibits automatic reset	0.0	0 to 255.9	Defines fault code 1 that inhibits automatic fault reset. Note: Enter the code and subcode of the fault, such as 187.1. In this case, the power unit EEPROM junction temperature parameter storage error (E187.1) cannot be reset automatically.
H3-14	Fault code 2 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-15	Fault code 3 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-16	Fault code 4 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-17	Fault code 5 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-18	Fault code 6 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-19	Fault code 7 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-20	Fault code 8 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-21	Fault code 9 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13
H3-22	Fault code 10 that inhibits automatic reset	0.0	0 to 255.9	Same as H3-13

16.7 Solutions To Common Faults

Table 16–5 Solutions to common faults (function)

No.	Fault symptom	Possible cause	Verification method	Solution
1	There is no display upon power-on. 	The grid voltage is excessively low.	Measure the input power supply and check whether the voltage is outside the normal voltage range of the drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		The control board or the operating panel is faulty.	-	1. Replace the control board and operating panel. 2. Contact the technical support.
		The switched-mode power supply on the driver board of the drive is faulty.	Measure the voltage values of the 24 V and 10 V output interfaces on the driver board to check whether the values reach 24 V and 10 V. If not, a fault occurs.	Contact the technical support.
		The pre-charge resistor of the drive is damaged.	-	Contact the technical support.
		The rectifier bridge is damaged.	Measure the DC bus voltage of the drive and check whether it is lower than A3-56 (Undervoltage threshold). If yes, the rectifier bridge is damaged.	Contact the technical support.
2	"-H-C" is displayed upon power-on. 	The output circuit of the drive is grounded or short-circuited.	Use a megger to measure the voltage on the U/V/W terminals of the drive. If the voltage is close to 0, short circuit occurs.	Replace the U/V/W cables at the output terminals and re-connect them.
		The grid voltage is excessively low.	Measure the input power supply and check whether the voltage is outside the normal voltage range of the drive.	Ensure that the grid voltage is within the normal range (380 V to 480 V, -15% to +10%).
		Components on the control board are damaged.	If the fault persists after preceding fault causes are rectified, components on the control board may be damaged.	Contact the technical support.
3	"-sto" is displayed upon power-on. 	The STO input signal is disconnected.	Check whether the STO input switch is open.	Close the STO input switch.
		The wiring or power supply of the STO circuit is faulty.	Check whether the STO circuit wiring and power supply are normal.	Ensure that the STO circuit wiring and power supply are normal.

No.	Fault symptom	Possible cause	Verification method	Solution
4	The display is normal upon power-on. However, after the drive starts to run, "-H-C-" is displayed and the drive stops immediately. 	The peripheral control terminals are short-circuited.	Measure the voltage of the external control terminals to determine whether short circuit occurs.	Reconnect the short-circuited terminals.
		The fan is damaged or short-circuited.	1. Check whether the fan operates properly 2. Check whether the line voltage is close to 0. If yes, short circuit occurs.	1. Reconnect the cables. 2. Replace the damaged fan.
		The drive is damaged.	If the fault persists after the preceding fault caused are rectified, the drive may be damaged.	Contact the technical support.
5	The motor does not rotate after the drive runs.	The cable between the drive and motor is wired improperly.	Check whether the cable between the drive and motor is wired improperly.	Re-connect the drive and the motor according to the wiring diagram in the user guide.
		The motor control method or mode is set incorrectly.	Check whether motor control parameters are set correctly.	Set motor control parameters according to the operating conditions, such as F0-01 (Motor control method) and F0-02 (Motor control mode).
		AC drive parameters (motor parameters) are set improperly.	Check whether the rated motor parameters (C4-01 to C4-11) are consistent with those on the motor nameplate, such as the rated motor frequency and rated motor speed.	Set the rated motor parameters (C4-01 to C4-11) according to the motor nameplate.
		V/f control parameters are set improperly.	Start the drive under heavy duty in V/f control mode and check whether the motor rotates. If not, d2-14 (Manual torque boost) is excessively low.	Increase the setpoint of d2-14 (Manual torque boost) properly.
		The driver board is faulty.	If the fault persists after the preceding fault causes are rectified, the driver board may be faulty.	Contact the technical support.
6	DI terminals are deactivated.	Parameters are set improperly.	Check whether parameters (group E0) related to terminal setting are set properly.	Reset parameters related to terminal setting in group E0.
		External signals are incorrect.	Check whether the external signal cables are wired properly.	See the DT60 user guide for how to connect external signal cables.
		The control board is faulty.	If the fault persists after the preceding fault causes are rectified, the control board may be faulty.	1. Replace the control board. 2. Contact Inovance for technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
7	APPE1 is displayed after power-on. 	The auxiliary integrated circuit program on the control board is incomplete.	Check whether the program in the control board has been programmed or erased once.	Re-program the auxiliary integrated circuit program.
		Components on the control board are damaged.	If the fault persists after preceding fault causes are rectified, components on the control board may be damaged.	Contact the technical support.

Table 16–6 Solutions to common faults (performance)

No.	Fault symptom	Possible cause	Verification method	Solution
1	The input side is abnormal.			
	The input power factor on the grid side is excessively low.	The absence of a line reactor and a DC reactor can result in high harmonic current on the grid side, which can in turn cause a low power factor.	Check whether the model selected matches the requirements.	If a specific power factor on the grid side is required, use a model with reactors. If this product series does not have a reactor, install an external input reactor. **Note:** There is no obvious correlation between the rectification power factor and efficiency. Common diode rectifiers have low power factors but high efficiency.
	The input current measured by the clamp meter deviates greatly from the theoretical value.	The grid-side current harmonics are relatively large, and the current waveform is not a standard sine wave. Therefore, measuring the input current directly using a clamp meter will result in significant deviations.	Check whether the rectifier unit of the drive is AFE (active front end).	Measure the input current using an oscilloscope current clamp in RMS (root mean square) mode. Measure the input current using the current clamp of a power quality analyzer.
	The three-phase current on the grid side is unbalanced.	Unbalanced grid-side impedance can cause fluctuations at twice the grid frequency (that is, 100 Hz fluctuations for a 50Hz grid), resulting in unbalanced current.	Check whether the bus voltage fluctuates at 100 Hz and ensure that no phase loss occurs on the input side. The built-in DC input reactor may resonate with unbalanced grid impedance, resulting in grid harmonics at twice the grid frequency.	The power supply unit is designed with sufficient margin to accommodate unbalanced grid impedance. If the three-phase input current imbalance is within 10% of the driver's rated current, no action is required. To address three-phase input current imbalance, use a three-phase reactor on the input side or select models without DC input reactors.
		The rectifier diode is damaged.	Set the multimeter to the diode test mode. Connect the red probe to R/S/T and the black probe to the positive bus to measure the upper bridge. Connect the black probe to R/S/T and the red probe to the negative bus to measure the lower bridge. A consistent voltage drop of around 0.25 V to 0.6 V indicates that the rectifier diode is normal. A damaged diode typically features a voltage drop of 0 or infinite.	Contact the technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
1	The input grid voltage is normal when the drive is stopped. However, when the drive operates under load, the output voltage is low, and both input and output currents are high.	1. The grid is identified as a weak grid. 2. There is a reactor on the input side and the voltage drop across the reactor is significant.	During motor startup, check whether the bus voltage decreases significantly as the output power increases.	1. Appropriately increase the overmodulation coefficient (A5-06) to a value not exceeding 108% to increase the output voltage and reduce the output current. 2. Select a reactor with moderate inductance. Excessive inductance results in voltage drop when input current rises, thereby influencing the input voltage. 3. Increase the grid voltage. For example, the user can adjust the transformer tap to increase the grid voltage by 5%. Most transformers are equipped with a tap that can slightly increase the grid voltage, but not all.
2	The output side is abnormal.			
	The output voltage and output current fluctuate significantly.	1. The filtering magnitudes of the output voltage and output current are different. 2. The motor fluctuates.	1. Compare the fluctuation amplitude of the output voltage and output current within the same filter time. 2. For actual motor speed fluctuation, targeted analysis and optimization are required.	1. Check the filtered output current and set an appropriate filter time (Ab-94 to Ab-98 for group U0). 2. Contact Inovance for technical support.
	The output voltage of the drive exceeds the rated voltage of the motor.	The input grid voltage is excessively high, resulting in high bus voltage.	Check whether the grid output voltage is significantly higher than the rated voltage of the motor, which is certain to occur when the motor is operating at high speed and under heavy load.	This is a normal phenomenon requiring no action. The output phase voltage of the drive is a square wave pulse voltage over the carrier frequency cycle. The amplitude of the square wave voltage matches the bus voltage. Different output voltages result in different pulse widths. The voltage shock to the motor is directly related to the bus voltage, not the output voltage. Therefore, it is recommended to maximize the output voltage to save energy.
	The low-speed output current measured by the oscilloscope and AC current clamp/ clamp meter is too low, and the waveform shows distortion.	The measurement of both the clamp meter and the AC current clamp are based on the AC inductance principle. The AC magnetic field generated by low-frequency output current is weak, resulting in measurement deviations and waveform distortions.	1. Increase the output frequency and check whether the output current waveform and magnitude are correct. 2. Decrease the output frequency and check whether the output current of the drive fluctuates significantly.	It is recommended to use a DC current probe to measure the output current. **Note:** The low-frequency current waveform is based on the waveform of the drive, as the drive can accurately sample the DC current.

No.	Fault symptom	Possible cause	Verification method	Solution
3	Faults occurred in V/f control.			
	The drive shakes during stop.	The acceleration abruptly changes during stop, resulting in torque shock.	1. Increase the deceleration time and check whether the shock amplitude decreases. Set b7-09 [Ramp deceleration end arc time] to check whether the shock decreases.	1. Set F0-45 to 1 to enable the S-curve function of RFG and set b7-09 [Ramp 1 deceleration end arc]. If the deceleration time is short, set b7-08 [Ramp 1 deceleration start arc] properly. 2. Increase d0-28 [Waiting time of DC braking at stop] as needed.
	When the motor decelerates to stop according to the DI stop signal, the stop position of the motor exceeds the limit.	1. There is a delay in the transmission of the stop signal to the drive. 2. The drive filters input reference signals like DI signals. 3. The deceleration time does not match the actual mechanical requirements. 4. Power generation results in overvoltage or overcurrent suppression. 5. The deceleration capacity is insufficient, with torque or current reaching limits.	1. Check whether there is a delay in the transmission of the stop signal through the PLC, such as the delay in the PLC scan cycle. 2. Check the DI input filter time 1 (E0-16). If the deceleration time is very short (such as 100 ms), set the DI filter time to 0. 3. Check the actual deceleration time. The default base value for acceleration and deceleration time corresponds to the time at the maximum frequency. 4. Monitor the waveform. During deceleration, power generation occurs. If the bus voltage reaches the overvoltage suppression threshold (d1-55), the feedback speed deviates from the reference, resulting in position overshoot. Set d1-54 to 0 to disable overvoltage suppression and operate the drive for several times to check whether overvoltage occurs. 5. Check the monitored waveform to see whether the output torque in vector control mode reaches the limit (set by F2-30 and F2-31). Check whether the output current in V/f control mode reaches the overcurrent suppression threshold (d2-27).	1. Connect the DI directly to the drive for quicker response. 2. Set the DI input filter time 1 (E0-16) to 0. 3. If the deceleration time is too short, decrease the ramp 1 deceleration time (F0-49). 4. Enable excitation (d0-39 for vector control only; D0-41 for over-excitation in V/f mode (≠0 (default): ON)) and try increasing the over-excitation coefficient (d0-40 in vector control/d0-41 in V/f control). Increase the deceleration time properly when allowed by the process. If the fault persists, connect a braking resistor. Increase the overcurrent suppression threshold (d2-27) properly. 5. The same rule applies in vector control. In vector control mode, increase the torque limit (d1-09/d1-10) properly.

No.	Fault symptom	Possible cause	Verification method	Solution
3	The output current is excessively high.	1. The load is excessive. 2. The V/f torque boost is excessively high. 3. For loads such as fans and water pumps, the output current may be excessively high when energy-saving control is not used. 4. If the operating current is high only during high-speed operation under heavy duty in field-weakening range, the grid voltage may be excessively low. 5. Incorrect motor rated parameters or incorrect motor connection method (Y-type or delta type) result in motor operation errors. 6. There may be a deviation in current sampling, even if the output current deviation is small.	1. Compare the output current of two drives with the same power. If only one drive shows a high output current, it may indicate a mechanical issue. 2. Insufficient torque boost can result in high V/f low-frequency output current during low-speed, heavy-load startup. 3. Check whether energy-saving control is enabled under loads such as fans and water pumps. 4. Check whether the grid voltage is excessively low. If yes, increase overmodulation. 5. Check whether the basic motor parameters are faulty. If the output current of the motor is still high during no-load operation in V/f mode, the rated motor parameters may be incorrect. 6. There may be a 1% deviation in output current sampling of the drive. If there is a small current deviation, use the same current clamp to test whether the high output current is caused by sampling deviation.	1. If a mechanical fault occurs, optimize the mechanical design and assembly. If the fault persists, select a drive of higher power rating. 2. Increase the torque boost coefficient properly. Note that an excessively high torque boost value can also result in high output current. 3. For steady-state loads such as fans and water pumps, set d5-25 to 1 to enable energy-saving control of asynchronous motor, which can effectively reduce energy consumption. 4. In the high-speed field-weakening range, set A5-06 to 107% to increase voltage utilization, which can decrease the output current. 5. Set the rated motor parameters correctly. Some motor nameplates list multiple sets of motor parameters, so ensure the correct set is selected. If motor parameters are set correctly but the output current is still high, decrease the rated motor voltage. 6. Use the same current clamp for output current measurement and sampling.
	The output voltage of the drive is lower than other machines during field-weakening operation.	Low grid voltage or a weak, loaded grid that experiences voltage drop can result in lower output voltage and higher output current under the same load.	Check whether the bus voltage drops significantly during operation with high load.	1. Set A5-06 to 107% to increase the overmodulation coefficient. 2. Adjust the transformer tap to increase the input voltage properly.

No.	Fault symptom	Possible cause	Verification method	Solution
3	The V/f control speed is not accurate enough.	During loaded operation in V/f mode, there is a deviation (slip) between the rotor speed of the asynchronous motor and the frequency reference. Without slip compensation, there will be a deviation between the rotor output speed and the speed reference.	Use a frequency sweeper to check whether the actual motor speed deviates significantly from the speed reference.	The response of V/f slip compensation is relatively slow. For steady-state loads, set d2-41 to 1 to enable slip compensation, which can effectively increase the speed accuracy of asynchronous motor in V/f control mode. For dynamic loads, vector control is required for high speed accuracy.
	The drive starts slowly in quick start mode.	1. There is a delay in the start command. 2. The torque boost in V/f control mode is set incorrectly, resulting in insufficient starting torque. 3. The output current limit is low, resulting in a deviation between the output acceleration frequency and the reference. 4. The setting of the starting frequency or DC braking at start can result in a delay at startup.	1. For fast start/stop control, check whether the DI terminal filter is set to 0 ms. 2. Increase the torque boost properly and check whether the startup delay is reduced. 3. Check whether the transient output current reaches the overcurrent suppression threshold. 4. Check whether the DC braking time at start (d0-25) is set to 0 s and whether the starting frequency hold time (d0-24) is set to 0 s.	1. Ensure that the DI terminal filter (E0-16) is set to 0 ms. 2. Increase the torque boost (d2-14) properly. Keep it below 6% to prevent high current and overload. 3. Increase the overcurrent suppression threshold (d2-27) properly. If the output current reaches the limit, use a drive with higher power rating. 4. Set the DC braking time at start (d0-25) to 0s and the starting frequency hold time (d0-24) to 0s.
	When multiple drives are used to drive the same load, the output current among drives is unbalanced.	With multiple drives are used to drive the same load, each drive controls its own speed. During this process, minor mechanical errors can result in significant load deviation among the motors.	Check whether the loads are controlled in a balanced way. Faults are likely to occur when each drive controls its own speed.	Use droop control to balance the current among different drives; otherwise, the output current cannot be balanced. The droop rate is recommended to be set to a percentage of the motor rated slip. For details see "V/f Droop Control" in DT60 user guide.
4	Faults occurred in vector control.			
	The motor operates in reverse direction during decelerating to stop.	1. Integral overshoot occurs when the speed loop integral time (Ti) and the proportional gain (Kp) are excessively low, causing the motor to operate in reverse direction. 2. When the motor stops suddenly, the output torque drops to 0 and elastic mechanical parts rebound, resulting in shaking at the mechanical end.	1 .Increase the integral time (F2-03) to 0.5s for regular models and 1.0s for large inertia models. Gradually increase Kp (F2-02) to check whether the speed overshoot decreases. 2 .Enable the S-curve function of RFG (F0-45 = 1) to gradually release the elastic torque and decrease the shock caused by sudden changes in acceleration.	1. Increase the integral time (F2-03) to 0.5s for regular models and 1.0s for large inertia models, and then gradually increase Kp (F2-02). 2. Enable the S-curve function of RFG (F0-45 = 1) to gradually release the elastic energy and decrease the elastic deformation caused by sudden changes in output torque. Set a shorter arc time for ramp-down end arc of ramp 1 (F0-53). Set a short shut-down delay time (d0-16) to ensure the machine stops securely before shut-down. Set a short DC braking time at stop (d0-29) to check whether the fault is rectified.

No.	Fault symptom	Possible cause	Verification method	Solution
4	The output current is excessively high in vector control mode.	1. The load is excessive. 2. For loads such as fans and water pumps, the output current may be excessively high when energy-saving control is not used. 3. If the output current is high only during high-speed, field-weakening operation, it may be due to low grid voltage. 4. Incorrect motor rated parameters or wrong motor connection method (Y-type or delta type) can result in abnormal motor operation. 5. There may be a deviation in current sampling, even if the output current deviation is small. 6. Dynamic auto-tuning is not performed. 7. The output current of synchronous motor during low-speed operation in SVC mode is high. 8. With overmodulation enabled in vector control mode, asynchronous motors output slightly higher current when operating in no-load, field-weakening range. 9. The output current is excessively high during normal operation.	1. Compare the output current of two drives with the same power. If only one drive shows a high output current, it may indicate a mechanical issue. 2. Check whether energy-saving control is enabled under loads such as fans and water pumps. 3. Check whether the grid voltage is excessively low. If yes, increase overmodulation. 4. Check whether the basic motor parameters are faulty. If the output current of the motor is still high during no-load operation in V/f mode, the rated motor parameters may be incorrect. 5. There may be a 1% deviation in output current sampling of the drive. If there is a small current deviation, use the same current clamp to test whether the high output current is caused by sampling deviation. 6. It is recommended to perform a complete dynamic auto-tuning in vector control mode. For the initial commissioning of batch applications, a complete no-load auto-tuning is recommended. Download complete parameter files for batch replication. 7. Inject current to low-speed synchronous motors in SVC mode to ensure current stability. 8. During high-speed, no-load operation, the field-weakening depth of the asynchronous motors decreases, output current slightly increases, and load-carrying capacity improves. During loaded operation, the output current decreases. 9. Other possible causes lead to the fault.	1. If a mechanical fault occurs, optimize the mechanical design and assembly. If the fault persists, select a motor of higher power rating. 2. For steady-state loads such as fans and water pumps, set d5-25 to 1 to enable energy-saving control of asynchronous motor, which can effectively reduce energy consumption. 3. In the high-speed field-weakening range, set A5-06 to 107% to increase voltage utilization, which can decrease the output current. 4. Set the rated motor parameters correctly. Some motor nameplates list multiple sets of motor parameters, so ensure the correct set is selected. If motor parameters are set correctly but the output current is still high, decrease the rated motor voltage. 5. Use the same current clamp for output current measurement and sampling. 6. Performing dynamic auto-tuning or downloading all parameters after dynamic auto-tuning can partially address the issue of high output current. 7. This is a normal phenomenon requiring no action. 8. This is a normal phenomenon requiring no action. 9. Contact Inovance for technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
4	The deceleration time for large inertia models is excessively long.	1. The set deceleration time does not match the deceleration time required. 2. Without a braking resistor, the motor generates power during deceleration, which causes the bus voltage to rise and trigger overvoltage suppression, slowing down the motor deceleration. 3. The generating torque limit is too low.	1. Check whether the feedback speed (U6-00) matches the set speed (U6-01). If so, the fault can be attributed to the improper deceleration time. 2. Check whether the bus voltage (L32-48) rises to the overvoltage suppression threshold (F2-40) and the feedback speed deviates from the set speed. If yes, the fault can be attributed to overvoltage suppression. 3. Increase F2-30/F2-31 properly to check whether the deceleration is quickened. Excessively low generating torque rarely occurs.	1. Decrease the ramp-down time of ramp 1 (F0-49). 2. In vector control mode, overvoltage suppression is disabled by default. You can enable over-excitation (d0-39) to reduce the overvoltage suppression time. If the fault persists, it is recommended to install a braking resistor. 3. Increase F2-30/F2-31 properly to raise the generating torque limit. Then, check whether the braking resistor can consume energy in quick generating state and whether there is a risk of overvoltage.
	The speed fluctuates greatly during high-speed, field-weakening operation.	The field-weakening control bandwidth is insufficient, resulting in motor resonance.	Motor resonance occurs in field-weakening range. When the output voltage no longer increases as the speed increases, it indicates that the motor enters field-weakening range.	Set d4-17 to 5 and restart the drive.
	The actual speed during high-speed, field-weakening operation cannot reach the set value.	1. The torque is limited. 2. The torque limit results in insufficient power output.	1. Check whether the output torque reaches the torque limit (d1-09). 2. Increase the disturbance torque coefficient (d1-23) and check whether the actual speed can follow the set speed.	1. Increase the torque limit (d1-09). 2. Increase the disturbance torque coefficient (d1-23).

No.	Fault symptom	Possible cause	Verification method	Solution
4	During quick acceleration/ deceleration, the motor output torque fluctuates, with unusual noise generated.	The acceleration and deceleration is too fast, resulting in deviation between the feedback current and the current reference.	Set d4 -17 to 5 and restart the drive.	Set d4 -17 to 5 and restart the drive.
	The motor starts in reverse direction.	1. The magnetic pole position auto-tuning angle of the synchronous motor is incorrect. 2. The SVC control at low speed is unstable. 3. There is an additional torque in the reverse direction, which causes the motor to operate in reverse direction upon startup. 4. For active loads, when the output torque is lower than the load during startup, the motor operates in reverse direction. This usually occurs in applications with a brake.	1. Keep the motor in a stopped state and repeatedly start it at 0 speed. Check whether the flux angle (magnetic pole position auto-tuning angle) is stable. 2. Check whether the feedback speed fluctuates greatly and whether the output torque is excessively high. 3. Check whether additional torque (b5-24/b5-25/b5-26/b5-27) is set, as this can result in abnormal shock to the motor upon startup. 4. Active loads are mainly hoisting loads or elastic loads. During startup, the release of gravity or elastic potential energy can cause the motor to operate in reverse direction.	1. Increase the magnetic pole position auto-tuning current (d0-75/d6-53). 2. Contact the technical support. 3. Set b5-24/b5-25/b5-26/b5-27 to 0. The default value is 0. 4. Increase the speed loop Kp (F2-02) properly to speed up the response. The user can also set a proper starting frequency (d0-23) and starting frequency hold time (d0-24) to speed up the response.

No.	Fault symptom	Possible cause	Verification method	Solution
4	The torque output capacity of the motor in SVC mode is insufficient, but the displayed output torque is much higher than the actual load.	1. The motor inductance is incorrect. 2. The back EMF of the synchronous motor or the motor stator resistance is incorrect, which can affect the low-speed torque output capacity in SVC mode. 3. The model parameters of the drive does not match the actual model, resulting in incorrect auto-tuning parameters and operation failure.	1. Check whether a complete parameter auto-tuning is performed. 2. Disconnect the motor and perform a complete no-load dynamic auto-tuning to obtain the correct motor parameters. 3. Check whether the model parameters (A3-02 to A3-04) correspond to the nameplate.	1. It is recommended to perform a complete parameter auto-tuning. Values recommended by the motor manufacturer may differ from the auto-tuned values. The auto-tuned values should prevail. 2. Disconnect the motor and perform a complete no-load dynamic auto-tuning to obtain the correct motor parameters. 3. Ensure that the model parameters (A3-02 to A3-04) match the values indicated on the nameplate.
	The load-carrying capacity of the drive during startup in SVC mode is insufficient and low-frequency operation occasionally gets stuck.	1. The motor model parameters are incorrect. 2. The acceleration time in SVC mode is too long, which causes the drive to operate near 0 speed for a long time, resulting in occasional divergence. 3. The speed loop parameters at 0 speed are too low, resulting in slow output torque rise and divergence when the motor operates at 0 speed for too long. 4. The magnetic pole position auto-tuning is incorrect, resulting in insufficient load-carrying capacity during startup.	1. It is recommended to perform a complete dynamic parameter auto-tuning to check whether the condition improves and to check whether the drive model setting is correct. 2. Decrease the acceleration time to check whether the drive still gets stuck during startup in SVC mode. 3. Increase d3-07 and decrease d3-08 to intensify the speed loop near speed 0. Check whether the motor still gets stuck during startup. 4. Increase the initial position detection current of the synchronous motor (d0-75 and d6-53).	1. Ensure that the drive model and the motor auto-tuning parameters are correct. It is recommended to perform a complete no-load dynamic auto-tuning. If not possible, write correct back EMF values and perform a static auto-tuning (C2-00 = 13). 2. If the system is not sensitive to acceleration time, reduce the acceleration time coefficient at low speed (b7-41) and set b7-42 to 3% to accelerate the drive at low speed. 3. Increase d3-07 and decrease d3-08 to intensify the speed loop near speed 0. 4. Increase the initial position detection current of the synchronous motor (d0-75 and d6-53).

No.	Fault symptom	Possible cause	Verification method	Solution
4	The operating speed overshoot is high.	In vector control mode, the integral effect of the speed loop parameters is strong (integral Ti is too small) and Kp is small, resulting in slow integral reset and output overshoot.	Increase Kp (F2-02) and Ti (F2-03) to check whether overshoot is alleviated.	1. Increase Kp (F2-02) and Ti (F2-03). 2. Enable feedforward control. See section "Acceleration Torque Feedforward Adjustment" in the user guide for how to adjust the feedforward.
	The acceleration of high inertia models is slow.	1. The output torque limit is excessively low, resulting in a low average output torque during acceleration. 2. The speed loop parameters are excessively low, resulting in a long time to reach the maximum torque.	1. Increase the output torque limit (F2-30/F2-31) properly and check whether the acceleration time becomes faster. 2. Increase the speed loop Kp (F2-02) properly and check whether the acceleration time becomes faster.	1. Increase the output torque limit (F2-30/F2-31) properly. 2. Increase the speed loop Kp (F2-02) properly.
	The motor creeps at 0 rpm in SVC mode, which may result in overcurrent occasionally.	When the drive operates at low speed in SVC mode, the back EMF is low and the observed speed is inaccurate. Prolonged operation at 0 speed may result in faults such as model divergence and overload.	Slightly increase the motor operating speed (2%) to stabilize the motor operation. When the set speed is 0, the motor runs unstably. If I/F mode is not enabled when running at zero speed, faults can occur.	For synchronous motors in SVC mode, I/F control can be enabled (set the tens of d0-85 to 1) to keep the motor speed at 0 rpm. For asynchronous motors in SVC mode, you can make the asynchronous motor enter DC mode at zero speed (d6-27 = 2) to keep the motor speed at 0 rpm.
	There is a significant delay in the actual operation of the motor after the start key is pressed.	1. Pre-excitation of the asynchronous motor is delayed. 2. The DC braking start time and starting frequency time have been set.	1. Observe through an oscilloscope whether acceleration starts after the set time elapses upon an operation command and whether the feedback speed is consistent with the speed reference during acceleration. 2. Check whether the DC braking start time or starting frequency time is not 0.	1. Increase the pre-excitation current (d0-19) properly to enhance startup capability. 2. Set the DC braking start time and starting frequency time to 0 (d0-24 = 0, d0-25 = 0).
	Multiple asynchronous motors receive the start command at the same time but motors does not start at the same time.	Asynchronous motors vary in size and pre-excitation completion time. Therefore, even if the start command is sent at the same time, acceleration is not started at the same time	The motor size and specifications are different. Generally, the startup time is not consistent.	Set d0-17 (Pre-excitation mode) to 0 (Pre-excitation based on time) for all drives and then set the pre-excitation time (d0-18) of the drives to the same value.

No.	Fault symptom	Possible cause	Verification method	Solution
5	Motor faults occur.			
	Electric corrosion occurs on the motor bearing.	Electric corrosion is usually caused by improper grounding and non-insulated bearing in the non-drive end bearing of the motor.	Pits and depressions exist on the inner and outer rings of the bearing and the rolling elements, with discoloration due to metal burning.	Connect the grounding terminal of the motor to the grounding terminal of the drive, and ensure the ground of the drive is grounded properly to the earth. The motor non-drive end must be equipped with an insulated bearing.
	The synchronous motor is demagnetized.	1. The carrier frequency is set improperly, resulting in excessive current harmonics and abnormal motor temperature rise. 2. The motor oscillates and generates excessive heat during operation. 3. The motor back EMF harmonics are excessive and the coercivity is low, which may easily incur demagnetization. 4. The motor is not in a well-ventilated environment.	1. Use an oscilloscope to check whether the U/V/W phase current waveforms demonstrate adequate sinusoidal integrity. 2. Check that the carrier frequency setting is sufficient, with a carrier ratio higher than 12 at least. 3. For high-speed motors and motors with low inductance, select a proper reactor or LC filter. 4. Measure whether the motor temperature rise during operation is normal.	1. Perform complete parameter auto-tuning. 2. Set the carrier frequency to a value higher than the maximum output frequency x 12. 3. For high-speed motors and motors with low inductance, select a proper reactor or LC filter. Observe whether the excitation current, torque current, and rotor speed fluctuate greatly (higher than 6%) during operation. 4. Take external heat dissipation measures. For example, improve the cooling conditions, increase the flow of the water-cooled motor to reduce the water temperature, and prevent the hot air from entering the fan of an air-cooled motor. Keep the motor away from other heating sources and check whether the air duct is blocked.
5	The system efficiency is not good.	The process does not match the pump's optimal efficiency point in terms of head, flow rate, and velocity.The process mismatch leads to poor efficiency, mismatch between the forward flow rate and the actual optimal efficiency point of the pump, energy loss due to improper piping design, and large pressure flow fluctuation due to improper process parameters.	1. Check whether the operating speed of the drive fluctuates dramatically and regularly. 2. Check whether the actual efficiency deviates greatly from the design efficiency.	Contact the technical support.
		Misalignment in installation of the motor output shaft results in energy loss.	1. Measure the installation alignment accuracy of the motor with an alignment tool. 2. Measure the radial runout using a micrometer.	Ensure proper alignment is achieved, then measure the efficiency again.
		The commissioning parameters of the drive are set improperly, resulting in poor system efficiency.	After checking that mechanical conditions are proper, observe whether the motor speed fluctuates cyclically.	Perform commissioning again according to the process. If the fault persists, contact the technical support.

No.	Fault symptom	Possible cause	Verification method	Solution
5	The noise is excessive.	1. The excessive noise may be caused by mechanical noise, improper mechanical installation alignment, and mechanical damage. 2. The electromagnetic noise is excessive.	1. For mechanical noise, increase the operating speed and then perform a coast-to-stop to check whether the noise is cleared. 2. For electromagnetic noise, change the carrier frequency and check whether the noise is reduced.	1. Optimize the mechanical system. 2. Increase the carrier frequency (A5-01) properly. Enable random PWM (set different depths through A5-11) in V/f mode.
	The motor vibration is excessive.	1. Jitter occurs in the speed control. 2. The motor installation is misaligned, resulting in jitter. 3. Excessive vibration occurs during operation of the motor due to jitter on the load end. 4. The motor cogging torque fluctuation results in speed fluctuation.	1. Observe whether the output torque and output speed oscillate through waveforms in the software tool. 2. Disassemble the coupling and observe whether jitter is cleared. 3. Increase the operating speed and then perform a coast-to-stop after the drive stops to check whether vibration is cleared. 4. Obvious torque fluctuation occurs during no-load operation of the motor, especially during operation at low speed. The fluctuation is significantly reduced after the speed is increased.	1. Adjust the AC drive control. If the fault persists, contact Inovance for technical support. 2. Ensure the motor shaft is correctly aligned. 3. Analyze the mechanical causes. 4. Contact the technical support.
5	Motor temperature rise is excessive.	1. The output current is high, and the load is excessive. 2. The heat dissipation conditions of the motor are improper. 3. The carrier frequency is low, and the current harmonics are excessive. 4. High input voltage causes high bus voltage, large voltage harmonics, leading to increased current harmonics. 5. In long cable drive applications, current harmonics increase, resulting in motor temperature rise.	1. Check whether the motor load is excessive. 2. Check whether the cooling fan of the motor works properly, whether the air duct is blocked, and whether the cooling water temperature and flow of the water-cooled motor meet the requirements. 3. Check whether the carrier frequency of the drive meets the control requirements and whether the carrier frequency ratio is greater than 12. 4. Check whether the grid voltage is excessively high (> 420 V). 5. In long cable applications, ground capacitance is present. Extended cable lengths induce natural reflections that intensify output current harmonics. The higher the carrier frequency, the higher the current harmonics, and the higher the temperature rise can be.	1. Reduce the load properly. 2. Ensure that the fan works properly, the air duct is not blocked, and the cooling water temperature and flow meet the requirements. 3. Ensure the carrier frequency is greater than 12, and check whether the carrier frequency meets motor requirements. 4. If high grid voltage causes increased motor temperature, increase the carrier frequency (A5-01) properly. 5. In long cable applications, reduce the carrier frequency properly to effectively reduce motor temperature rise and the overvoltage surge caused by voltage reflection.

No.	Fault symptom	Possible cause	Verification method	Solution
5	The motor generates noise upon start and the noise disappears during operation.	1. Asynchronous motor: By default, the motor starts with current excitation. Some motors may generate excitation noise when the pre-excitation current is high. 2. Synchronous motor: A bumping sound can be generated when magnetic pole position auto-tuning is performed through the pulse method.	1. Asynchronous motor: Check whether the pre-excitation method is time-based excitation. 2. Synchronous motor: Check the magnetic pole position auto-tuning method, try auto-tuning with high frequency injection.	1. Asynchronous motor: Set the pre-excitation method to time-based excitation (d0-17 = 0), and increase the pre-excitation time properly. 2. Synchronous motor: Try magnetic pole position auto-tuning with high frequency injection (d0-71 = 1) to reduce the noise during initial position auto-tuning.
	Motor resonance occurs.	An inherent oscillation frequency is present in the machine. When the motor runs to this frequency, resonance can occur between the motor and the machine.	In motor resonance, obvious current/torque oscillation occurs at a specific speed point. Operations at speeds lower than or higher than this specific point are normal without resonance.	1. Set frequency jump function to prevent the set speed from being equal to the resonance frequency, avoiding the machine from running in the resonance state for a long time. 2. Reduce the speed loop Kp (F2-02) properly and increase Ti. 3. Set a low torque current filtering time, such as d3-48 = 5 ms. The above measures are used to mitigate the impact of the resonance point. To eliminate resonance, the root cause must be rectified.

16.8 List of Fault Codes

The drive enters the error state when certain limits are reached. The error types of the drive are divided into four types, which are fault (E) > minor fault (L) > Alarm (A) > Prompt (N), ranking from high to low based on the severity level. See the following table for details.

Table 16–7 Correspondence between fault types and fault levels

Fault type	Fault level
Fault (E)	Coast to stop
	Stop at maximum capability
	Quick stop
	Decelerate to stop
Minor fault (L)	Operating at limited speed
	Operating at limited power
	Operating at limited current
	Operating at limited torque
Alarm (A)	Alarm
Prompt (N)	Prompt
	Ignore

Note

After troubleshooting, reset the fault to exit the drive from the fault state.

E002.1: Hardware overcurrent

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The instantaneous output current exceeds 3.535 x rated drive current (A3-03).

Troubleshooting:

Cause	Verification method	Solution
The output is grounded.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. (Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the ground short circuit part. Replace the U/V/W output cables or motor.
Output phase-to-phase short circuit occurs.	Method 1: Measure the resistance between U/V, V/W, and W/U with a multimeter to check whether the resistances are symmetric. If resistances are not symmetric, an error occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs.	Check the output short circuit part. Replace the U/V/W output cables or motor.
Speed loop parameter values are excessively high in SVC mode.	Check whether the value of F2-02/ F2-03 is higher than the default value.	1. Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start running and observe whether the drive can run smoothly. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high speed loop parameter values in SVC mode.

Cause	Verification method	Solution
The synchronous motor is demagnetized in SVC mode.	1. Check whether the carrier frequency (A5-01) is set to an excessively low value. 2. Check whether the speed control oscillates. Check whether the actual speed jitters excessively through the continuous oscilloscope function of the iFA drive commissioning software. 3. Check whether the motor back EMF harmonics and output current harmonics are excessively high. 4. Check whether the motor back EMF is excessively low. Record the current back EMF (F1-12). Disconnect the motor coupling and perform dynamic auto-tuning of the synchronous motor again (F1-69 = 12). Compare whether the auto-tuned back EMF (F1-12) is lower than the original back EMF. If yes, an error occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The carrier frequency is too low during high-speed operation.	Check whether the carrier frequency (A5-01) set for the motor during high-speed operation is higher than the output frequency x 12. If not, overcurrent may occur due to dissipated control.	1. Increase the carrier frequency during high-speed motor control. 2. Calculate the derating rate based on the required carrier frequency (12 x output frequency) during model selection.
The synchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1), and then start the drive again.
Overcurrent occurs due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope function of the iFA software tool to check whether the actual excitation (L3224), torque current (L3226), and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the fluctuation range does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. 2. Change the motor control mode to SVC (F0-01 = 0) and perform parameter auto-tuning.

Cause	Verification method	Solution
Overcurrent suppression parameters are improperly when an asynchronous motor is used in V/f mode.	Check that the overcurrent suppression function is enabled (d2-26=1), and check whether the overcurrent suppression point (d2-27), overcurrent suppression Kp/Ki (d2-28/29) are excessively high or low.	Reduce the overcurrent suppression Kp/Ki first. If the fault persists, increase the setpoint again. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.)
Overvoltage suppression or undervoltage suppression parameters are set improperly when an asynchronous motor is used in V/f mode.	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage phase.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) in undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) in overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again.
The value of the torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29 ≠ 0) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02 to A3-04) are consistent with those on the nameplate.	Set the drive model parameters (A3-02 to A3-04) according to the nameplate label of the drive.

Cause	Verification method	Solution
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
Overcurrent occurs on the braking resistor.	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. Remove the braking resistor and enable the drive to run again. Check whether overcurrent occurs again after the bus voltage increases. If not, the braking resistor is faulty. In this case, check the following. 1. Check whether the braking output is short-circuited. 2. Check whether the braking resistor is wired correctly. 3. The resistance of the braking resistor is excessively low.	1. Re-connect the braking resistor. 2. Replace with a braking resistor of higher resistance.
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, check whether violent feedback speed fluctuation, unusual motor noise, motor stall, or slightly continuous reverse rotation occurs. If yes, an exception occurs.	1. Avoid the long-term operation in SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable I/F control (set the tens of d0-85 to 1 for low-speed processing mode).
Hardware errors occur.	Contact the technical support.	Contact the technical support.

E002.2: Software overcurrent

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The instantaneous output current exceeds the custom software overcurrent threshold (A3-54).

Troubleshooting:

Cause	Verification method	Solution
The output is grounded.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.
Output phase-to-phase short circuit occurs.	Method 1: Measure the resistance between U/V, V/W, and W/U with a multimeter to check whether the resistances are symmetric. If resistances are not symmetric, an error occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs.	Check the output short circuit part. Replace the U/V/W output cables or motor.
Speed loop parameter values are excessively high in SVC mode.	Check whether the value of F2-02/ F2-03 is higher than the default value.	1. Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start running and observe whether the drive can run smoothly. If the fault persists, halve the speed loop Kp again. 2. If the fault persists, the fault is not caused by excessively high speed loop parameter values in SVC mode.
Synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.

Cause	Verification method	Solution
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The carrier frequency is low during high-speed operation.	Check whether the carrier frequency set for the motor during high-speed operation is higher than the result of output frequency x 12. If no, control dissipation may result in overcurrent.	The carrier frequency of high-power machines is low by default. In this case, increase the carrier frequency of the motor during high-speed operation. Calculate derating according to the carrier frequency and select the model according to the derating coefficient.
<p>The synchronous motor is started during rotation in SVC mode.</p	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Overcurrent occurs due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC mode.
Overcurrent suppression parameters are improperly when an asynchronous motor is used in V/f mode.	Ensure that overcurrent suppression is enabled (d2-26 = 1). Check whether the overcurrent suppression point (d2-27) and overcurrent suppression Kp/Ki (d2-28/d2-29) are set to excessively high or low values.	Reduce the overcurrent suppression Kp/Ki first. If the fault persists, increase the setpoint again. (For high-power motors, reduce the overcurrent suppression Kp/Ki properly.)
Overvoltage suppression or undervoltage suppression parameters are set improperly when an asynchronous motor is used in V/f mode.	Check whether overvoltage suppression (d1-54) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage stage.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) in undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) in overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again.
The value of the torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).

Cause	Verification method	Solution
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29 ≠ 0) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation in the SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable I/F control, and set the tens place of d0-85 (low-speed processing mode) to 1.

Cause	Verification method	Solution
The custom software overcurrent threshold (A4-29) is set to excessively low value.	Check whether the custom software overcurrent threshold is excessively low.	Increase the custom software overcurrent threshold.
Hardware errors occur.	Contact the technical support.	Contact the technical support.

E002.3: Phase W overcurrent

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The instantaneous output current of phase W exceeds the overcurrent threshold.

Troubleshooting:

Cause	Verification method	Solution
Synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note: When the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The carrier frequency is low during high-speed operation.	Check whether the carrier frequency set for the motor during high-speed operation is higher than the result of output frequency x 12. If no, control dissipation may result in overcurrent.	The carrier frequency of high-power machines is low by default. In this case, increase the carrier frequency of the motor during high-speed operation. Calculate derating according to the carrier frequency and select the model according to the derating coefficient.
The synchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Cause	Verification method	Solution
Overcurrent occurs due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/3226) and operating frequency (U0-00) of the motor are oscillating. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applies.
Overvoltage suppression or undervoltage suppression parameters are set improperly when an asynchronous motor is used in V/f mode.	Check whether overvoltage suppression (d1-39) or undervoltage suppression (d1-63) is enabled and observe whether overcurrent occurs in the overvoltage or undervoltage phase.	Adjust undervoltage suppression Kp/Ki (d1-66/d1-67) in undervoltage suppression. Adjust overvoltage suppression Kp/Ki (d1-57/d1-58) in overvoltage suppression. Decrease the setpoint first. If the fault persists, increase the setpoint again.
The value of the torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29 ≠ 0) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.

Cause	Verification method	Solution
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
Overcurrent occurs on braking resistor.	Braking resistor overcurrent occurs when the bus voltage increases to the actual operating voltage of the braking unit (A4-01) due to motor deceleration or speed fluctuation. Remove the braking resistor and enable the drive to run again. Check whether overcurrent occurs again after the bus voltage increases. If not, check the following. 1. Check whether the braking output is short-circuited. 2. Check whether the braking resistor is wired correctly. 3. The resistance of the braking resistor is excessively low.	1. Re-connect the braking resistor. 2. Use a braking resistor of higher resistance.
The synchronous motor diverges when operating near 0 Hz in SVC mode (synchronous motor in SVC).	When the synchronous motor is in the SVC mode and the set speed (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation can occur.	1. Avoid long-term operation in the SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable I/F control, and set the tens of d0-85 (Low-speed processing mode) to 1.
Hardware errors occur.	Contact the technical support.	Contact the technical support.

E002.4: Hardware VCE fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Monitored VCE signal error

Troubleshooting:

Cause	Verification method	Solution
Hardware errors occur.	Contact the technical support.	Contact the technical support.

E005.1: Bus overvoltage

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The bus voltage exceeds the effective overvoltage threshold (A3-58).

Troubleshooting:

Cause	Verification method	Solution
The output is grounded.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. (Note: When the grid is an IT system, short circuit to ground cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.)	Check the ground short circuit part. Replace the U/V/W output cables or motor.
In the power generation state, the braking recovery power is insufficient (synchronous motor/ asynchronous motor in SVC mode).	1. Check whether the motor is in the generating state. 2. Use a multimeter to check whether the power of the braking resistor power is excessively low. 3. Check whether the braking resistor is connected securely.	1. Increase the deceleration time (F0-49) to reduce the generating power. 2. Replace with a braking resistor of higher power. 3. Re-connect the braking resistor. 4. Enable overvoltage suppression when the load allows (d1-54 = 0). Note: Active loads such as cranes does not support overvoltage suppression.
Sudden removal of the load causes speed overshoot and generation when the synchronous motor/ asynchronous motor is used in SVC mode.	Check whether the actual motor speed increases significantly after the load is suddenly removed. If yes, an error occurs.	1. Increase the speed loop Kp (F2-02). 2. Increase the speed loop Ti (F2-03). The recommended value is 2s.
The value of the speed loop gain is excessively low, resulting in power generation after feedback speed overshoot when the speed reference reaches the target value (synchronous motor/asynchronous motor in SVC mode).	Observe whether overvoltage occurs after the speed reaches the target value during acceleration.	1. Increase the speed loop Kp (F2-02) and the speed loop Ti (F2-03) to 2s. 2. Enable S-curve (b7-00 = 1) and set ramp acceleration end arc (F0-51).

Cause	Verification method	Solution
Speed loop parameter values are excessively high in SVC mode.	Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s. Start running and observe whether the drive can run smoothly. If the fault persists, reduce the Kp to half the current value several times. If the fault still occurs, the fault is not caused by this cause.	Reduce the speed loop Kp (F2-02) to half the current value and set the speed loop Ti (F2-03) to 2s.
The synchronous/asynchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Overvoltage occurs due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applies.
The deceleration time is too short.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	1. Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly. 2. For applications with low speed tracking requirements, enable overvoltage suppression (F2-39=1). For applications with high speed tracking requirements, install a braking resistor. 3. In cases where it is not possible to install a braking resistor, increase the excitation current properly (SVC: d0-40; V/f: d0-41). When using SVC control, first enable vector overexcitation (d0-39 = 1).
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
The starting voltage of the braking unit is excessively high.	Check whether the effective action voltage of the braking unit (A4-01) reaches the overvoltage threshold (A3-57).	The effective actuation voltage of the braking unit varies with the voltage class of the device. Manual modification is not required under normal conditions. In extreme cases, reduce the action voltage of the braking unit (A4-00).

Cause	Verification method	Solution
The incoming voltage is excessively high.	Check whether the input voltage is within the normal range (380 V to 480 V).	1. Reduce the input voltage to a value within the normal range (380 V to 480 V). 2. Increase the overvoltage suppression activation voltage (F2-40) and the braking unit activation voltage (A4-00).
The overvoltage suppression parameters are set improperly.	Enable overvoltage suppression (d1-39 = 1) and check whether the overvoltage suppression Kp/Ki (d1-57/d1-58) is set to excessively low or high values (based on actual operating conditions).	Decrease the setpoint of kp or ki first. If the fault persists, increase the setpoint again. In addition, for large inertia models, reduce the setpoint further. Adjust overvoltage suppression Kp/Ki (d1-57/58).
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual settings. The synchronous motor coasts to stop manually or as triggered by a fault upon overspeed of the synchronous motor.	Check whether the output voltage (F1-12 x U0-00 x 1.414) of the synchronous motor exceeds the overvoltage threshold A4-39 upon overspeed of the synchronous motor. If yes, interruption of the operation may result in overvoltage, which can damage the drive. Note: When the synchronous motor overspeed occurs, the output voltage (F1-12 x U0-00 x 1.414) can be much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time, leading to back EMF short circuit in the output diode during switch-on in the reverse direction.	1. Limit the speed upper limit by setting d1-03 (Digital reference of positive frequency upper limit) to a value ≤ A4-39/(1.414 x F1-12). 2. Replace with a motor with a higher back EMF. Note: A motor with high back EMF can effectively reduce the output current. However, operating at a speed above the limit may result in damage caused by overvoltage.

E008.1: Contactor operating frequently

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

When the drive is not powered off, soft start is triggered on the relay multiple times within a short period of time.

Troubleshooting:

Cause	Verification method	Solution
The incoming contactor is abnormal.	Use a multimeter to check whether the incoming contactor is normal.	Replace the incoming contactor.
ON/OFF operations are performed frequently.	Check whether ON/OFF operations are performed on the drive through operators or through the host controller.	Ensure that the input voltage is within the normal range (380 V to 480 V) or wait until the input voltage stabilizes.
The pre-charge contactor of the drive is faulty.	Contact the technical support.	Contact the technical support.

E009.1: Bus undervoltage

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The bus voltage is lower than the unervoltage threshold (A3-56).

Troubleshooting:

Cause	Verification method	Solution
The input phase is lost.	Measure whether the line voltages between R/S, S/T, and R/T are symmetrical.	Check whether the input switches, contactors, and wiring terminals are abnormal and re-connect them.
Power dip occurs and the grid voltage is unstable.	Check whether undervoltage occurs in other devices in the same cabinet at the same time. Note：Undervoltage is mostly caused by power dip.	In load scenarios such as fans, water pumps, air compressors, and electric drums, enable undervoltage suppression (d1-63 = 1). Note： When undervoltage suppression is enabled (d1-63 = 1), a brief speed drop occurs during undervoltage suppression and the drive converts the motor kinetic energy into electrical energy to stabilize the bus voltage, preventing the undervoltage fault.
The incoming voltage is excessively low.	1. Check whether the input voltage is within the normal range (380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the upstream circuit breaker or contactor is normal.
The undervoltage suppression parameters are set improperly.	1. Check whether undervoltage suppression (d1-63 = 1) is enabled and whether the undervoltage suppression Kp/Ki (d1-66/d1-67) are set to excessively high or low values. 2. During undervoltage suppression, undervoltage fault is triggered when the actual speed is lower than the minimum operating frequency (d1-72) of undervoltage suppression. In this case, the drive stops.	1. Adjust the undervoltage suppression Kp/Ki (d1-66/67). Decrease the setpoint first. If the fault persists, increase the setpoint again. 2. If a low operating speed is required, adjust the minimum running frequency for undervoltage suppression (d1-72).

Cause	Verification method	Solution
Undervoltage occurs during motor oscillation.	Check whether the output torque (U0-06) and bus voltage (U0-02) are subject to large oscillation (fluctuation above 10%) in the same frequency as that of bus fluctuation.	Rectify the motor oscillation.
The pre-charge contactor is abnormal and the pre-charge resistor cannot be disconnected properly.	Check whether the undervoltage fault occurs after power-on, whether the bus recovers after stop, and whether the undervoltage fault disappears after stop.	Contact technical support to replace the relay.
Hardware errors (circuit board) occur.	Contact the technical support.	Contact the technical support.

E009.3: Pre-drive timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The bus voltage falls below the undervoltage threshold (A3-56) within the specified time after the start command is triggered.

Troubleshooting:

Cause	Verification method	Solution
The input circuit is not connected properly.	Check whether cables are connected properly.	Reconnect the AC drive.
The input voltage is excessively low.	Check whether the input voltage is within the normal range (380 V to 480 V).	Increase the input voltage to a value within the normal range (380 V to 480 V).
Hardware errors (circuit board) occur.	If the input fault persists, the hardware may be damaged.	Contact the technical support.

E010.1: Drive overload

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The cumulative overload coefficient (L3208) of the drive reaches 100%.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The synchronous motor diverges when operating near 0 Hz in SVC mode (synchronous motor in SVC).	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation in the SVC mode at speeds close to 0. 2. Enable IF control, and set the tens place of d0-85 (low-speed processing mode) to 1.
The synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
The Synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.

Cause	Verification method	Solution
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29 ≠ 0) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
The value of the torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).

Cause	Verification method	Solution
The synchronous/asynchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Overload occurs due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	1. Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applies.
An error occurs during synchronous motor magnetic pole angle auto-tuning in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.

Cause	Verification method	Solution
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual setting.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the product of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.
Derated operation applies due to long-term operation at low frequencies.	Check whether the current operating frequency is 0 Hz to 5 Hz at low frequency. If yes, the system is in the low-frequency derating range. (In this range, the drive power will be lower than the rated power.) Note 1: During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. Note 2: When the frequency is in the low frequency range from 0 Hz to 5 Hz, the derating is reduced from 20% to 0%.	Replace with a drive of higher power.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
Derating occurs due to excessively high carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.

E011.1: Motor overload

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The cumulative overload coefficient (L3210) of the motor reaches 100%.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
Synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The incoming voltage is excessively low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the incoming switch is normal.
The motor overload protection coefficient (d1-46) is set to an excessively low value.	Check whether the current value of d1-46 is lower than the default value.	1. Increase the motor overload protection coefficient (d1-46). 2. If the fault persists after long-term operation, switch off the motor overload protection (d1-45 = 0).

E012.1/A012.1/L012.1/N012.1: Input phase loss

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

Input phase loss is detected in the hardware circuit.

Troubleshooting:

Cause	Verification method	Solution
The input cables of the AC drive are connected improperly.	Check whether the input cables of the drive are connected properly.	Re-connect the AC drive according to the wiring diagram.
The incoming voltage is excessively low.	Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). Check whether the upstream circuit breaker or contactor trips or cannot be closed.	Increase the input voltage to a value within the normal range. Ensure that the incoming switch is normal.
The diode of the drive is damaged.	Use a multimeter to check whether the diode of the drive is damaged.	Contact the technical support.

E013.1: Phase U loss

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase U current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Verification method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output cables of the drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit is tripped.	Close the output contactor or brake.

Cause	Verification method	Solution
The motor is faulty.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between phases U and V, U and W, and V and W of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.2: Phase V loss

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase V current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Verification method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output cables of the drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit trips.	Close the output contactor or brake.

Cause	Verification method	Solution
The motor is faulty.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between phases U and V, U and W, and V and W of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E013.3: Phase W loss

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase W current in the operating state is much lower than the other two phases.

Troubleshooting:

Cause	Verification method	Solution
The output cables of the drive are connected improperly.	Check whether the output cables of the drive are connected properly.	Re-connect the output cables of the drive.
The output contactor is faulty or trips.	Check whether the output contactor is disconnected and whether the circuit is tripped.	Close the output contactor or brake.
The motor is faulty.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.
The motor winding is unbalanced.	Measure the phase-to-phase resistance between phases U and V, U and W, and V and W of the motor with a multimeter to check whether they are equal.	Repair or replace the three-phase winding of the motor.

E014.1: Drive overtemperature

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The power module temperature exceeds the overtemperature threshold (A3-51).

Troubleshooting:

Cause	Verification method	Solution
The ambient temperature is excessively high.	Measure the ambient temperature to check whether it is higher than 50°C.	Lower down the ambient temperature.
The air duct is blocked.	Check whether the air filter of the fan is blocked.	Clean the ventilation duct.
The fan is damaged.	After cooling down, start the drive and observe whether the fan rotates.	Replace the damaged fan.
The thermistor of drive module is damaged.	Contact the technical support.	Contact the technical support.
The drive is damaged.	The fault persists after the preceding measures are taken.	Contact the technical support.

E014.2: Driver chamber temperature too high

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is reported when the drive chamber temperature (U0-83) exceeds 99°C.

Troubleshooting:

Cause	Verification method	Solution
1. The fan is damaged. 2. The power rating of the drive is excessively low, causing overload of the drive. 3. The air duct is blocked. 4. Heat dissipation in the surrounding environment is improper.	Check whether the drive chamber temperature (U0-83) is higher than the value of A4-08.	1. Replace the damaged fan. 2. Select a drive with proper power rating. 3. Clean the air duct. 4. Rectify the working environment and improve heat dissipation conditions.

E015.1/A015.1/L015.1/N015.1: External fault 1

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

The signal state that corresponds to external fault 1 (H2-00) is high level.

Troubleshooting:

Cause	Verification method	Solution
Input signals are activated.	Check whether the state of the input signal corresponding to external fault 1 (H2-00) is high level (H2-00 = 1).	Restore the state of the external fault 1 (H2-00) input signal to low level (H2-00 = 0).

E015.2/A015.2/L015.2/N015.2: External fault 2

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E015.1/A015.1/ L015.1/N015.1: External fault 1		

Fault cause:

Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level.

Troubleshooting:

Cause	Verification method	Solution
Input signals are activated.	Check whether the state of the input signal corresponding to external fault 2 (H2-01) is low level (H2-00 = 0).	Restore the state of the external fault 2 (H2-01) input signal to high level (H2-00 = 1).

E018.1: Current detection circuit fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The current zero drift detected in the stop state is excessively high.

Troubleshooting:

Cause	Verification method	Solution
The current sampling hardware is abnormal.	Contact the technical support.	Contact the technical support.

E019.1: Motor auto-tuning timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The auto-tuning is not done for a long time.

Troubleshooting:

Cause	Verification method	Solution
Motor parameters are set incorrectly.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.2: Motor auto-tuning interrupted

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Auto-tuning is interrupted.

Troubleshooting:

Cause	Verification method	Solution
The drive stops during parameter auto-tuning.	Check whether the drive stops during parameter auto-tuning.	Perform parameter auto-tuning again.
Voltage dip occurs during parameter auto-tuning.	Check whether transient power off occurs due to input voltage fluctuation.	Wait for the input voltage to stabilize before starting the drive. If power-on fails for a long time, check whether the main contactor and grid are normal.

E019.4: Back EMF auto-tuning error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The auto-tuned back EMF is not within the allowable range.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive or the motor is stalled.	1. During high-speed operation in vector control, if the product of output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is large, the load is excessive. 2. Check whether the brake can be released properly.	1. Reduce the load. 2. Release the brake.
The motor does not rotate.	Observe whether the motor shaft starts to rotate.	Remove the brake or device that prevents the motor from rotating.
Overcurrent occurs during auto-tuning of the magnetic pole position.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may result in overcurrent in magnetic pole position auto-tuning.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.5: Incorrect motor type

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The motor auto-tuning mode (F1-69) does not match the motor type (F1-00).

Troubleshooting:

Cause	Verification method	Solution
The motor type is set improperly.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.6: Current sampling phase-to-phase gain deviation auto-tuning error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is reported when the current sampling gain deviation between UV/VW phases is higher than that set by the software.

Troubleshooting:

Cause	Verification method	Solution
Phase-to-phase gain deviation auto-tuning error occurs upon current sampling.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly. Improper setting may lead to abnormal auto-tuning of gain deviation between current sampling phases.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E019.7: No-load current auto-tuning limit exceeded

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is triggered when the no-load current is not within the allowable range specified by the software.

Troubleshooting:

Cause	Verification method	Solution
The auto-tuned no-load current is abnormal.	Check the no-load current (C4-30) of the asynchronous motor. If the value is not within 20% to 50% of the rated motor current (C4-04), the auto-tuned values are abnormal.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E021.1: Continuous operation of EEPROM timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop		

Fault cause:

The continuous operation of the EEPROM exceeds 60 seconds.

Troubleshooting:

Cause	Verification method	Solution
EEPROM read/write errors occur.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for writing parameters is correct, and whether the RAM address mapping for each group of parameters is correct. If the above two causes are ruled out, the integrated circuit may be damaged.	Reduce the number of operations on this parameter by the host controller. If parameters written through communication is incorrect, set a correct RAM address. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.2: EEPROM read fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop		

Fault cause:

The attempt to read parameters in EEPROM fails.

Troubleshooting:

Cause	Verification method	Solution
EEPROM read/write errors occur.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for writing parameters is correct, and whether the RAM address mapping for each group of parameters is correct. If the above two causes are ruled out, the integrated circuit may be damaged.	Reduce the number of operations on this parameter by the host controller. If parameters written through communication is incorrect, set a correct RAM address. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.3: EEPROM write failure

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop		

Fault cause:

The attempt to write parameters to EEPROM fails.

Troubleshooting:

Cause	Verification method	Solution
EEPROM read/write errors occur.	Check whether a certain parameter is modified frequently by the host controller. Check whether the RAM address for writing parameters is correct, and whether the RAM address mapping for each group of parameters is correct. If the above two causes are ruled out, the integrated circuit may be damaged.	Reduce the number of operations on this parameter by the host controller. If parameters written through communication is incorrect, set a correct RAM address. If the fault persists after the preceding measures are taken, contact Inovance for technical support.

E021.4: EEPROM read/write count limit exceeded within 1s

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop		

Fault cause:

The number of read/write operations within 1s exceeds the value of P0-62.

Troubleshooting:

Cause	Verification method	Solution
EEPROM read/write errors occur.	Check through the host controller whether the memory operation on the user side within 1s is frequent.	Reduce the number of write/read operations within 1s.

E021.5: EEPROM internal buffer limit exceeded

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop		

Fault cause:

The number of EEPROM operations exceeds the number of EEPROM operation queues.

Troubleshooting:

Cause	Verification method	Solution
The internal cache of EEPROM exceeds the limit.	In the case of parameter writing through communication, check through the host controller whether the write operation is too frequent.	Reduce the number of write operations within 1s.

E023.1: Drive output ground fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Current is detected between the output phase and ground.

Troubleshooting:

Cause	Verification method	Solution
The output is grounded.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.

E026.1/A026.1/L026.1/N026.1: Operating time reached

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

The cumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).

Troubleshooting:

Cause	Verification method	Solution
The cumulative operating time reaches the setpoint.	Check that the cumulative operating time (Ad-00, Ad-01) reaches the set value (P0-18, P0-19).	Set parameter initialization (A0-00) to 2 to clear the cumulative operating time.

E027.1/A027.1/L027.1/N027.1: User-defined fault 1

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

The user-defined fault 1 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 1 source is valid (H2-02 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 1 to "Inactive" (H2-02 = 0) and disable the fault.

E027.2/A027.2/L027.2/N027.2: User-defined fault 2

Default fault level:	Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Fault level range:	Same as E027.1/ A027.1/L027.1/ N027.1: User-defined fault 1		

Fault cause:

The user-defined fault 2 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 2 source is valid (H2-03 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 2 to "Inactive" (H2-03 = 0) to disable the fault.

E027.3/A027.3/L027.3/N027.3: User-defined fault 3

Default fault level:	Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Fault level range:	Same as E027.1/ A027.1/L027.1/ N027.1: User-defined fault 1		

Fault cause:

The user-defined fault 3 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 3 source is valid (H2-04 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 3 to "Inactive" (H2-04 = 0) to disable the fault.

E027.4/A027.4/L027.4/N027.4: User-defined fault 4

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

User-defined fault 4 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 4 source is valid (H2-05 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 4 to "Inactive" (H2-05 = 0) to disable the fault.

E027.5/A027.5/L027.5/N027.5: User-defined fault 5

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

User-defined fault 5 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 5 source is valid (H2-06 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 5 to "Inactive" (H2-06 = 0) to disable the fault.

E027.6/A027.6/L027.6/N027.6: User-defined fault 6

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

User-defined fault 6 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 6 source is valid (H2-07 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 6 to "Inactive" (H2-07 = 0) to disable the fault.

E027.7/A027.7/L027.7/N027.7: User-defined fault 7

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

User-defined fault 7 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 7 source is valid (H2-08 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 7 to "Inactive" (H2-08 = 0) to disable the fault.

E027.8/A027.8/L027.8/N027.8: User-defined fault 8

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

User-defined fault 8 is triggered.

Troubleshooting:

Cause	Verification method	Solution
The signal of the user-defined fault is input through the connector.	Check whether the user-defined fault 8 source is valid (H2-09 = 1). This fault is reported when the fault source is active.	Set the source of user-defined fault 8 to "Inactive" (H2-09 = 0) to disable the fault.

E028.1/A028.1/L028.1/N028.1: User-defined alarm 1

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 1 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 1 is valid (H2-10 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 1 to "invalid" (H2-10 = 0) to disable the alarm.

E028.2/A028.2/L028.2/N028.2: User-defined alarm 2

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 2 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 2 is valid (H2-11 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 2 to "invalid" (H2-11 = 0) to disable the alarm.

E028.3/A028.3/L028.3/N028.3: User-defined alarm 3

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 3 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 3 is valid (H2-12 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 3 to "invalid" (H2-12 = 0) to disable the alarm.

E028.4/A028.4/L028.4/N028.4: User-defined alarm 4

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 4 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 4 is valid (H2-13 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 4 to "invalid" (H2-13 = 0) to disable the alarm.

E028.5/A028.5/L028.5/N028.5: User-defined alarm 5

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 5 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 5 is valid (H2-14 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 5 to "invalid" (H2-14 = 0) to disable the alarm.

E028.6/A028.6/L028.6/N028.6: User-defined alarm 6

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 6 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 6 is valid (H2-15 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 6 to "invalid" (H2-15 = 0) to disable the alarm.

E028.7/A028.7/L028.7/N028.7: User-defined alarm 7

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 7 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 7 is valid (H2-16 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 7 to "invalid" (H2-16 = 0) to disable the alarm.

E028.8/A028.8/L028.8/N028.8: User-defined alarm 8

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Custom alarm 8 triggered

Troubleshooting:

Cause	Verification method	Solution
The signal of user-defined alarm is input through the connector.	Check whether the source of custom alarm 8 is valid (H2-17 = 1). This alarm is reported if the alarm source is valid.	Set the source of custom alarm 8 to "invalid" (H2-17 = 0) to disable the alarm.

E029.1/A029.1/L029.1/N029.1: Cumulative power-on time reached

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Check whether the cumulative power-on time (Ad-02 and Ad-03) has reached the set power-on time threshold (P0-16 and P0-18).

Troubleshooting:

Cause	Verification method	Solution
The cumulative power-on time reaches the setpoint.	Defines whether the cumulative power-on time (Ad-02 and Ad-03) reaches the set power-on time (P0-16 and P0-18).	Set parameter initialization (A0-00) to 2 to clear the cumulative power-on time.

E030.1/A030.1/L030.1/N030.1: Output three-phase loss fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

When the three-phase loss protection is enabled, this fault is triggered when the three-phase output current keeps lower than the three-phase Output phase loss occurs. detection threshold (d1-84) for the time defined by d1-85 (Three-phase Output phase loss occurs. detection time).

Troubleshooting:

Cause	Verification method	Solution
The AC drive runs without the motor.	Check whether the output cables of the drive are connected properly.	Reconnect the AC drive.

E031.1/A031.1/L031.1/N031.1: PID feedback loss

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

This fault is triggered when the PID feedback value exceeds the PID detection upper limit (P2-30) or falls below the PID detection lower limit (P2-31).

Troubleshooting:

Cause	Verification method	Solution
PID feedback is not within the loss detection range.	Check the input value of the corresponding PID feedback source according to the setpoint of PID feedback source selection (P2-04). For example, when the PID feedback source is set to "5: Communication", the input value of the PID feedback source is the value set through communication. Determine whether the PID feedback value is higher than the upper limit of PID detection (P2-30) or lower than the lower limit of PID detection (P2-31).	Adjust the input value of the PID feedback source or set the PID feedback parameter (P2-30\P2-31) properly to ensure that the PID feedback value is within the upper and lower limits of PID detection. Increase the upper limit of PID detection (P2-30) by 10% in sequence, or decrease the lower limit of PID detection (P2-31) by 10% in sequence.

E032.1/A032.1/L032.1/N032.1: Parameter reset error

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

When parameter reset is performed through parameter initialization (A0-00), the execution fails.

Troubleshooting:

Cause	Verification method	Solution
Parameter reset errors occur.	When parameter reset is performed through parameter initialization (A0-00), the execution fails.	Perform parameter initialization (A0-00) again.

E032.2/A032.2/L032.2/N032.2: Parameter backup error

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Parameter backup by setting the user backup (A0-39) parameter fails.

Troubleshooting:

Cause	Verification method	Solution
Parameter backup errors occur.	Parameter backup by setting the user parameter backup (A0-39) fails.	Perform parameter backup again.

E032.4/A032.4/L032.4/N032.4: Parameter setting error

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Improper parameter setting

Troubleshooting:

Cause	Verification method	Solution
Parameters are set improperly.	1. When the value of U2-98 is 1, a fault occurs. Check whether parameters are set improperly. 2. In group P0, check whether the user load curve is set properly. Check whether the x-coordinate increases in sequence. If not, a fault occurs. In group P0, check whether the lower limit exceeds the upper limit in the x-coordinate. If yes, a fault occurs.	Ensure that the user load curve in group P0 is set correctly. The x-coordinate must be increased by 1/2/3 in sequence, and the upper limit must be greater than the lower limit.

E032.6/A032.6/L032.6/N032.6: Power-on parameter verification error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The property of parameters read through EEPROM upon power-on are incorrect. For example, the parameter value read is not within the upper and lower limits.

Troubleshooting:

Cause	Verification method	Solution
Parameter check errors occur upon power-on.	When abnormal parameters are detected during power-on verification and the 16-bit parameter error type (U2-95) is not 0, a parameter verification error occurs.	Contact the technical support.

E032.7/A032.7/L032.7/N032.7: Invalid parameter backup

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Parameter backup failed

Troubleshooting:

Cause	Verification method	Solution
The number of backup parameters exceeds the upper limit.	When the value of U2-99 is 1, it indicates that the number of backup parameters exceeds the upper limit (A0-39).	After clearing the parameter backup record, perform parameter backup again.

E032.8/A032.8/L032.8/N032.8: Parameter initialization error upon power-on

Default fault level:	0: Coast to stop	Resettable:	Not isolated
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Parameter upper limit initialization fails.

Troubleshooting:

Cause	Verification method	Solution
Parameter initialization errors occur upon power-on.	When the value of the power-on initialization completion flag (U2-91) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E032.9/A032.9/L032.9/N032.9: Property change error

Default fault level:	0: Coast to stop	Resettable:	Not isolated
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The parameter setpoint exceeds the upper and lower limits.

Troubleshooting:

Cause	Verification method	Solution
Parameter property change errors occur.	When the value of the power-on initialization completion flag (U2-92) is 0, it indicates that parameter initialization fails.	Power on again or contact the technical support.

E040.1: Pulse-by-pulse current limit fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is reported when the output current exceeds the pulse-by-pulse limit and the duration of the pulse-by-pulse limit reaches the threshold in the V/f control mode of asynchronous motor.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive or the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The power rating of the drive is excessively low.	The rated current of motor (F1-04) is higher than that of the drive (A3-03).	Reduce the load or replace with a drive of higher power rating.
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly (F0-48 and F0-49). Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.

Cause	Verification method	Solution
The output is grounded.	Method 1: Measure the ground impedance of the output terminal with a tramegger. If it is not at the MΩ level, the impedance is abnormal. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs. Note: When the grid is an IT system, ground short circuit cannot be detected during self-test. To enable this function, install an insulation monitor to the IT system.	Check the ground short circuit part. Replace the U/V/W output cables or motor.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Output phase-to-phase short circuit	Method 1: Measure the resistance between U/V, V/W, and W/U with a multimeter to check whether the resistances are symmetric. If resistances are not symmetric, an error occurs. Method 2: Enable manual self-test (C2-04 = 1) and enable the drive to run. If a fault is reported, an error occurs.	Check the inter-phase short circuit part and replace the motor or cable.
Oscillation occurs on the asynchronous motor in V/f mode.	Use the continuous oscilloscope function in the commissioning software to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor fluctuate. The fluctuation range of the actual excitation/torque current of the motor does not exceed 10% under normal conditions.	1. Increase or decrease the oscillation suppression gain in V/f mode (d2-23) properly and observe whether overcurrent is suppressed. 2. Change the motor control mode to SVC (F0-01 = 0). After parameter auto-tuning, the SVC mode applies.
Output phase loss occurs.	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If Output phase loss occurs. occurs, the resistance is infinite. Method 2: Enable self-test (C2-04 = 1) and run the drive to check whether faults occur.	Check the phase loss part and replace the motor or cable.

Cause	Verification method	Solution
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
The value of the torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	Check whether the manual torque boost (d2-14) is set to an excessively high value. When the torque boost mode is automatic or automatic+manual, check whether the stator resistance (F1-20) has been auto-tuned.	Run again after reducing the manual torque boost value. Perform static partial auto-tuning on the asynchronous motor (F1-69 = 1) and run again.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/voltage of the drive (A3-02/A3-03/A3-04) are consistent with those on the nameplate.	Set model parameters properly.

E042.1/A042.1/L042.1/N042.1: Excessive speed deviation

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/L027.1/N027.1: User-defined fault 1		

Fault cause:

The deviation between the actual motor speed and the set speed is higher than the threshold (d1-40), and such status keeps after the time defined by d1-39 elapses.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive when the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation in the SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable I/F control and set the tens of low-speed processing mode (d0-85) to 1.
Synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 2), perform parameter auto-tuning. Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.

Cause	Verification method	Solution
The synchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
An error occurred during magnetic pole angle auto-tuning of synchronous motor error in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/ d1-10) properly.
The power limit is set to an excessively low value.	Check whether output power (U0-05) reaches the power limit for generating/motoring (d1-13 to d1-17).	Increase the power limit (d1-13/d1-14) properly.

E042.2/A042.2/L042.2/N042.2: Actual speed opposite to speed reference

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The actual speed is in opposite direction to the set speed.

Troubleshooting:

Cause	Verification method	Solution
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid long-term operation in the SVC mode at speeds close to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable I/F control, and set the tens of d0-85 (Low-speed processing mode) to 1.
The synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The synchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).

Cause	Verification method	Solution
An error occurred during magnetic pole angle auto-tuning of synchronous motor error in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.

E043.1/A043.1/L043.1/N043.1: Motor overspeed

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

This fault is reported when the actual motor speed exceeds the overspeed protection threshold (d1-37) and such status lasts after the time defined by d1-36 elapses.

Troubleshooting:

Cause	Verification method	Solution
The load is excessive the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.

Cause	Verification method	Solution
An error occurred during magnetic pole angle auto-tuning of synchronous motor error in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
The motor overspeed detection parameters are set improperly.	Check whether motor overspeed detection parameters (d1-36/d1-37) meets current requirements. If the parameter value can cover the actual speed change range of the motor, the parameter value is correct.	Set motor overspeed detection parameters (d1-36/d1-37) properly so that the parameter value can cover the actual speed change range of the motor.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-02) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/ d1-10) properly.

Cause	Verification method	Solution
The power limit is set to an excessively low value.	Check whether output power (U0-05) reaches the power limit for generating/motoring (d1-13 to d1-17).	Increase the motoring/generating power limit (d1-13/d1-14) properly.
The starting torque is excessive in torque control.	Check whether the motor control mode is torque control (F0-02 = 1) and whether a large torque reference is set.	Do not start in the torque control mode with a large torque reference at no load.

E043.2/A043.2/L043.2/N043.2: Asynchronous motor stall in SVC mode

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

This fault is triggered when the actual motor speed exceeds the asynchronous motor SVC runaway protection threshold (d1-92) and lasts for the time defined by d1-91.

Troubleshooting:

Cause	Verification method	Solution
The synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.

E045.1/A045.1/L045.1/N045.1: Motor overtemperature

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The read-out temperature of the expansion card is higher than the motor overtemperature protection threshold (E2-76).

Troubleshooting:

Cause	Verification method	Solution
The temperature sensor is connected loosely.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor temperature is too high.	Check whether the motor temperature is higher than the motor overtemperature protection threshold (E2-76).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor overtemperature protection threshold is set to an excessively low value.	Check whether the motor overtemperature protection threshold (E2-76) is set to an excessively low value.	Increase the value of motor overtemperature protection threshold (90°C to 100°C for the regular motors).

E045.2/A045.2/L045.2/N045.2: Motor pre-overtemperature

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The read-out temperature of the expansion card is higher than the motor pre-overtemperature alarm threshold (E2-75).

Troubleshooting:

Cause	Verification method	Solution
The temperature sensor is connected loosely.	Check the wiring of the temperature sensor.	Ensure that the temperature sensor is connected securely.
Motor temperature is too high.	Check whether the motor temperature is higher than the motor pre-overtemperature alarm threshold (E2-75).	Increase the carrier frequency or take other heat dissipation measures to cool the motor.
The motor pre-overtemperature alarm threshold is too low.	Check whether the motor pre-overtemperature alarm threshold (E2-75) is set to an excessively low value.	Increase the value of motor overtemperature protection threshold (90°C to 100°C for the regular motors).

E046.1: Load monitoring overload fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Load monitoring overload action (P0-68) is selected as fault. The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 for the time defined by P0-85 (Permissible overload time).

Troubleshooting:

Cause	Verification method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is triggered (P0-68 has a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and overload permission time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.2: Load monitoring overload alarm

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Load monitoring overload action (P0-68) is selected as a alarm. The load monitoring signal keeps exceeding the lower limit of the load set by P0-75 to P0-79 after the time defined by P0-85 (Permissible overload time) elapses.

Troubleshooting:

Cause	Verification method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is triggered (P0-68 has a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and overload permission time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E046.3: Load monitoring load loss fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

Load monitoring overload action (P0-69) is set to "Fault". The load monitoring signal keeps exceeding the upper limit defined by P0-75 to P0-79 after the time defined by P0-86 (Permissible load loss time) elapses.

Troubleshooting:

Cause	Verification method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is triggered (P0-68 has a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and overload permission time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

A046.4: Load monitoring load loss alarm

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E027.1/A027.1/ L027.1/N027.1: User-defined fault 1		

Fault cause:

The load monitoring load loss action (P0-69) is set to "Alarm". The load monitoring signal keeps exceeding the lower limit defined by P0-80 to P0-84 after the time defined by P0-86 (Permissible load loss time) elapses.

Troubleshooting:

Cause	Verification method	Solution
The load monitoring parameter is set improperly.	1. Check that the load monitoring overload action (P0-68) is triggered (P0-68 has a non-zero value). 2. Check the load monitoring curve parameters (P0-70 to P0-84) and overload permission time (P0-85).	Set the load monitoring curve parameters (P0-70 to P0-84) according to actual conditions.

E047.1: STO1 disconnected

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The 24 V input detection of STO1 fails.

Troubleshooting:

Cause	Verification method	Solution
The STO1 signal is disconnected.	Check whether the 24 V power supply of STO1 is normal.	Ensure that the STO1 is connected properly.

E047.2: STO2 disconnected

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The 24 V input detection of STO2 fails.

Troubleshooting:

Cause	Verification method	Solution
The STO2 signal is disconnected.	Check whether the 24 V power supply of STO2 is normal.	Ensure that the STO2 is connected properly.

E047.3: STO circuit power supply error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The power supply of some components of the STO circuit is abnormal.

Troubleshooting:

Cause	Verification method	Solution
Undervoltage or overvoltage occurs on the STO circuit.	Check whether the control board power supply is normal.	Check whether the control board is normal. If the control board is abnormal, replace the control board.

E047.4: STO input subsystem fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is reported when an error is detected in the STO input subsystem diagnostic feedback signal.

Troubleshooting:

Cause	Verification method	Solution
The STO circuit input subsystem is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact the technical support.

E047.5: STO BUFFER integrated circuit fault

Default fault level:	0: Coast to stop	Resettable:	Not isolated
Fault level range:	0: Coast to stop		

Fault cause:

This fault is triggered when an STO buffer hardware circuit error is detected.

Troubleshooting:

Cause	Verification method	Solution
The STO output block integrated circuit is abnormal.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact the technical support.

E047.7: STO FLASH verification failed

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is triggered when a change in the code saved in STO-Flash is detected.

Troubleshooting:

Cause	Verification method	Solution
The STO-FLASH diagnosis fails upon power-on.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact the technical support.

E047.8: STO RAM verification failed

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

This fault is triggered when a change in the data stored in the STO-RAM is detected.

Troubleshooting:

Cause	Verification method	Solution
The STO-RAM diagnosis fails upon power-on.	Check whether the operating panel or commissioning software has a corresponding fault code.	Contact the technical support.

E051.1: An error occurs during magnetic pole position auto-tuning.

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The magnetic pole position auto-tuning is interrupted due to an error.

Troubleshooting:

Cause	Verification method	Solution
An error occurs during magnetic pole position auto-tuning.	Method 1: Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If Output phase loss occurs. occurs, the resistance is infinite. Method 2: Enable self-test (C2-04 = 1) and run the drive to check whether faults occur.	Check the phase loss part and replace the motor or cable.

E056.1: Self-test interrupted

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

A stop command is sent during system self-test, leading to unusual interruption.

Troubleshooting:

Cause	Verification method	Solution
The self-test process has been interrupted.	Check whether the drive stops during self-test.	Perform self-test again and ensure that no stop command is inputted during self-test.
A fault occurs during the self-test.	Check whether any other fault is reported.	Rectify the fault reported.

E056.2: Short circuit upon exclusive activation of upper-arm IGBT of phase U

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The VCE signal error is detected by IGBT.

Troubleshooting:

Cause	Verification method	Solution
The VCE signal of the upper-arm IGBT of phase V is abnormal.	Contact the technical support.	Contact the technical support.

E056.3: Short circuit upon exclusive activation of lower-arm IGBT of phase U

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The VCE signal error is detected by IGBT.

Troubleshooting:

Cause	Verification method	Solution
The VCE signal of the lower-arm IGBT of phase V is abnormal.	Contact the technical support.	Contact the technical support.

E056.4: Short circuit upon exclusive activation of upper-arm IGBT of phase V

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The VCE signal error is detected by IGBT.

Troubleshooting:

Cause	Verification method	Solution
The VCE signal of the upper-arm IGBT of phase U is abnormal.	Contact the technical support.	Contact the technical support.

E056.5: Short circuit upon exclusive activation of lower-arm IGBT of phase V

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The VCE signal error is detected by IGBT.

Troubleshooting:

Cause	Verification method	Solution
The VCE signal of the lower-arm IGBT of phase U is abnormal.	Contact the technical support.	Contact the technical support.

E056.9: Phase loss in self-test output

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Phase loss occurs on the motor output during self-test of the drive.

Troubleshooting:

Cause	Verification method	Solution
Output phase loss occurs. is detected during self-test of the drive.	Perform manual self-test (C2-04 = 1) and start the drive to check whether Output phase loss occurs. exists.	Re-connect the output circuit of the drive.

E057.1: Upper-arm IGBT of phase U or lower-arm IGBT of phase V cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

U+V-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The upper-arm IGBT of phase U or lower-arm IGBT of phase V is faulty.	Contact the technical support.	Contact the technical support.

E057.2: Lower-arm IGBT of phase U or upper-arm IGBT of phase V cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

U+V-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The lower-arm IGBT of phase U or upper-arm IGBT of phase V is faulty.	Contact the technical support.	Contact the technical support.

E057.3: Upper-arm IGBT of phase V or lower-arm IGBT of phase W cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

V+W-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The upper-arm IGBT of phase V or lower-arm IGBT of phase W is faulty.	Contact the technical support.	Contact the technical support.

E057.4: Lower-arm IGBT of phase V or upper-arm IGBT of phase W cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

V+W-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The lower-arm IGBT of phase V or upper-arm IGBT of phase W is faulty.	Contact the technical support.	Contact the technical support.

E057.5: Upper-arm IGBT of phase W or lower-arm IGBT of phase U cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

W+U-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The upper-arm IGBT of phase W or lower-arm IGBT of phase U is faulty.	Contact the technical support.	Contact the technical support.

E057.6: Lower-arm IGBT of phase W or upper-arm IGBT of phase U cannot be turned on

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

W+U-IGBT open circuit is detected.

Troubleshooting:

Cause	Verification method	Solution
The lower-arm IGBT of phase W or upper-arm IGBT of phase U is faulty.	Contact the technical support.	Contact the technical support.

E057.7: Short circuit in U/V output

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Output phase-to-phase short circuit occurs on U/V terminals.

Troubleshooting:

Cause	Verification method	Solution
Output phase-to-phase short circuit occurs on U/V terminals.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.
The phase UV output is short-circuited to ground.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.

E057.8: Short circuit in V/W output

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Output phase-to-phase short circuit is detected on the V/W terminal.

Troubleshooting:

Cause	Verification method	Solution
Phase-to-phase short circuit occurs on phase U/V.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.
Output ground fault occurs on phase V/W.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.

E057.9: Short circuit in W/U output

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Output phase-to-phase short circuit is detected on the W/U end.

Troubleshooting:

Cause	Verification method	Solution
Phase-to-phase short circuit occurs on phase U/W.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.
Output ground fault occurs on phase U/W.	Check whether short circuit exists with a tramegger.	Re-connect the output circuit of the drive.

E058.1: Phase U current sensor installed reversely

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase U current direction is detected to be reversed.

Troubleshooting:

Cause	Verification method	Solution
The phase U sensor is installed reversely.	Contact the technical support.	Contact the technical support.

E058.2: Phase V current sensor installed reversely

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase V current direction is detected to be reversed.

Troubleshooting:

Cause	Verification method	Solution
The phase V sensor is installed reversed.	Contact the technical support.	Contact the technical support.

E058.3: Phase W current sensor installed reversely

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Phase W current is reversed.

Troubleshooting:

Cause	Verification method	Solution
The phase W sensor is installed reversed.	Contact the technical support.	Contact the technical support.

E058.4: Phase U/V current sensor misaligned

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase U/V current sampling is abnormal.

Troubleshooting:

Cause	Verification method	Solution
Phase U and phase V current sensors are misaligned.	Contact the technical support.	Contact the technical support.

E058.5: Phase W/V current sensor misaligned

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase V/W current sampling is abnormal.

Troubleshooting:

Cause	Verification method	Solution
Phase V and phase W current sensors are misaligned.	Contact the technical support.	Contact the technical support.

E058.6: Phase W/U current sensor misaligned

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The phase W/U current sampling is abnormal.

Troubleshooting:

Cause	Verification method	Solution
Phase W/U current sensors are misaligned.	Contact the technical support.	Contact the technical support.

E059.1/A059.1/L059.1/N059.1: Phases V/W unbalanced

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

The U/V phase output is unbalanced with the other phases.

Troubleshooting:

Cause	Verification method	Solution
The load at the output end is unbalanced.	Check whether the phase V/W current on the load end is balanced.	Adjust the output current on the load end to ensure that the V/W phase current does not differ greatly.
The consistency of the current sensor is improper.	Contact the technical support.	Contact the technical support.

E059.2/A059.2/L059.2/N059.2: Phases U/W unbalanced

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E059.1/A059.1/ L059.1/ N059.1: Unbalanced between V and W phases		

Fault cause:

The V/W phase output is unbalanced with the other phases.

Troubleshooting:

Cause	Verification method	Solution
The load at the output end is unbalanced.	Check whether the phase V/W current on the load end is balanced.	Adjust the output current on the load end to ensure that the V/W phase current does not differ greatly.
The consistency of the current sensor is improper.	Contact the technical support.	Contact the technical support.

E059.3/A059.3/L059.3/N059.3: Phases U/V unbalanced

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	E059.1/A059.1/L059.1/ N059.1: Phase V/W unbalanced		

Fault cause:

The W/U phase output is unbalanced with the other phases.

Troubleshooting:

Cause	Verification method	Solution
The load at the output end is unbalanced.	Check whether the phase V/W current on the load end is balanced.	Adjust the output current on the load end to ensure that the V/W phase current does not differ greatly.
The consistency of the current sensor is improper.	Contact the technical support.	Contact the technical support.

E060.1: Capacitor leakage

Default fault level:	0: Coast to stop	Resettable:	Not isolated
Fault level range:	0: Coast to stop		

Fault cause:

The bus voltage fluctuation range exceeds the threshold for a certain period.

Troubleshooting:

Cause	Verification method	Solution
Capacitor leakage occurs.	Check whether leakage occurs on the bus capacitor.	Replace the bus capacitor.

E061.1: braking resistor overload

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The braking time of the built-in braking resistor reaches the threshold.

Troubleshooting:

Cause	Verification method	Solution
The built-in braking resistor is braking for a long period of time.	Check whether the braking resistor has been in power generation mode for a long time.	Replace with an external braking resistor.

E080.1/A080.1/L080.1/N080.1: Fan speed feedback error

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

This fault is reported when the fan is stalled.

Troubleshooting:

Cause	Verification method	Solution
1. The fan is damaged. 2. The fan is obstructed by surrounding objects. 3. The fan cable is disconnected.	Check whether the fan has stopped running or become stuck.	1. Replace the damaged fan. 2. Clear away surrounding obstacles. 3. Replace the fan cable.

E084.1/A084.1/N084.1: Brake release failure

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop D: Alarm F: Not detected		

Fault cause:

The brake release command is generated, but there is no feedback signal after the set time elapses.

Troubleshooting:

Cause	Verification method	Solution
1. Check signal feedback point or feedback source wiring, or positive and negative logic. 2. Check whether the set time is proper.	1. Check signal feedback point or feedback source wiring, or positive and negative logic. 2. Check whether the set time is proper.	1. The feedback contact of the brake is damaged. Replace the sensor. 2. Set A7-04 to a higher value.

E084.2/A084.2/N084.2: Brake apply failure

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	E080.1/A080.1/L080.1/ N080.1: Fan speed feedback error		

Fault cause:

The brake apply command is generated but there is no feedback signal.

Troubleshooting:

Cause	Verification method	Solution
1. Check signal feedback point or feedback source wiring, or positive and negative logic. 2. Check whether the set time is proper.	1. Check signal feedback point or feedback source wiring, or positive and negative logic. 2. Check whether the set time is proper.	1. The feedback contact of the brake is damaged. Replace the sensor. 2. Set A7-04 to a higher value.

E084.3/A084.3/N084.3: Brake release timeout fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E080.1/A080.1/ L080.1/ N080.1: Fan speed feedback error		

Fault cause:

When the operation command has been sent, the brake release condition cannot be met, and the set time is exceeded, the release signal cannot be sent.

Troubleshooting:

Cause	Verification method	Solution
Check whether the brake release conditions set through group P4 are proper.	Check whether the brake release conditions set through group P4 are proper.	When brake release conditions are set, the corresponding starting torque and starting speed must be greater than the threshold for releasing the brake.

E084.6/A084.6/N084.6: Brake release auto-tuning fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E080.1/A080.1/ L080.1/ N080.1: Fan speed feedback error		

Fault cause:

Dynamic auto-tuning is enabled, but brake release auto-tuning is not allowed (P4-21).

Troubleshooting:

Cause	Verification method	Solution
Check whether dynamic auto-tuning of brake release is allowed through P4-21.	Check whether dynamic auto-tuning of brake release is allowed through P4-21.	Allow dynamic auto-tuning of brake release through P4-21.

E085.1/A085.1/L085.1/N085.1: Sequence fault 1

Default fault level:	15: Ignore	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

Execution of basic time slice times out.

Troubleshooting:

Cause	Verification method	Solution
Software sequence calling errors occur.	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.2/A085.2/L085.2/N085.2: Sequence fault 2

Default fault level:	15: Ignore	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/L085.1/N085.1: Sequence fault 1		

Fault cause:

Basic control module execution timeout

Troubleshooting:

Cause	Verification method	Solution
Software sequence calling errors occur.	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.3/A085.3/L085.3/N085.3: Sequence fault 3

Default fault level:	15: Ignore	Resettable:	Yes
Fault level range:	E085.1/A085.1/L085.1/ N085.1: Sequence fault 1		

Fault cause:

Execution of basic drive module times out.

Troubleshooting:

Cause	Verification method	Solution
Software sequence calling errors occur.	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E085.4/A085.4/L085.4/N085.4: Sequence fault 4

Default fault level:	15: Ignore	Resettable:	Yes
Fault level range:	E085.1/A085.1/L085.1/ N085.1: Sequence fault 1		

Fault cause:

The current status duration exceeds the maximum downtime.

Troubleshooting:

Cause	Verification method	Solution
Software sequence calling errors occur.	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact technical support.

E093.1/A093.1/L093.1/N093.1: Motor stall fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	E085.1/A085.1/L085.1/ N085.1: Sequence fault 1		

Fault cause:

When the motor reaches the torque limit and the motor operating frequency keeps lower than the stall fault detection frequency (d1-81) within the time defined by d1-80, a motor stall fault can be reported.

Troubleshooting:

Cause	Verification method	Solution
A motor stall fault is reported when the torque is limited in the speed control mode.	Check whether the torque is limited in the speed control mode.	Disable motor stall detection (d1-79 = 0).
The load is excessive the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Perform parameter auto-tuning again (F1-69 = 12). 3. Enable IF control, and set the tens place of d0-85 (low-speed processing mode) to 1.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.

Cause	Verification method	Solution
The synchronous motor is started during rotation in SVC mode.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
An error occurred during magnetic pole angle auto-tuning of synchronous motor error in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
The current limit is set to an excessively low value.	Check whether the maximum motor current (F1-13), the maximum AC drive current (A3-05), and the output current (U0-04) reach the limit.	Increase the current limit properly (F1-13).
The torque limit is set to an excessively low value.	Check whether the output torque (U0-06) reaches the limit.	Increase the torque limit (d1-09/ d1-10) properly.
The power limit is set to an excessively low value.	Check whether the output power (U0-05) reaches generating/ motoring power limit (d1-13 to d1-17). For details, see section "Power limit" in the function guide.	Increase the power limit (d1-13/d1-14) properly.

E093.2/A093.2/L093.2/N093.2: Motor step loss fault

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

After motor step loss detection is enabled, when the deviation between the magnetic flux setpoint and the feedback value keeps exceeding the step loss fault detection threshold (d1-86) within the time defined by d1-85, this fault can be reported. It is active only for asynchronous motors.

Troubleshooting:

Cause	Verification method	Solution
The synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
Output phase loss occurs.	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If Output phase loss occurs. occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and run the drive. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.

E093.3/A093.3/L093.3/N093.3: Current control error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

After current control error detection is enabled, when the deviation between the set current and feedback current keeps exceeding the current control error detection threshold (d1-88) within the time defined by (d1-87), this fault can be reported.

Troubleshooting:

Cause	Verification method	Solution
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
Output phase loss occurs.	1. Use a multimeter to measure the resistance between UV, VW, and WU. Normally, the resistance does not exceed 100 Ω. If Output phase loss occurs. occurs, the resistance is infinite. 2. Enable manual self-test (C2-04 = 1) and run the drive. If no fault is reported, the drive is normal.	Check the phase loss part and replace the motor or cable.
The droop coefficient is excessively high (SVC mode of the synchronous/asynchronous motor).	Check whether the droop function (d3-27 = 1) is enabled, ensure that the droop coefficient (d3-29) does not exceed the rated slip of the motor, and check whether the set frequency (U0-01) shows obvious oscillation every time.	The droop coefficient (d3-29) is lower than the rated slip of the motor.

E094.1/A094.1/L094.1/N094.1: Calculated number of pole pairs inconsistent with the set value

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The set number of motor pole pairs (F1-14) is different from the auto-tuned number of motor pole pairs.

Troubleshooting:

Cause	Verification method	Solution
The set number of motor pole pairs is inconsistent with the actual number.	Check whether the number of active pole pairs (F1-15) of the motor is consistent with the parameters provided by the motor manufacturer.	Set the number of motor pole pairs correctly (F1-14).

E094.2/A094.2/L094.2/N094.2: Rated power/voltage/current of the motor mismatch

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The set motor power factor is not within the allowable range.

Troubleshooting:

Cause	Verification method	Solution
The rated power, voltage, and current of the motor do not match.	Check whether the rated motor power P (F1-01), rated voltage U (F1-03), rated current I (F1-04), and power factor (C4-09) are set outside the normal range.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.

E094.3/A094.3/L094.3/N094.3: No-load current parameter range error

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The auto-tuned no-load current value is outside the allowable range.

Troubleshooting:

Cause	Verification method	Solution
The rated motor parameters are set incorrectly. Therefore, the auto-tuned no-load current is outside the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.4/A094.4/L094.4/N094.4: Mutual inductance, no-load current, and rated voltage not match

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The deviation between the rated flux and the flux calculated based on the rated voltage and frequency exceeds the allowable range.

Troubleshooting:

Cause	Verification method	Solution
The auto-tuned mutual inductance or no-load current are not consistent with the rated voltage or rated frequency.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E094.5/A094.5/L094.5/N094.5: Rotor resistance parameter range error

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The auto-tuned rotor resistance is not within the allowable range.

Troubleshooting:

Cause	Verification method	Solution
The auto-tuned rotor resistance is not within the allowable range.	Check whether motor nameplate parameters (F1-00 to F1-12) are set properly.	Set the motor parameters (F1-00 to F1-12) according to the motor nameplate before performing motor parameter auto-tuning.

E110.1/A110.1/L110.1/N110.1: Drive pre-overload

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The cumulative value of drive overload is reached (100% - AC drive pre-overload threshold (A4-28)).

Troubleshooting:

Cause	Verification method	Solution
The load is excessive and the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. For case 3, release the brake. If the fault persists are preceding measures are taken, use a drive with higher power rating.
The synchronous motor diverges when operating near 0 Hz in SVC mode.	When the synchronous motor is in the SVC mode and the set frequency (U0-01) is near 0, violent speed feedback fluctuation, unusual motor noise, motor stall, or slight reverse rotation occurs.	1. Avoid the long-term operation in the SVC at speeds closed to 0. 2. Enable IF control, and set the tens place of d0-85 (low-speed processing mode) to 1.

Cause	Verification method	Solution
The synchronous frequency of the asynchronous motor is close to 0 Hz during operation in SVC mode.	The synchronous motor is connected to a generating load. The synchronous frequency (L3212) is close to 0 (within 0.5% fluctuation) and operation lasts for more than 10s.	Avoid the long-term operation in the SVC mode at speeds near 0.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Synchronous/Asynchronous motor parameters are not auto-tuned in SVC mode.	In the SVC control mode (F0-01 = 0), perform parameter auto-tuning. Compare the parameters in group F1 to default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.
The acceleration/deceleration time in V/f mode is excessively short when an asynchronous motor is used in V/f mode.	Check whether the deceleration time is excessively short. If the deceleration time is excessively short, increase the deceleration time gradually (5s every time). Repeat the test to check whether the fault persists. If the fault does not occur, the fault cause is excessively low acceleration/ deceleration time.	Check whether the current acceleration/deceleration time is the value needed by the process; otherwise, prolong the acceleration/deceleration time properly. Enable overcurrent suppression function (d2-26=1). If overcurrent persists, first reduce the setpoint, and if ineffective, then increase the setpoint. Increase manual torque boost (d2-14) properly. In applications with extremely rapid start-stop cycles, enable DC braking at stop (d0-29) and ensure the DC braking time (d0-29) extends until the next start. In applications where multiple motors start simultaneously, applying DC braking at start (d0-25) to all motors can significantly reduce the inrush current during startup.

Cause	Verification method	Solution
The V/f curve voltage reference is excessively high when an asynchronous motor is used in V/f mode.	When the V/f curve is set to multi-point V/f (d2-00 = 1), reduce the voltage at the point with the highest voltage/frequency ratio among the multi-point curves (d2-02 to d2-10), and check whether the fault can be rectified. When the V/f curve is set to decoupled V/f (d2-00 = 10), first set the frequency, then slowly try to increase the voltage. If the output current reaches the rated value while the output voltage is still lower than the voltage set upon fault, this indicates that the V/f decoupled voltage is set improperly.	When using multiple-point V/f, reduce the voltage/frequency ratio in the multiple-point V/f curve to prevent it from exceeding the ratio in the linear V/f curve, which could cause motor overexcitation. In decoupled V/f mode, set the voltage ramp-up/down time (d2-50/d2-51) to match the frequency to prevent the voltage from ramping up too quickly or the output voltage from rising to an excessively high value.
Values of torque boost parameters are excessively high when an asynchronous motor is used in V/f mode.	When the torque boost mode is manual or manual+automatic, check whether the manual torque boost (d2-14) is set to an excessively high value and whether the stator resistance (F1-20) is auto-tuned. When the torque boost mode is automatic, check whether the stator resistance (F1-20) is auto-tuned.	If the manual torque boost (d2-14) is set to an excessively high value, decrease the manual torque boost (d2-14). Perform static partial auto-tuning of the asynchronous motor again (F1-69 = 1).
The synchronous/asynchronous motor is started during rotation in SVC.	Before start, check whether the motor is rotating, especially check whether the load is heavy with large inertia. The time for the motor with such a load to coast to stop is long.	Set the start mode to flying start (d0-02 = 1).
Overload due to oscillation when an asynchronous motor is used in V/f mode.	Use the continuous oscilloscope in the software tool to check whether the actual excitation/torque current (L3224/L3226) and operating frequency (U0-00) of the motor are oscillating. Under normal conditions, the actual excitation/ torque current fluctuation range of the motor does not exceed 10%.	Increase or decrease the V/f oscillation suppression gain (d2-23) properly and observe whether overcurrent is suppressed. The motor control mode is changed to SVC (F0-01 = 0). After parameter auto-tuning, the motor runs in SVC mode.

Cause	Verification method	Solution
An error occurred during magnetic pole angle auto-tuning of synchronous motor error in SVC mode.	When the motor is rotating freely, select pre-positioning start (d0-71 = 3) and observe whether the motor can start normally. When the motor cannot rotate freely, check whether motor Lq/Ld (F1-34/F1-32) is lower than 1.5. Check whether the motor is a synchronous motor with squirrel-cage bars.	When the motor is rotating freely, there may be slight movement at the start of pre-positioning. If it does not affect the process, this method is recommended for starting. When the motor cannot rotate freely and Lq/Ld (F1-34/F1-32) of the motor is lower than 1.5, select voltage pulse start mode (d0-71 = 0) and increase the synchronous motor initial position detection current (d0-75). Otherwise, select high-frequency injection start mode (d0-71 = 1), and set the initial position compensation angle (d0-76) to 180 and operate for several times. For synchronous motors with squirrel cage, reverse rotation may occur under inaccurate auto-tuned pole position. It is recommended to apply the V/f mode for asynchronous motors.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The power rating of the drive is excessively low.	Check whether a low-overload model is used for high-overload applications or a low-power drive is used to drive a high-power motor.	Use a drive with higher power rating.
The synchronous motor reports a fault after overspeed or the synchronous motor coasts to stop after manual setting.	When the synchronous motor overspeed occurs, the value of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is much higher than the bus voltage. After the motor is interrupted, the field weakening current disappears and the U/V/W phase voltage increases dramatically in a short time. This causes the output diode to energize in the reverse direction and back EMF short circuit. If the product of back EMF (F1-12) x operating frequency (U0-00) x 1.414 is higher than the overvoltage threshold, operation interruption may cause overvoltage of the drive and may damage the drive.	Set the positive frequency upper limit (d1-03) to the result of overvoltage threshold (A4-39)/ (1.414 x back EMF of synchronous motor). Keep the maximum operating speed below this limit. Select the motor type properly. A motor with high back EMF can effectively reduce the output current. However, running at a speed above the limit may result in overvoltage or damage.

Cause	Verification method	Solution
Derated operation applies due to long-term operation at low frequencies.	During low-frequency operation, large fluctuation in IGBT temperature may easily occur, resulting in thermal stress and damage the IGBT. The derating ratio increases from 0% to 20% when frequency changes from 5 Hz to 0 Hz.	Use a drive with higher power rating.
Model-related parameters are set incorrectly.	Check the nameplate of the drive to ensure the rated power/current/ voltage of the drive (A3-02/A3-03/ A3-04) are consistent with those on the nameplate.	Set model parameters properly.
Derated operation applies due to excessively high carrier frequency.	Setting the carrier frequency (A5-01) to a value higher than the default can result in derating of the output with load.	Set a proper carrier frequency. If the high carrier frequency output capability is insufficient, it is recommended to use a drive with higher power.

E111.1/A111.1/L111.1/N111.1: Motor pre-overload

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

When pre-overload protection is enabled, the cumulative overload of the motor exceeds the motor overload alarm coefficient (d1-47).

Troubleshooting:

Cause	Verification method	Solution
The load is excessive the motor is stalled.	Case 1: When the asynchronous motor is overloaded, switch to V/f control (F0-01 = 2) and observe whether the output current is also excessively high. If the motor parameters are correctly set and overload still occurs during slow acceleration with load, then the load is excessive. Case 2: During high-speed operation in vector control, if the output torque (U0-06) x operating frequency (U0-00) is close to the output power (U0-05) and the output torque is high, the load is excessive. Case 3: Check whether the brake can be released properly.	In case 1, when the asynchronous motor operates at low speed when overloaded, increase the no-load current (F1-30) properly and simultaneously decrease the mutual inductance (F1-28), ensuring their product remains unchanged. In case 2, when the synchronous motor operates at low speed when overloaded, increase the MTPA tuning coefficient (d5-29) for a salient pole motor and observe whether the overall output current decreases; when overload occurs due to excessive load in the high-speed field weakening range, increase the overmodulation coefficient (A5-06) to a value lower than or equal to 108%. In case 3, release the brake. If the preceding methods are ineffective, it is recommended to use a drive of higher power rating.
The synchronous motor is demagnetized in SVC mode.	Record the current back EMF (F1-12), disassemble the motor coupling, and perform dynamic auto-tuning for the synchronous motor (F1-69 = 12) again. Check whether the newly auto-tuned back EMF is lower than the initial auto-tuned value. If yes, an exception occurs. Note that when the motor temperature increases, the back EMF decreases by less than 10%. If the back EMF recovers after cooling, it is normal.	Analyze the specific demagnetization causes. Common causes include low carrier frequency, oscillation in speed control mode, and excessive motor back EMF and output current harmonic. If the preceding errors are not rectified, demagnetization may occur again even after the motor is replaced.
Motor parameters are set incorrectly.	Check the nameplate of the motor to ensure the basic parameters of the motor (F1-00 to F1-12) are consistent with those on the nameplate.	Set the motor rated parameters (F1-00 to F1-12) according to the motor nameplate.
The incoming voltage is excessively low.	1. Check whether the input voltage meets the design requirements (380 V models: 380 V to 480 V). 2. Check whether the upstream circuit breaker or contactor trips or cannot be closed.	1. Increase the input voltage to a value within the normal range. 2. Ensure that the inlet switch is normal.
The motor pre-overload alarm coefficient (d1-47) is set improperly.	The default motor overload data of the drive does not match the actual motor. The actual motor temperature rise is not high.	Increase the motor pre-overload alarm coefficient (d1-47) to extend the time for the motor to report an overload. If the motor continues to report a fault during long-term operation, you can directly turn off the motor overload protection.

E114.1/A114.1/L114.1/N114.1: Module pre-overtemperature

Default fault level:	13: Alarm	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The module temperature exceeds the module pre-overtemperature threshold (Overtemperature - module pre-overtemperature margin (A3-52))

Troubleshooting:

Cause	Verification method	Solution
The ambient temperature is excessively high.	Measure the ambient temperature to check whether it is higher than 50°C.	Lower down the ambient temperature.
The air duct is blocked.	Check whether the air filter of the fan is blocked.	Clean the ventilation duct.
The fan is damaged.	After cooling down, start the drive and observe whether the fan rotates.	Replace the damaged fan.
The thermistor of drive module is damaged.	Test the thermistor of the drive.	Contact the technical support.
The drive is damaged.	The fault persists after the preceding measures are taken.	Contact the technical support.

E132.3: Parameter power-off error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

Parameter storage failure upon power-off

Troubleshooting:

Cause	Verification method	Solution
Parameter errors occur upon power-off.	Parameters are not saved upon power-off.	Contact the technical support.

E150.1/A150.1/L150.1/N150.1: Positive limit fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

This fault is reported if the value reaches or exceeds the positive limit (#51 DI).

Troubleshooting:

Cause	Verification method	Solution
The value reaches or exceeds the positive limit.	1. Read the DI terminal status through U0-07 and check whether the positive limit has been reached. 2. Observe whether the equipment position has exceeded the positive limit.	Enable the drive to run in the reverse direction until the device moves to a position within the safe range. In this case, the alarm will be reset automatically.

E150.2/A150.2/L150.2/N150.2: Negative limit fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 9: Operating at limited speed A: Run at limited power B: Run at limited current C: Run at limited torque D: Alarm E: Prompt F: Not detected		

Fault cause:

This fault is reported if the value reaches or exceeds the negative limit (#51 DI).

Troubleshooting:

Cause	Verification method	Solution
The value reaches or exceeds the negative limit.	1. Read the DI terminal status through U0-07 and check whether the negative limit has been reached. 2. Observe whether the equipment position has exceeded the negative limit.	Enable the drive to run in the forward direction until the device moves to a position within the safe range. In this case, the alarm will be reset automatically.

E155.1/A155.1/L155.1/N155.1: DO1 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO1 hardware feedback fault (bit2 of U0-62) is detected during DO1 output. The fault is reported after this condition persists for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO1 output. 2. Overtemperature occurs on DO1 hardware circuit. 3. The DO1 output circuit is damaged.	Check whether bit2 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E155.2/A155.2/L155.2/N155.2: DO2 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO2 hardware feedback fault (bit3 of U0-62) is detected during DO2 output. The fault is reported after such state lasts for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO2 output. 2. Overtemperature occurs on DO2 hardware circuit. 3. The DO2 output circuit is damaged.	Check whether bit3 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E155.3/A155.3/L155.3/N155.3: DO3 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO3 hardware feedback fault (bit4 of U0-62) is detected during DO3 output. The fault is reported after such state lasts for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO3 output. 2. Overtemperature occurs on DO3 hardware circuit. 3. The DO3 output circuit is damaged.	Check whether bit4 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E155.4/A155.4/L155.4/N155.4: DO4 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO4 hardware feedback fault (bit5 of U0-62) is detected during DO4 output. The fault is reported after this condition persists for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO4 output. 2. Overtemperature occurs on DO4 hardware circuit. 3. The DO4 output circuit is damaged.	Check whether bit5 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E155.5/A155.5/L155.5/N155.5: DO5 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO5 hardware feedback fault (bit6 of U0-62) is detected during DO5 output. The fault is reported after this condition persists for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO5 output. 2. Overtemperature occurs on DO5 hardware circuit. 3. The DO5 output circuit is damaged.	Check whether bit6 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E155.6/A155.6/L155.6/N155.6: DO6 hardware fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A DO6 hardware feedback fault (bit7 of U0-62) is detected during DO6 output. The fault is reported after this state lasts for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on DO6 output. 2. Overtemperature occurs on DO6 hardware circuit. 3. The DO6 output circuit is damaged.	Check whether bit7 of U0-62 is 1.	1. Reduce the load driven by DO. 2. Improve the working environment to cool down the drive. 3. Contact the manufacturer to replace the control board.

E159.1: Automatic fault reset failure

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The fault reset function is configured and the fault cause is eliminated, but the fault is not automatically reset.

Troubleshooting:

Cause	Verification method	Solution
Faults that inhibit fault reset have been reset.	Check whether faults that cannot be reset are set in H3-13...H3-22.	If non-resettable faults are set through H3-13...H3-22, check whether the non-resettable faults can be removed based on actual needs. If non-resettable faults are not in H3-13...H3-22, restart and check whether the fault can be rectified. If the fault persists, contact Inovance technical support.

E160.1/A160.1/L160.1/N160.1: Modbus-RTU communication timeout

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

Modbus timeout (not 0) is configured and no data is received after the timeout period elapses.

Troubleshooting:

Cause	Verification method	Solution
Ambient interference exists.	Check whether the RS485 communication cable is correctly connected.	Connect the 485 communication cable.
The baud rate and data format of the master and slave are inconsistent.	Check whether communication parameters such as station number (n2-02), communication baud rate (n2-00), and data format (n2-01) are set correctly. The baud rate and data format set by the host controller and the AC drive must be consistent. The station number must be unique. Otherwise, communication can fail.	Ensure that the baud rate, data format, and station number set by the host controller and those set in the AC drive are consistent.
The master does not send request data to the slave within the timeout period.	1. Check whether the master configures data request commands for the slave that reports errors. 2. Check whether the values of the Modbus communication timeout (n2-04) and the PLC communication cycle are proper. The Modbus communication timeout (n2-04) must be greater than the PLC communication cycle.	1. Ensure that the master configures data request command for the slave that reports errors. 2. Ensure that the value of the Modbus communication timeout (n2-04) is higher than the PLC communication cycle.

E165.1/A165.1/L165.1/N165.1: EtherNet/IP EtherNet communication timeout

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The device cannot receive the data packets sent by the controller within the set communication cycle or the data packets received are incorrect.

Troubleshooting:

Cause	Verification method	Solution
The power supply of the device is unstable or the network topology is disturbed.	1. Check whether the power supply of the equipment is stable. Measure whether the bus voltage is within the operating voltage range. If not, check whether a high-power device is using the same power supply. The same power supply is used for high-power devices. This may cause voltage instability. In this case, an independent power supply is required. 2. Check whether the communication cable and power cable are routed through different routes. If the communication cable is routed together with the power cable, interference may occur. It is recommended to route the cables through different routes according to the cable routing specifications.	1. Ensure that no high-power devices share the same power supply. Use an independent power supply. 2. Route the communication cables and power cables through different routes. 3. If the voltage is still unstable after preceding measures are taken, replace the power supply.
A fault occurs on the network device.	1. Ping the device continuously, check whether the device responds and whether the response delay is greater than the set communication service cycle. If no response or response delay is greater than the communication service cycle, the network equipment may be faulty. Use the step-by-step ping method to locate the faulty device and replace it. If the response delay is lower than the communication service cycle, check whether the delay fluctuation is stable or too large. If it is unstable or too large, the network equipment may be faulty or the network bandwidth may be insufficient. 2. Check whether the network bandwidth is sufficient with the command ifconfig.	1. Replace the network device that is faulty in the network topology. 2. If the network bandwidth is insufficient, reduce the number of nodes in the network topology or upgrade the network bandwidth.
The controller is faulty.	Check whether the controller works properly and whether there is any data sent. If not, the controller is abnormal and needs to be replaced.	Replace the controller.

E165.2/A165.2/L165.2/N165.2: EtherNet/IP EtherNet hardware error

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The EtherNet integrated circuit cannot be configured.

Troubleshooting:

Cause	Verification method	Solution
The EtherNet integrated circuit is faulty.	Check whether the MCB network port, PHY integrated circuit, and network transformer are dirty.	Clean the dirty parts. If this is not possible, contact technical support.

E165.3/A165.3/L165.3/N165.3: EtherNet/IP MAC not programmed

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

No MAC address or illegal MAC address is detected after power-on.

Troubleshooting:

Cause	Verification method	Solution
MAC address is lost.	Check whether the MAC address of the drive can be read by the host controller through the iFA commissioning software. If it cannot be read, the MAC address is lost.	Contact the technical support.

E165.4/A165.4/L165.4/N165.4: EtherNet/IP IP conflict

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

Two identical IP addresses are detected in the communication network.

Troubleshooting:

Cause	Verification method	Solution
IP address conflict exists in the communication network.	Disconnect the device from the network and check whether the fault disappears. If there is no fault when the device is not connected to the network, the fault is reported after connection. The IP address of this device conflicts with other devices in the network.	Modify the IP address of the conflict device.

E166.1/A166.1/L166.1/N166.1: PROFINET communication timeout

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

After normal communication with the master is established, the connection is interrupted.

Troubleshooting:

Cause	Verification method	Solution
The master or slave is disconnected during communication.	The operating panel displays the fault code.	Check the communication lines between the master and slave.

E166.3/A166.3/L166.3/N166.3: PROFINET mapping address error

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The slave receives the PZD mapping configured by the master, but some or all of the mapped addresses are illegal, such as no parameter available, read-only parameters are being written, write-only parameters are being read.

Troubleshooting:

Cause	Verification method	Solution
The mapping configured during configuration is invalid.	The operating panel displays the fault code and the master cannot establish data interaction with the slave.	Modify the illegal mapping address.

E170.1/A170.1/L170.1/N170.1: Internal communication disturbed or module operation stopped

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The internal bus data is being disturbed, resulting in check failure.

Troubleshooting:

Cause	Verification method	Solution
The power supply is unstable.	Check whether the main power supply of the device is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the main control board or replace with a new one.

E170.2/A170.2/L170.2/N170.2: Synchronous frame loss fault on the main control board end during internal communication

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

The synchronous frame cannot be received or the received synchronous frame data is abnormal.

Troubleshooting:

Cause	Verification method	Solution
The power supply is unstable.	Check whether the main power supply of the device is stable, whether the wiring is complete, and whether the power supply is shared by other high-power equipment.	Replace with a stable independent power supply.
There is a strong electromagnetic radiation source near the equipment.	Check whether high-power devices that can generate electromagnetic radiation are near the drive.	Remove such high-power devices or install metal shield to the devices.
A fault occurred on the device.	Check whether the main control board and components of the device are contaminated or damaged.	Clean the main control board or replace with a new one.

E174.1/A174.1/L174.1/N174.1: 24 V safety power supply 1 fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A hardware feedback fault is detected during 24 V safety power supply 1 output (bit1 of U2-13). The fault is reported after such state lasts for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on the 24 V safety power supply. 2. Overtemperature occurs on the 24 V safety power supply circuit. 3. The 24 V safety power supply output circuit is damaged.	Check whether bit 0 of U0-62 is 1.	1. Troubleshoot peripheral circuits to reduce the load on the peripheral drive. 2. Clean the air duct and improve heat dissipation conditions. 3. Contact the manufacturer to replace the control board.

E174.2/A174.2/L174.2/N174.2: 24 V safety power supply 2 fault

Default fault level:	3: Decelerate to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

A hardware feedback fault is detected during 24 V safety power supply 2 output (bit2 of U2-13). The fault is reported after such state lasts for one second.

Troubleshooting:

Cause	Verification method	Solution
1. Overcurrent occurs on the 24 V safety power supply. 2. Overtemperature occurs on the 24 V safety power supply circuit. 3. The 24 V safety power supply output circuit is damaged.	Check whether bit 0 of U0-62 is 1.	1. Troubleshoot peripheral circuits to reduce the load on the peripheral drive. 2. Clean the air duct and improve heat dissipation conditions. 3. Contact the manufacturer to replace the control board.

E186.1: Failure in reading/writing model parameters

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

Model parameters are not written or read successfully.

Troubleshooting:

Cause	Verification method	Solution
Power unit EEPROM read/write times out.	Check whether the operating panel or commissioning software has a corresponding fault code.	If the fault persists after restart, contact the technical support.

E186.2: Power unit parameter error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 2: Quick stop 3: Decelerate to stop 15: Ignore		

Fault cause:

There is not storage-type parameters in the power unit.

Troubleshooting:

Cause	Verification method	Solution
The power body is replaced with a new one.	Check whether the power unit is new.	Set A3-19 to 1 and reset after downloading the model parameters.

E186.3: Preset model parameters of main control board not matching the power board

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E186.2: Power unit parameter error		

Fault cause:

The model parameters in the main control board are not consistent with those in the power unit.

Troubleshooting:

Cause	Verification method	Solution
The power unit has been replaced and the parameters of the power unit are inconsistent with those of the main control board.	Check whether the power unit has been replaced.	Reset the operation.
The control board has been replaced and the parameters of the control board are inconsistent with the those of the power unit.	Check whether the control board has been replaced.	Reset the operation.

E189.1/A189.1/L189.1/N189.1: IDS communication timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E085.1/A085.1/ L085.1/N085.1: Sequence fault 1		

Fault cause:

Communication between the commissioning software and the drive fails.

Troubleshooting:

Cause	Verification method	Solution
The IDS communication fault is triggered when the software tool is disconnected from the drive after obtaining control permissions and controlling the motor operation.	Check whether the SOP-20 and the PC are connected reliably. Check whether the connection between SOP-20 and the drive is proper, and whether the routing is proper.	Ensure the SOP-20 is reliably connected to the PC. Ensure the connection between SOP-20 and the driver is reliable. Ensure the wiring is proper. You can install a ferrite core to eliminate interference.

E192.1: Speed tracking timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The speed tracking time exceeds the threshold.

Troubleshooting:

Cause	Verification method	Solution
The speed of the synchronous motor exceeds the tracking range.	Check whether the synchronous motor speed is excessively high (U0-00).	Set d0-02 to 1 (Flying start) after the speed of the synchronous motor (F0-30) is reduced.
Asynchronous motor parameters are incorrect.	Compare the parameters in group F1 to the default values to check whether auto-tuning has been performed.	Perform accurate parameter auto-tuning or download all auto-tuning parameters.

E193.1: Undervoltage suppression limit reached

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The speed reaches the minimum operating frequency (d1-72) or the maximum operating time (d1-68) during undervoltage suppression in the vector control mode.

Troubleshooting:

Cause	Verification method	Solution
In vector control, the speed is reduced to the frequency lower limit (d1-72) during undervoltage suppression. The bus voltage can no longer be kept through power generation.	1. Check whether the operating frequency (U0-00) at fault is lower than the minimum operating frequency in undervoltage suppression (d1-72). If yes, an exception occurs. 2. Start the drive after the bus voltage is stabilized. Check whether the main contactor/grid is normal if power-on is not possible for a long time.	Replace the main contactor. Ensure that the power grid is normal.
Enable operating time limit during undervoltage suppression (bit2 of d1-76 = 1). When the undervoltage suppression operating time reaches the maximum operating time (d1-68), the bus voltage cannot be kept through power generation.	Check that the operating time limit is enabled during undervoltage suppression (bit2 of d1-76 = 1), and the operating time during undervoltage suppression reaches the maximum operating time (d1-68).	If the operating time does not need to be limited during undervoltage suppression, you can disable the limit on the operating time.

N194.1: STO1 and STO2 disconnected

Default fault level:	14: Prompt	Resettable:	Yes
Fault level range:	14: Prompt		

Fault cause:

The 24 V inputs of STO1 and STO2 are abnormal.

Troubleshooting:

Cause	Verification method	Solution
Both STO1 and STO2 are disconnected.	Check whether the 24 V power supply of the STO is normal.	1. Check that the wiring is normal. 2. Contact the technical support.

E195.1: Parameter download interrupted unexpectedly

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop		

Fault cause:

The attempt to download parameters through the commissioning software fails.

Troubleshooting:

Cause	Verification method	Solution
The drive powers off during parameter download.	Check whether the operating panel or commissioning software has a corresponding fault code.	Perform any of the following steps to restore the parameters, and then reset the fault. 1. Perform parameter initialization. 2. Perform parameter download.

E198.1/A198.1/L198.1/N198.1: SD card parameter copy error

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4 to 8: Reserved 9: Operating at limited speed 10: Operating at limited power 11: Operating at limited current 12: Operating at limited torque 13: Alarm 14: Prompt 15: Ignore		

Fault cause:

This fault is triggered upon parameter copy error of the SD card.

Troubleshooting:

Cause	Verification method	Solution
1. The SD card is not inserted. 2. The SD card is damaged. 3. The CAN communication between the main control board and the operating panel is interfered.	Check U0-78/U0-79/U0-80 to confirm whether parameter copy is abnormal.	1. Check whether an SD card is inserted. 2. Replace the SD card.

E198.2/A198.2/L198.2/N198.2: SD card parameter copy timeout

Default fault level:	0: Coast to stop	Resettable:	Yes
Fault level range:	Same as E198.1/A198.1/L198.1/N198.1: SD card parameter copy error		

Fault cause:

This fault is triggered when the parameter copy time exceeds the time (default 180s) defined by A0-29.

Troubleshooting:

Cause	Verification method	Solution
1. The SD card is damaged. 2. The CAN communication between the main control board and the operating panel is disturbed.	Check whether the parameter copy time exceeds the time set through A0-29.	1. Check whether an SD card is inserted. 2. Replace the SD card.

17 Maintenance

17.1 Safety Instructions for Maintenance

- Maintenance, inspection, and parts replacement must be performed only by professionals.
- Never service the equipment with power on. Failure to comply can result in an electric shock.
- Cut off all power supplies of the equipment, and wait for at least the time specified on the warning label before maintenance.



- Measure that the voltage between the positive and negative busbar terminals of the main circuit is below 36 V before maintenance.
- Mechanical protective measures must be taken during maintenance to protect personal safety. Wear or use necessary protective devices (such as anti-crush shoes and protective gloves) to prevent product damage and personal injury caused by unexpected incidents such as falling objects.

17.2 Routine Maintenance

17.2.1 Routine Maintenance List

17.2.1.1 Routine Checklist

Table 17–1 Routine checklist

No.	Item	Compliance
1	The motor operates without generating unusual noise.	☐
2	The motor operates without generating unusual vibration.	☐
3	The motor cooling fan operates properly.	☐
4	The electrical cabinet operates properly.	☐
5	The electrical cabinet cable tray operates properly.	☐
6	The operating current of the drive does not exceed the rated current of the drive.	☐
7	The operating current of the drive does not exceed the rated current of the motor.	☐

No.	Item	Compliance
8	The main circuit power supply voltage is normal.	☐
9	The control circuit power supply voltage is normal.	☐

17.2.1.2 Routine Cleaning List

Table 17–2 Routine cleaning list

No.	Item	Compliance
1	Remove dust on the equipment, especially metal dust, to prevent the dust from entering the equipment.	☐
2	Remove the liquid and oil from the surface of the equipment to prevent contaminants from corroding the equipment.	☐



- Keep the equipment clean.
- Disconnect the HV fast breaker on the battery side before cleaning. Clean the equipment with a blower gun or dry cleaning cloth.

17.2.2 Regular Checklist

Table 17–3 Regular checklist

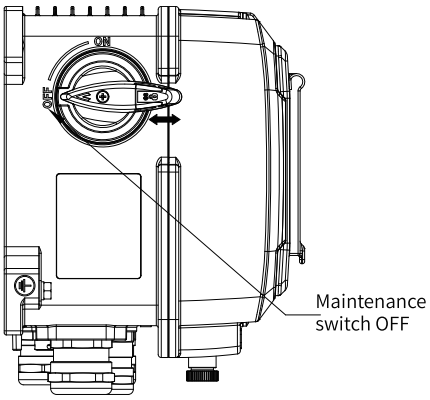
No.	Item	Compliance
1	No wastes, dirt, or dust exist on the surface.	☐
2	The power cables or couplings are not discolored.	☐
3	The insulation layer of the cable is not aged or cracked.	☐
4	No loose contact or unusual noise is generated when the peripheral electromagnetic contactor operates.	☐
5	Peripherals are not short-circuited, contaminated by water, expanded, or cracked.	☐
6	The air duct or heatsink is not blocked.	☐
7	The fan is not damaged.	☐
8	The control circuit components are in good contact.	☐
9	The control circuit terminal screws are connected properly.	☐
10	The insulation layer of the control circuit cable is not cracked.	☐

17.2.3 Main Circuit Inspection Method

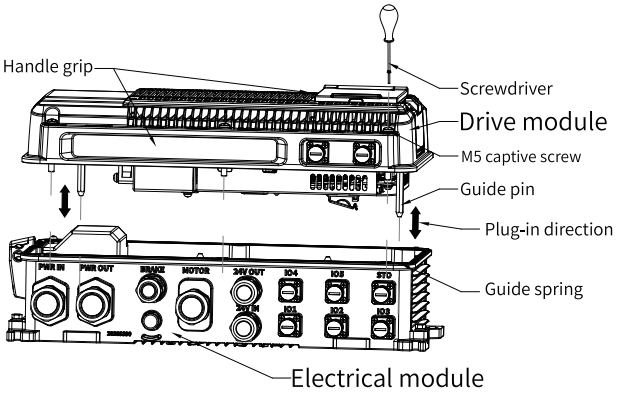
Ready

Before maintenance, perform the following operations.

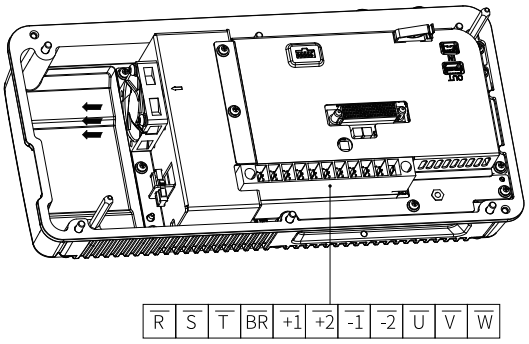
Step 1. Set the maintenance switch to the OFF position, and lock it if necessary.



Step 2. Remove the drive module from the electrical module.



Step 3. Use a multimeter to measure the voltage between the positive and negative busbar terminals of the main circuit (+2 /-2 on the terminal diagram), and proceed to the next step only when the voltage measured is below 36 V.



Main circuit power device inspection

By measuring the diode voltage drop of the drive rectifier bridge, inverter bridge, and braking transistor, the condition of the power module can be preliminarily determined. Use the diode test function of the multimeter to perform inspection on the main circuit terminals of the drive, as shown below.

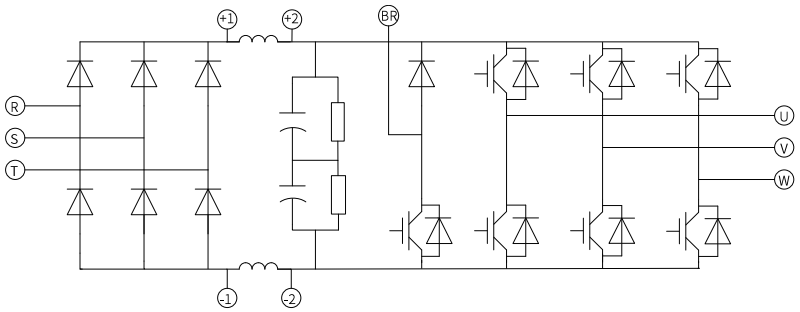


Figure 17-1 Main circuit topology

Test item	Tested component	Test position		Measurement standard
		Black probe of the multimeter	Red probe of the multimeter	
Rectifier bridge forward voltage drop	Upper arm of phase R	+1	R	Typical value about 0.4 V (Range: 0.25 V to 0.6 V, which must be consistent in R/S/T with an error within 0.1 V)
	Upper arm of phase S	+1	S	
	Upper arm of phase T	+1	T	
	Lower arm of phase R	R	-1	
	Lower arm of phase S	S	-1	
	Lower arm of phase T	T	-1	
Inverter bridge forward voltage drop	Upper arm of phase U	+2	U	Typical value about 0.4 V (Range: 0.25 V to 0.6 V, which must be consistent in U/V/W with an error within 0.1 V)
	Upper arm of phase V	+2	V	
	Upper arm of phase W	+2	W	
	Lower arm of phase U	U	-2	
	Lower arm of phase V	V	-2	
	Lower arm of phase W	W	-2	
Brake transistor forward voltage drop	Braking diode	+2	BR	Typical value about 0.4 V (Range: 0.25 V to 0.6 V)
	Braking IGBT	BR	-2	Typical value about 0.9 V (Range: 0.5 V to 1.2 V)
Bus short circuit detection	Bus	+2	-2	Typical value about 0.9 V (Range: 0.5 V to 1.2 V)

Main circuit current detection (input and output)

Main circuit current detection on the drive can only be performed after the drive runs properly with a motor. The current on input and output sides of the drive can be measured with a handheld current clamp or oscilloscope, which can be used to check whether the drive is normal, as shown below.

1. Input current detection:
   The magnitude of the input current is related to the motor load and grid capacity. The heavier the load and the larger the grid capacity, the greater the current can be.

   A handheld current clamp or oscilloscope can be used to measure the three-phase (R/S/T) input current (Ir, Is, It). In normal conditions, the three-phase input currents are balanced, with an error of about ±5% among phases. However, due to imbalances in the amplitude and phase of the three-phase grid voltage, as well as differences in line impedance, this error may be increased to about ±10%. Errors within ±10% are normal.

2. Output current detection:
   The magnitude of the output current is related to the motor load. The heavier the load, the greater the current can be.

   During stable operation of the drive, the output current can be viewed through the operating panel or measured through a handheld current clamp or oscilloscope. In normal conditions, the three-phase output currents are balanced, with a difference of about ±5% among phases. Note that the error may be increased to ±10% due to the motor. Errors within ±10% are normal.

Note

The current detection instrument to be used depends on actual requirements.

- If you only analyze the general problem, measure the three-phase input current and output current directly with the hand-held current clamp. You can determine whether the AC drive is abnormal through routine inspection.
- If you need to locate complex problems, such as motor jitter, torque fluctuation, and overload fault, For overcurrent faults, more detailed detection and analysis is required. In this case, an oscilloscope and corresponding current and voltage detection probes may be required.

17.2.4 Heat Dissipation Inspection Method

After the main power module inside the drive heats up, heat is generally transferred to the heatsink first. If the drive occasionally reports an overtemperature fault, the overall heat dissipation of the drive needs to be inspected, as shown below.

1. Ambient temperature inspection
   Check whether the ambient temperature of the drive is within the normal temperature range. Overtemperature may occur when the load is excessive and the ambient temperature exceeds the specified value. In this case, take measures to reduce the ambient temperature, such as installing an air conditioner in the equipment room.

2. Fan inspection
   Failure of the fan is the most common cause of improper heat dissipation. The drive supports fan inspection where a fault or an alarm is reported when the fan is short-circuited, stalled, or damaged. If the fan is faulty, check whether the fan cable is connected properly. If the fan is damaged, replace the fan.

17.3 Replacing the Drive

Prerequisites

- With backup data: After replacing the drive, data from the original drive will be lost. Therefore, before replacement, back up the data by saving the parameter file to a local PC or SD card. After replacement, load the parameter file to the new drive to quickly restore parameters. For details, see *"17.5 Parameter Upload/Download (Based on iFA Drive Software)" on page 1283*.
- Without backup data: No prerequisites

Procedure

1. Disconnect the main power supply of the drive. When the digital output of the drive uses an external 24 V power supply, disconnect the external 24 V power supply as well.
2. Disconnect cables from the drive.

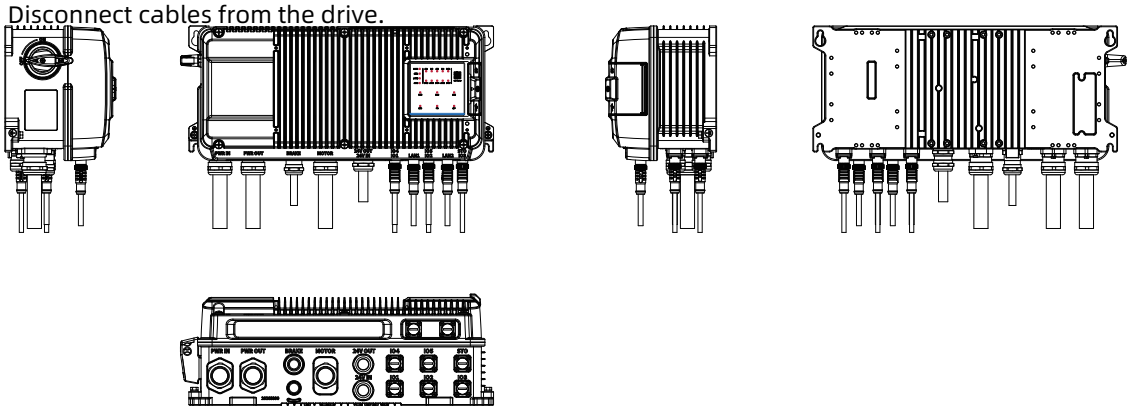


Figure 17-2 Before cable disconnection (gland version)

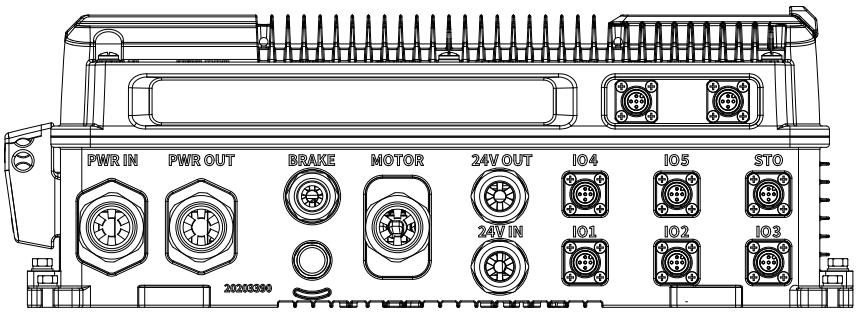


Figure 17-3 After cable disconnection (gland version)

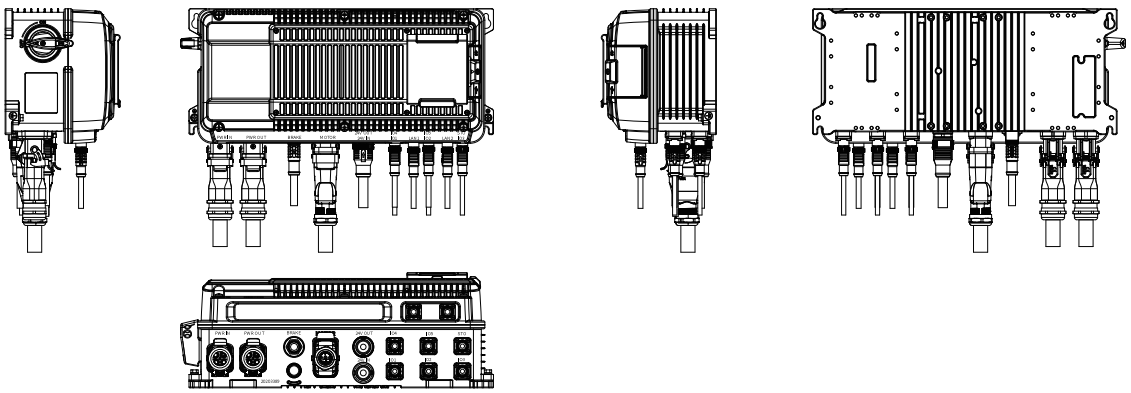


Figure 17-4 Before cable disconnection (heavy-duty version)

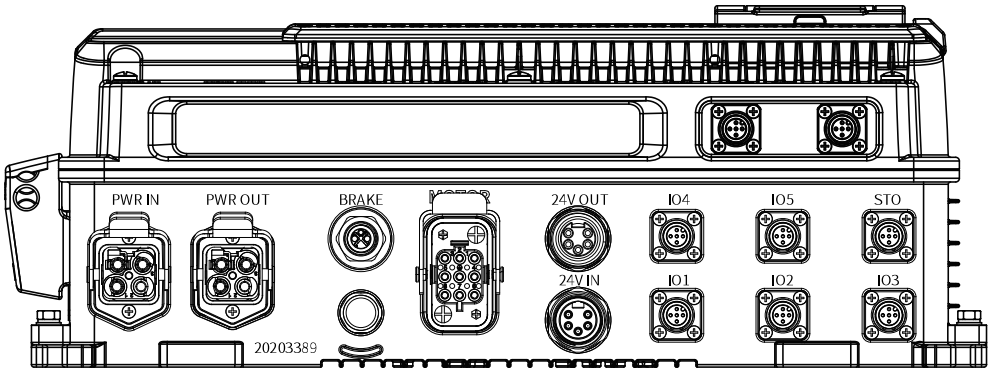


Figure 17-5 After cable disconnection (Heavy-duty version)

3. Open the plastic cover and remove the SD card for replacement into the new drive. (Skip this step if no data backup is available.)

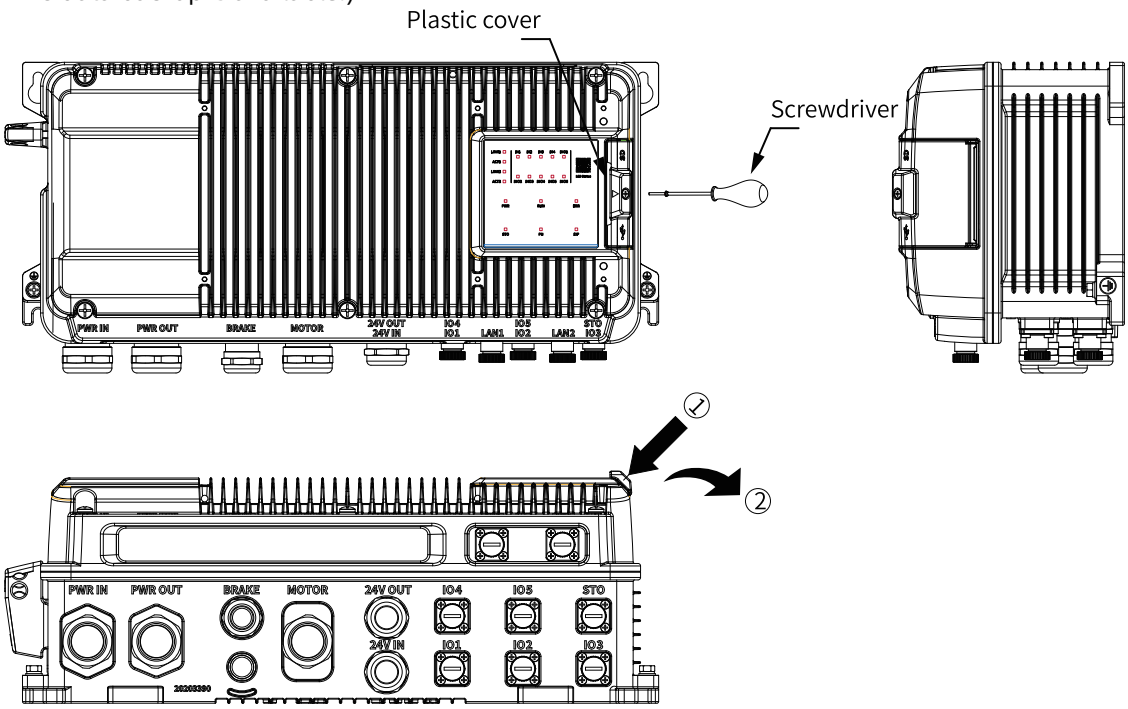


Figure 17-6 Operation control terminal open

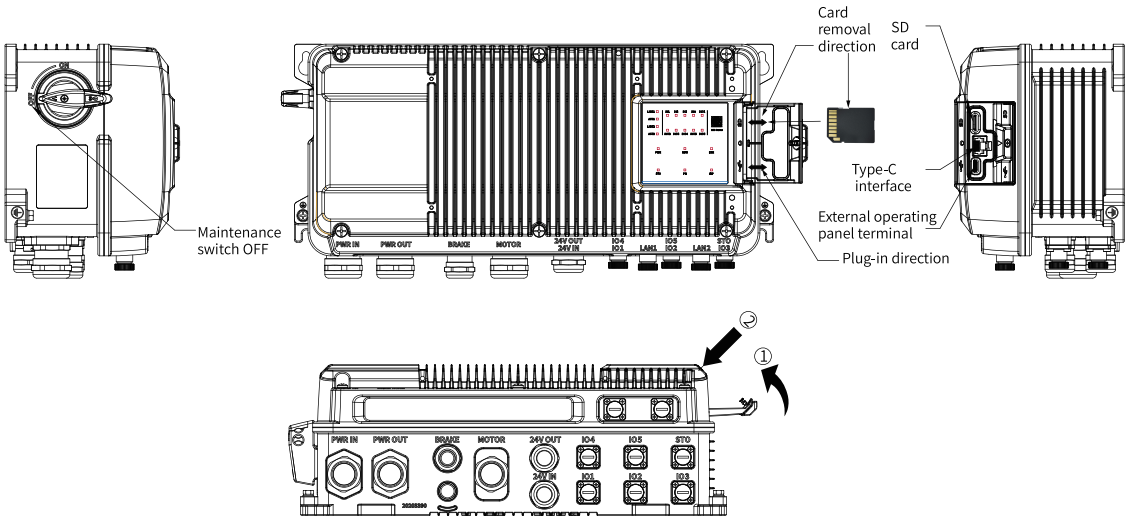


Figure 17-7 Operation control terminal closed

4. Disassembly the drive to be replaced.

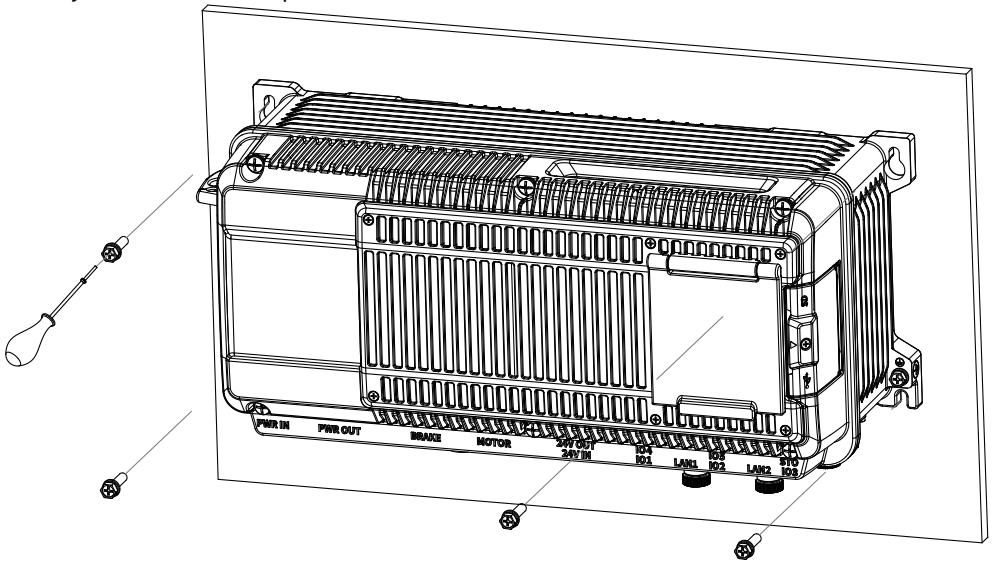


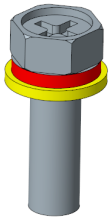
Figure 17-8 Disassembly diagram

17.4 Replacing Components

17.4.1 Maintainable Parts

Name	Reference service life	Item	Measures to extend service life
Fan	10 years	Replace the fan as shown in *"17.4.3 Replacing the Fan" on page 1280*.	Enhance protection around the drive to reduce accumulation of fibrous materials, dust, and other particles in the natural cooling airflow path of the drive. Clean the cooling airflow path regularly according to actual conditions. See details in *" Requirements for Extending Service Life" on page 39*.

17.4.2 Maintenance Tools

Tools	Application materials	Diagram	Position	Quantity	Recommended torque
Driver (matching the bolt head type)	M3 SEMS screw		Fixing DT60N T1 (1.5 kW to 2.2 kW) fan	2	0.55 N·m
	M3 captive screw		Fixing DT60N T1 (0.37 kW to 2.2 kW) plastic cover	1	
	M5 SEMS screw		Fixing DT60N T1 (0.37 kW to 2.2 kW) mounting foot	4	2.8 N·m
			Fixing DT60N T1 (0.37 kW to 2.2 kW) grounding connection	2	
	M5 captive screw		Fixing DT60N T1 (0.37 kW to 2.2 kW) drive module	6	

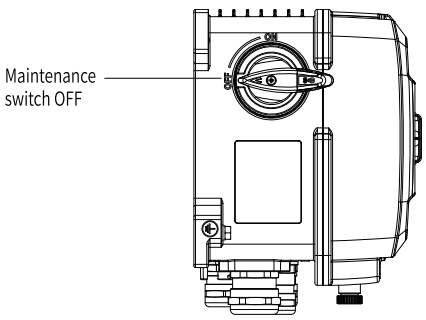
Note

- The tools shown are for reference only. You need to purchase these tools from a third party.
- Use qualified and calibrated tools.
- Unit conversion: 1 N·m ≈ 10 kgf.cm

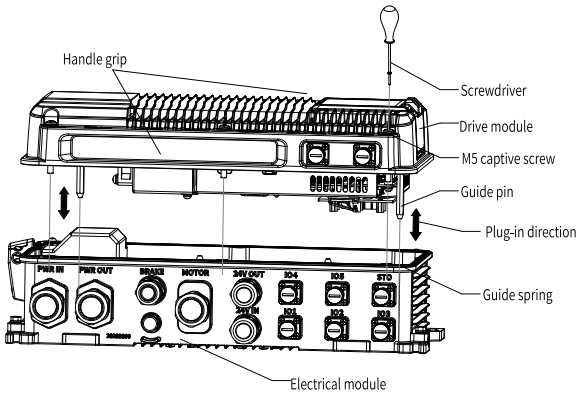
17.4.3 Replacing the Fan

Procedure

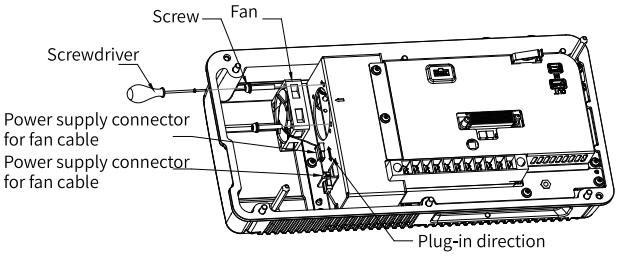
Step 1. Set the maintenance switch to the OFF position.



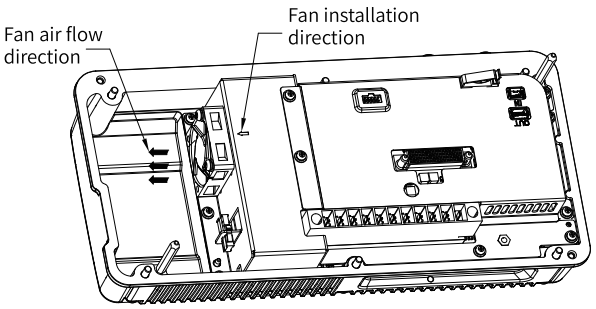
Step 2. Remove the drive module from the electrical module.



Step 3. Remove the two screws that used to secure the fan, then unplug the fan power connector from the fan power socket in the direction indicated by the arrow to remove the fan.

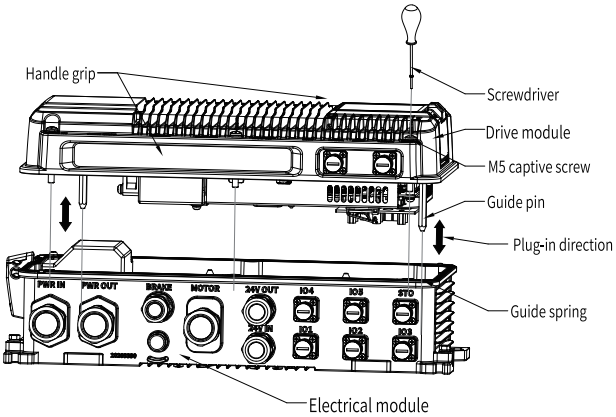


Step 4. Install a new fan based on the same procedure, but in the reverse order. When installing the fan, pay attention to the installation direction. The arrow indicates both the fan installation direction and the air extraction direction.



Step 5. Re-install the drive module onto the electrical module based on the same procedure, but in the reverse order.

Step 6. Power on the device to ensure the fan operates normally.



Note

Contact Inovance sales personnel for how to install the fan.

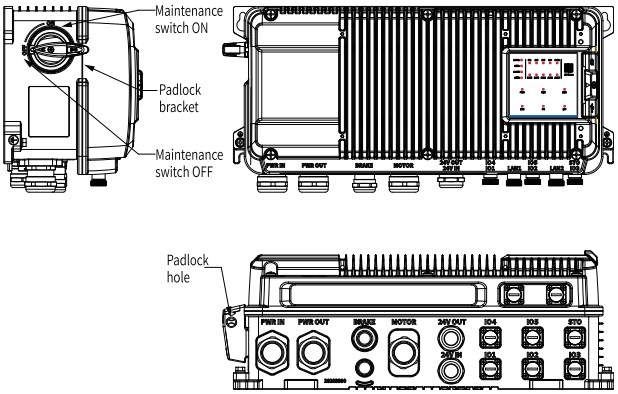
17.4.4 Replacing the Drive Module

Prerequisites

When the drive is replaced, data on the original drive will be lost. Before replacement, back up the data by saving the parameter file to a local PC or SD card. After replacement, load the parameter file into the new device to quickly restore the parameters. Power on the product and ensure the fan operates normally.

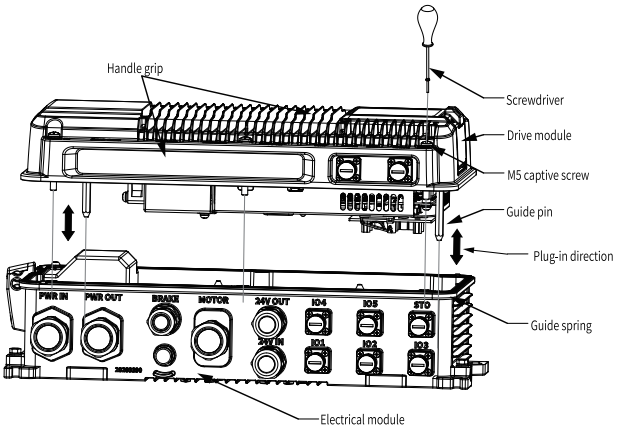
Procedure

Step 1. Set the maintenance switch to the OFF position to disconnect the main power supply of the drive. Lock the main power supply if necessary, and disconnect the external 24V power supply.

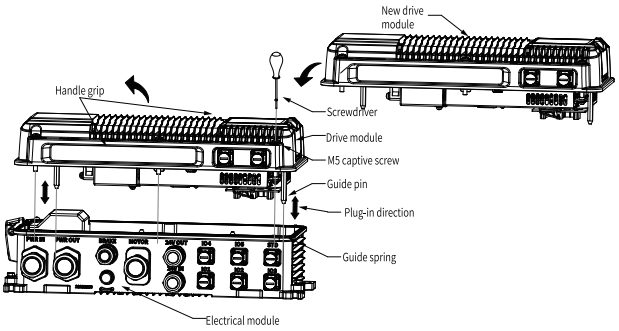


Step 2. Loosen the six M5 self-locking screws located above the drive module.

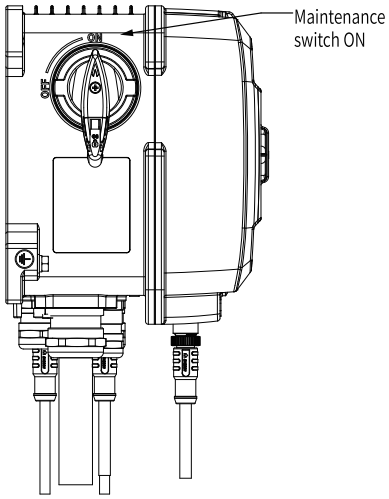
Step 3. Grasp the lower handle with left hand and the upper handle with right hand. Pull out vertically along the direction indicated by the arrow. Do not shake it.



Step 4. Replace the new drive module by first aligning the two guide pins with the guide spring holes, then insert it perpendicularly in the direction indicated by the arrow.



Step 5. Tighten the screws, remove the lock, set the maintenance switch to the ON position to reconnect the main power supply, and re-connect the 24 V power supply.



17.5 Parameter Upload/Download (Based on iFA Drive Software)

Application scenarios

Before replacing the drive or control board, save the parameter file to the local PC first. After replacement is done, import the parameter file from the local PC to the new drive to quickly restore the parameters.

Function description

Parameter upload: Used to save the drive parameters to the local PC.

Parameter download: Used to download the parameter file from the local PC to the drive.

Prerequisites

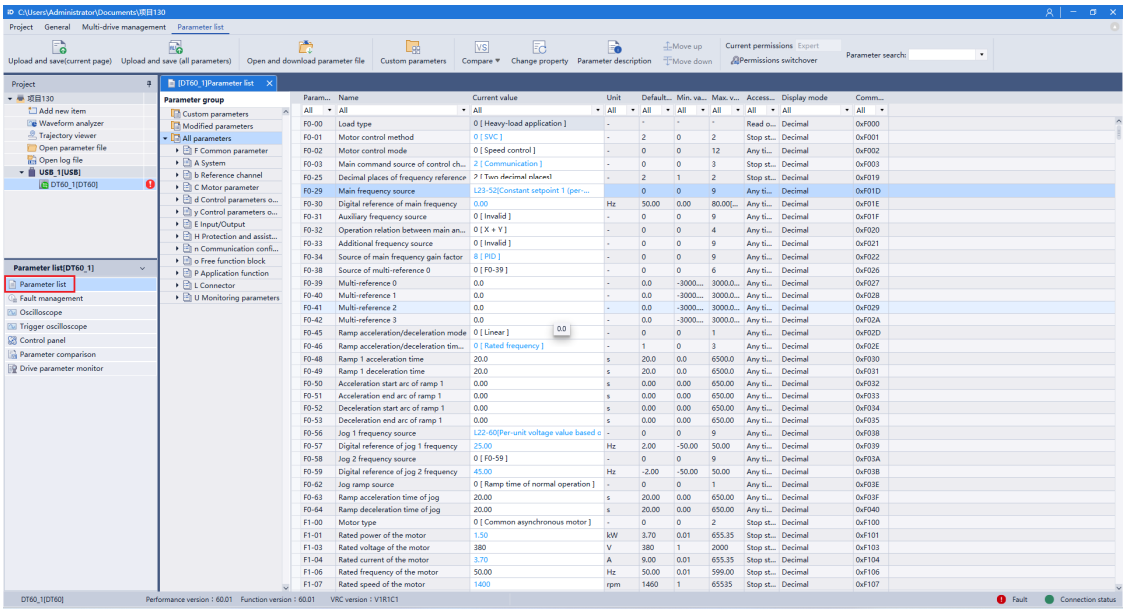
A new project has already been created in the iFA software, and the iFA software has been connected to the drive properly, as shown in *" Enter the Project" on page 125*

Procedure

Step 1: Backing up parameter file

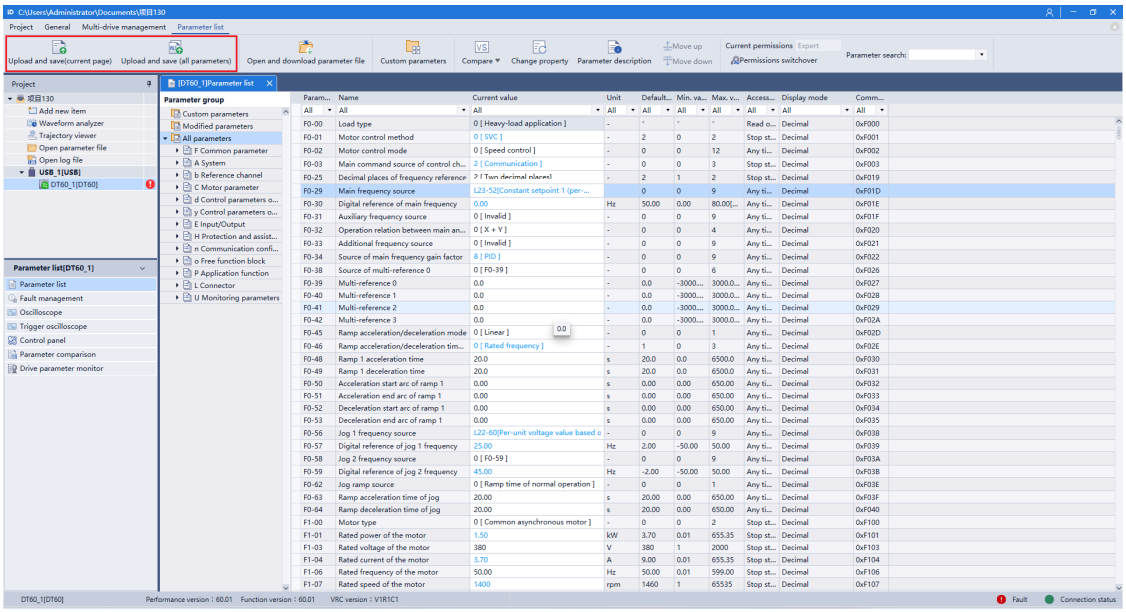
Back up the parameter file from the drive to the local PC, as shown below.

1. A green indicator appears next to the device name (DT60) in the left "Project tree", indicating the device is connected. Double-click on "Parameter list" in the left pane.

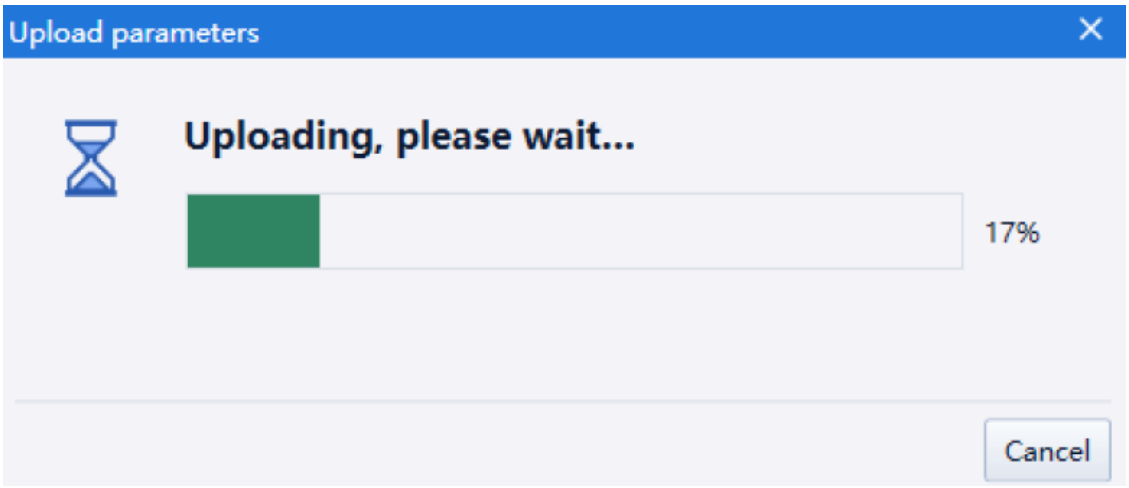


2. The parameter list for the device is displayed. Click the "Upload and save" or "Upload and save current page" button in the upper-left corner to back up the parameter file to the local PC.

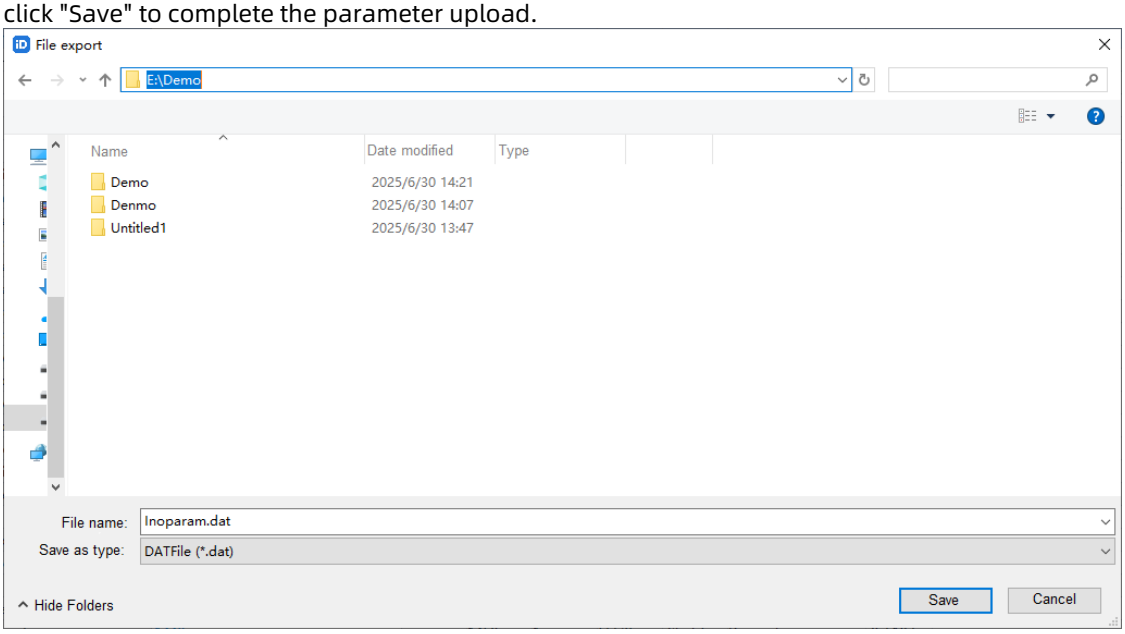
- "Upload and save": All parameters are backed up.
- "Upload and save current page": Only the parameters on the current page are backed up.



As shown in the figure below, the system starts uploading parameters. Do not operate during parameter upload.



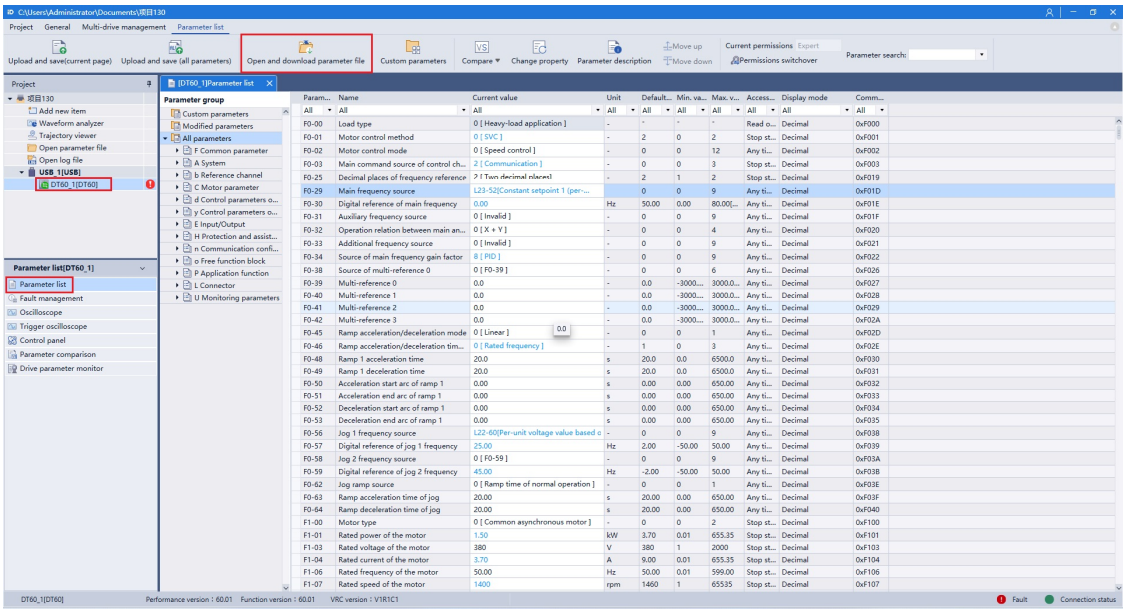
3. After parameters are uploaded, set the directory and filename for saving the parameter file, then click "Save" to complete the parameter upload.



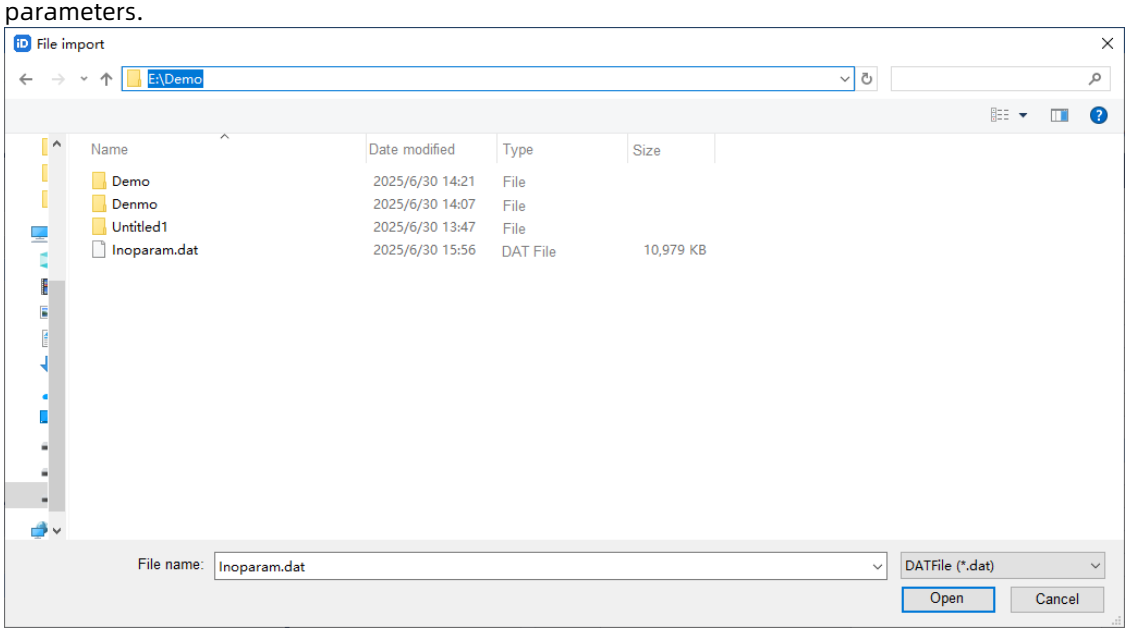
Step 2: Loading parameter file

Load the parameter file saved to the local PC to the drive or another device to achieve rapid parameter replication, as shown below.

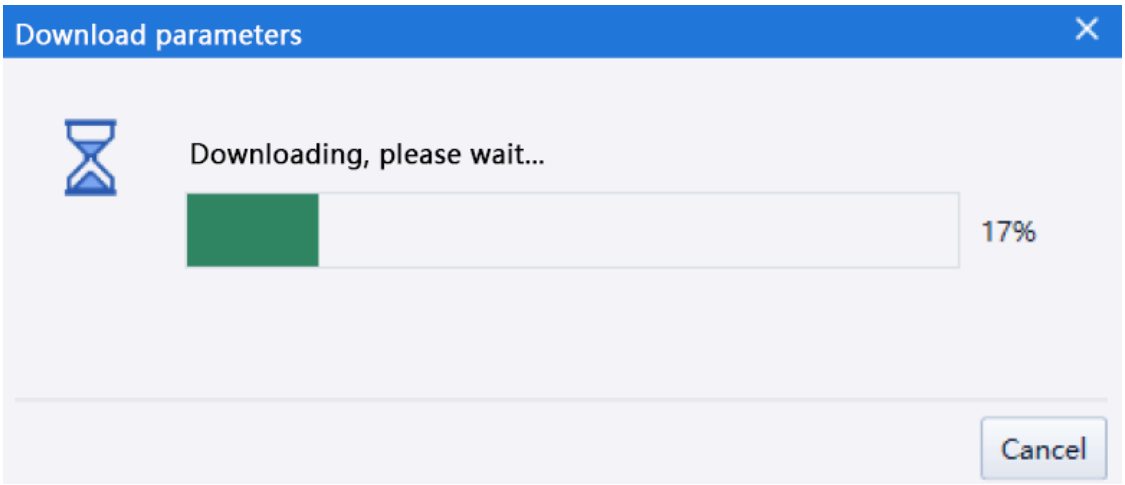
1. On the "Parameter list" page, select the corresponding project (DT60 for example) in the left "Project tree", then double-click "Parameter list" to open the parameter file. Click the "Open and download" button.



2. In the pop-up window, select the parameter file to import, then click "Open" to import the saved parameters.



3. As shown in the figure below, the system starts downloading parameters. Do not operate during parameter download.



4. After parameters are downloaded, a message indicating that operation is done will be displayed.

18 Technical Data

18.1 Electrical Specifications

Note

In the following tables, the rated power of the drive is measured under the following conditions.

For three-phase 380 V to 480 V models, the rated power of the drive is measured at an input voltage of 400 VAC.

Three-phase 380 V to 480 V

Table 18–1 Electrical specifications (Three-phase 380 V to 480 V) (T1: 0.37 kW to 2.2 kW)

Item		Specification					
Model: DT60		1R6	2R0	2R4	3R1	4R1	6R0
Structure		T1					
Input	Rated input current (A)	1.2	1.6	2.0	2.5	3.3	5.2
	Rated voltage/Rated frequency	Three-phase 380 VAC to 480 VAC, 50/60 Hz					
	Allowable voltage fluctuation range	-15% to +10%; actual allowable range: 323 VAC to 528 VAC					
	Allowable frequency fluctuation range	±5%, or 47.5 Hz to 63 Hz					
	Rated power supply capacity (kVA)	1.1	1.5	1.8	2.3	3.0	4.8
Output	Power (kW)	0.37	0.55	0.75	1.1	1.5	2.2
	Rated output current (A)	1.6	2.0	2.4	3.1	4.1	6.0
	Output voltage	Three-phase 0 V to input voltage					
	Maximum output frequency	599 Hz (editable through parameters)					
	Carrier frequency	0.8 kHz to 16 kHz (automatically adjusted according to the load characteristics)					
	Overload capacity	60s for 150% of the rated current, 3.5s for 200% of the rated current					
Cooling mode	Natural ventilation						
Overvoltage category	OVCIII						
Pollution degree	PD2						
Protection class	Class I						
Grid type	TN, TT, IT						

Item		Specification					
Model: DT60		1R6	2R0	2R4	3R1	4R1	6R0
IP rating	IP66						

18.2 General Specifications

Item			Technical specifications
Motor control performance	Applicable motor type		Asynchronous induction motor (IM) and permanent magnet synchronous motor (PMSM)
	Control mode		Sensorless vector control (SVC), and voltage/frequency (V/f) control
	Asynchronous motor (V/f)	Functions available	Energy-saving control, overvoltage suppression, overcurrent suppression, undervoltage suppression (voltage dip suppression), oscillation suppression, torque boost, slip compensation, V/f curve selection, decoupled V/f, DC braking, random PWM, fast deceleration upon over-excitation, and droop control
	Asynchronous motor (SVC)	Functions available	Energy-saving control, inertia auto-tuning, acceleration feedforward, adaptive speed loop parameters, droop control, free programming and self-adaption of speed loop parameters, load observer, overvoltage suppression, undervoltage suppression (voltage dip suppression), over-excitation fast deceleration, automatic voltage adjustment, flying start, and DC braking
		Speed regulation range	1:500
		Starting torque	200%
		Torque step response	Within 2 ms
		Torque control accuracy	±3% at frequencies above 5 Hz
		Speed stability accuracy	Within 10% of the rated slip value
		Field weakening ratio	6 x field weakening
	Permanent magnet synchronous motor (SVC)	Functions available	Speed tracking, electronic star connection, fast deceleration upon over-excitation, MTPA maximum torque-to-current ratio control, inertia auto-tuning and acceleration feedforward, droop control, adaptive speed loop parameter programming, overvoltage suppression, undervoltage suppression, DC braking, I/F control in SVC
		Speed regulation range	1:200
		Starting torque	200%
		Torque step response	Within 2 ms
		Speed stability accuracy	0.05% (without motor defects)
		Torque control accuracy	±3% at frequencies above 5 Hz

Item			Technical specifications
Basic functions	Resolution of input frequency		Digital setting: 0.01 Hz Analog setting: maximum frequency x 0.025%
	Operation	Operation command	Independent dual channel and dual channel, which can be switched freely Provides different start/stop sources (terminal, operating panel, communication, user-defined, connector). Provides standard control word.
		Frequency reference	Independent dual channel and dual channel, which can be switched freely Provides various sources (communication, operating panel, connector, and so on). Supports main frequency, auxiliary frequency, and various operations (addition, subtraction, multiplication, Max, Min). Supports additional frequency. Supports multi-level frequency limits.
		Auxiliary frequency reference	Supports various auxiliary frequency references and allows fine-tuning of the auxiliary frequencies and frequency synthesis.
		Standard command word	Normal start/stop (OFF1) Emergency stop (OFF2) Quick stop, stop with maximum capability (OFF3) Operation enable, operation pause
		Torque reference	Multiple torque reference sources: digital reference, multi-reference, PID, simple PLC, and communication, which can be switched through multiple methods
		Start/Stop mode	Dual channel, which can be switched freely Supports six different start/stop modes (single-wire mode, two-wire mode 1, two-wire mode 2, two-wire mode 3, three-wire mode 1, three-wire mode 2)
		Acceleration/ Deceleration time	Linear acceleration/deceleration and S-curve acceleration/deceleration 4 sets of acceleration/deceleration time 7-segment S-curve can be independently configured. Automatic switchover between acceleration/deceleration
		Multi-motor parameters	4 sets of independent motor parameters
	Multi-speed		Supports up to 16 multi-speed references. Supports different unit settings (Hz, rpm, rated %, maximum speed %). Supports free per-unit conversion. Supports user-defined limit.
	Ramp transition function		When speed references are sent through communication cyclically, automatic interpolation is supported to rectify command discontinuity caused by communication intervals, ensuring smooth operation.
	Output limit		Supports torque limit, power limit, current limit, torque limit, speed limit, and jump frequency.

Item			Technical specifications
Commissioning and configuration (human-machine interface)	Control terminal	DI/DO	Six normal DIOs. E0-59/E0-60 need to be configured as DI or DO function. The DI function of DIO is the same as regular DI. The DO function corresponds to PNP output. The frequency is 100 Hz and output voltage range is 0/24 V. The output current range is 0 mA to 400 mA, with short circuit protection supported.
	External 24 V input and cascaded output		The power supplies are divided into Switch power supply and UnSwitch power supply. The Switch power supply is used as an external power supply for the DIO terminal. The UnSwitch power supply is used for internal communication and basic functions. The input voltage range if 21.6 VDC to 26.4 VDC and the maximum current-carrying capacity of the input and cascaded output terminals is 8 A. The maximum internal load current of an individual drive with an UnSwitch power supply is 0.8 A. The maximum load current of the Switch power supply is 3 A (the actual load current is determined by the external load).
	Display and operations on the operating panel	LED operating panel	Used to display and change parameters and display drive status (forward run, reverse run, stop, operating panel, terminal, communication control, speed/torque control, and STO state).
		Key lock and function	To prevent inadvertent operations, keys on the operating panel can be locked partially, and functions with limited availability range can be assigned to some keys.
	Commissioning software tool		The commissioning software (iFA Drive) supports uploading and downloading of drive parameters, oscilloscope functions, and fault diagnosis. You can monitor internal status of the drive through the oscilloscope. Function logic is presented using data flow diagrams, enabling manual-free commissioning. This helps reduce the learning cost and shorten commissioning time.
	Parameter protection		Supports parameter access write protection to prevent inadvertent parameter modification.
	User password (parameter lock)		Supports user-defined passwords to protect parameter accessibility.
	Parameter access levels		Standard: default level with access to commonly used function parameters Extended: Extended with non-frequent function parameters Expert: Parameters for experts, which can be set with a password

Item			Technical specifications
Advanced functions	Applicability and usability	Application macro	Interface macros: pre-defined with interface schemes for start/stop, speed references, and so on, which can be configured with one key Industry macros: tailored for specific industry applications and combined with classic industry application cases to allow quick parameter configuration
		User-defined user parameter sets	You can recombine and generate new parameter sets. 1. Used to view or set parameters quickly. 2. Used for quick access to single command through communication.
		Auxiliary functions	Timed period arrival, operating time arrival, forward/reverse run dead zone time, frequency reference arrival, current reference arrival, and load speed conversion
		Configurable startup protection	Startup protection modes for different command sources can be configured flexibly.
		Automatic carrier frequency adjustment	Used to improve the overload capacity and allow the carrier frequency to be adjusted with the output frequency.
	Standard process	Process PID	Provides two sets of PID parameters, which can be switched automatically. PID initial value, PID pause, limit amplitude, PID feedback reference filtering, dead zone, integral saturation, forced PID, and PID feedback loss detection
		Free function module	Supports user-defined needs through different free function blocks. Supports arithmetic operations, logic operations, control functions, time control, switch selection functions, multi-point curves, data conversion, and other function blocks
		Simple PLC	Supports 16 operational instructions. Supports user-defined acceleration/deceleration time, speed, and operating time. Supports user-defined cycle mode. Supports value retention upon power failure. Supports pause and reset.
		Droop control	Allows multiple motors to drive the same load simultaneously.
		Jump frequency	Allows the drive to avoid mechanical resonance points of the load. Supports up to 4 jump frequency points.
		Motorized potentiometer	Indicates the virtual potentiometer output achieved through the software.
	Energy efficiency	Energy conservation statistics	Supports capacitor leakage detection and conversion to kWh, CO2 emission, and other related data for direct reading by the host controller.
		Sleep and wake-up	Used to switch the drive to the sleep or standby mode when continuous operation is not needed, and restart the drive when necessary to save energy.
	STO (supported, certification is marked on the nameplate if obtained)		STO safety level: SIL3 (IEC 61508), PL e, Cat.3 (EN ISO 13849) Terminal specification: Dual-loop input for STO1 and STO2, 24 VDC (±15%)

Item		Technical specifications
Communication	Two-in-one industrial EtherNet bus	Integrated dual EtherNet interfaces that support two industrial EtherNet protocols (PROFINET and EtherNet/IP) to reduce inventory costs and shortening delivery time
	Communication command word	Single-word control mode Bit control mode Free mode
	Action upon communication interrupt	Actions upon communication interrupt include "continue operation", "alarm", and "stop at fault".
	User-defined fault	Supports user-defined faults, alarms, and prompts.
	Historical fault log	Supports up to six fault logs. Fault code, fault subcode, operation data, and fault time
	Load monitoring	You can configure the normal operation range of the drive based on actual operating conditions. When the corresponding range is exceeded, you can define faults and alarms as needed.
	Automatic Fault Reset	The fault can be reset automatically. If the number of automatic resets is exhausted, the fault can no longer be reset. The fault whitelist and blacklist can be configured as needed.
	Automatic restart upon fault	After a fault occurs, automatic fault reset and restart are supported. When the number of automatic resets is exhausted, the fault can no longer be reset. The fault whitelist and blacklist can be configured freely.
	Fault protection	Provides protections against ground fault upon power-on, drive overcurrent, drive overload, motor overload, drive overvoltage, drive undervoltage, drive overtemperature, input phase loss, output phase loss, communication fault, current detection fault, braking overcurrent protection, motor load loss, motor step loss, motor stall, motor overspeed, motor overtemperature, current loop error, excessive speed deviation, demagnetization protection, overspeed protection, excessive zero drift, EEPROM read fault, motor parameter auto-tuning fault, ground fault, stall in SVC, and braking state detection fault.
	Capacitor leakage detection	Supports capacitor leakage detection.
	Self-test	Supports self-test on the drive and motor, IGBT shoot-through, current sensor sampling error, ground fault, phase loss, and phase-to-phase short circuit.
Environment	Operating location	Indoors and free from direct sunlight, conductive dust, oil mist, corrosive gas, flammable gas, vapors, water drips, and salty elements
	Altitude	For altitudes equal to or lower than 1000 m, derating is not required. For altitudes between 1000 m and 3000 m, derate 1% for every additional 100 m. For altitudes above 3000 m, contact Inovance.
	Ambient temperature	Storage temperature: -40°C to +60°C Transportation temperature: -20°C to +60°C Operating temperature: -20°C to +60°C. For temperatures above 50°C, derate 5% for every additional 1°C. The maximum temperature is 60°C.
	Humidity	< 95% RH, without condensation

18.3 Motor Compatibility

The following three motor types are supported. Select the motor type according to the actual working conditions.

- Three-phase asynchronous motor
- Three-phase permanent magnet synchronous motor

18.4 Overload Capacity of the Drive

Definition of overload capacity

Overload capacity refers to the ability to temporarily output more than 100% of its rated load. The overload capacity is generally defined based on the 1-minute rating, which is categorized into high overload and low overload.

- High overload: Within every 5-minute operating cycle, the drive is allowed to operate at 150% of the high overload rated output current for 1 min, and at 100% of the high overload rated output current for 4 min.
- Low overload: Within every 5-minute operating cycle, the drive is allowed to operate at 110% of the low overload rated output current for 1 min, and at 100% of the low overload rated output current for 4 min.

Typical load cycle of the drive

Typical applications of high overload mainly include the following.

- Cranes, elevators, lifts, and other lifting-type loads
- Machine tools, stamping press, and other metal processing applications
- Other applications involving high overload ratios, such as startup with high load

These three types of applications typically involve sudden loading and unloading or shock loads, occasionally resulting in output current to rise far above the rated current. High overload models meet the following cyclic overload operating conditions.

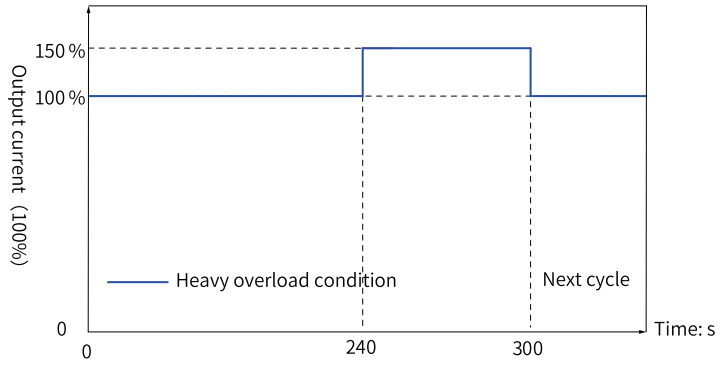


Figure 18-1 Cyclic overload diagram (high load)

Typical applications of low overload mainly include the following.

- Fans, pumps, air conditioning refrigeration, HVAC, and air compressors, and other fluid machinery applications
- Applications that occasionally involve low overload ratios

In these applications, the load is generally stable, and sudden load changes rarely occur. Low overload models meet the following cyclic overload operating conditions.

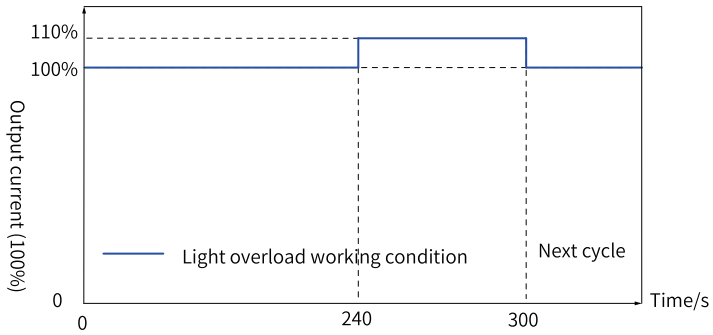


Figure 18-2 Cyclic overload diagram (low load)

18.5 EMC of the Drive

18.5.1 Introduction to Electromagnetic Compatibility

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. Therefore, EMC includes two requirements:

- On one hand, it specifies that the electromagnetic interference (EMI) generated by the equipment during normal operation cannot exceed defined limits in its operational environment.
- On the other hand, it requires the equipment to maintain normal functionality with a specified level of immunity to electromagnetic disturbances present in the environment, referred to as electromagnetic susceptibility (EMS).

EN IEC 61800-3 defines the following two types of environments.

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Devices are divided into the following four categories based on the intended application environment.

- Category C1: Power drive systems with the rated voltage less than 1000 V, intended for use in the first environment.

- Category C2 equipment: PDS with rated voltage less than 1000 V, which is neither a plug-in device nor a movable device and, when used in the first environment, is intended to be installed and commissioned only by professionals.
- Category C3 equipment: PDS with rated voltage less than 1000 V, intended for use in the second environment and not intended for use in the first environment.
- Category C4 equipment: PDS with rated voltage equal to or above 1000 V, or rated current equal to or above 400 A, or intended for use in complex systems in the second environment.

18.5.2 EMC Application in the Drive

To adapt the drive to the above-mentioned environments (see section *"18.5.1 Introduction to Electromagnetic Compatibility" on page 1296*), the following conditions must be met.

Second environment - Category C3

Interference resistance

The drive meets the standard requirements.

Interference emission from the drive

The drive can meet the standard requirements when the following conditions are fulfilled.

- The drive is connected to a TN or TT power grid with the neutral point grounded.
- Low-capacitance shielded motor cables are used.
- The maximum motor cable length does not exceed 10 m.
- The drive and motor are installed in strict accordance with the EMC installation requirements specified in the installation instructions.

Second environment - Category C2

Interference resistance

The drive is suitable for the second environment.

Interference emission from the drive

The drive can meet the standard requirements when the following conditions are fulfilled.

- The drive is connected to a TN or TT power grid with the neutral point grounded.
- Low-capacitance shielded motor cables are used.
- The maximum motor cable length does not exceed 10 m.
- The drive and motor are installed in strict accordance with the EMC installation requirements specified in the installation instructions.

18.6 Derated Operation

When the drive operates above its rated conditions (ambient temperature, altitude, and carrier frequency), derating of the drive is required, which means the output current of the drive must be reduced. Otherwise, the drive may be damaged.

18.6.1 Derating Based on Carrier Frequency

The carrier frequency may need to be increased in actual applications. Increasing the carrier frequency brings a series of benefits, such as reducing motor noise, reducing output current harmonics and torque ripple, and achieving better control performance with high-speed motors. However, increasing the drive carrier frequency can increase the heat generation of the drive, which may easily cause the drive to trigger alarms prematurely. Prolonged operation beyond rated specifications may shorten service life of the drive.

Therefore, if you need to increase the carrier frequency of the drive, derate the drive at the same time. You can derate the drive by reducing the output current of the drive. See the following table for derating based on the carrier frequency.

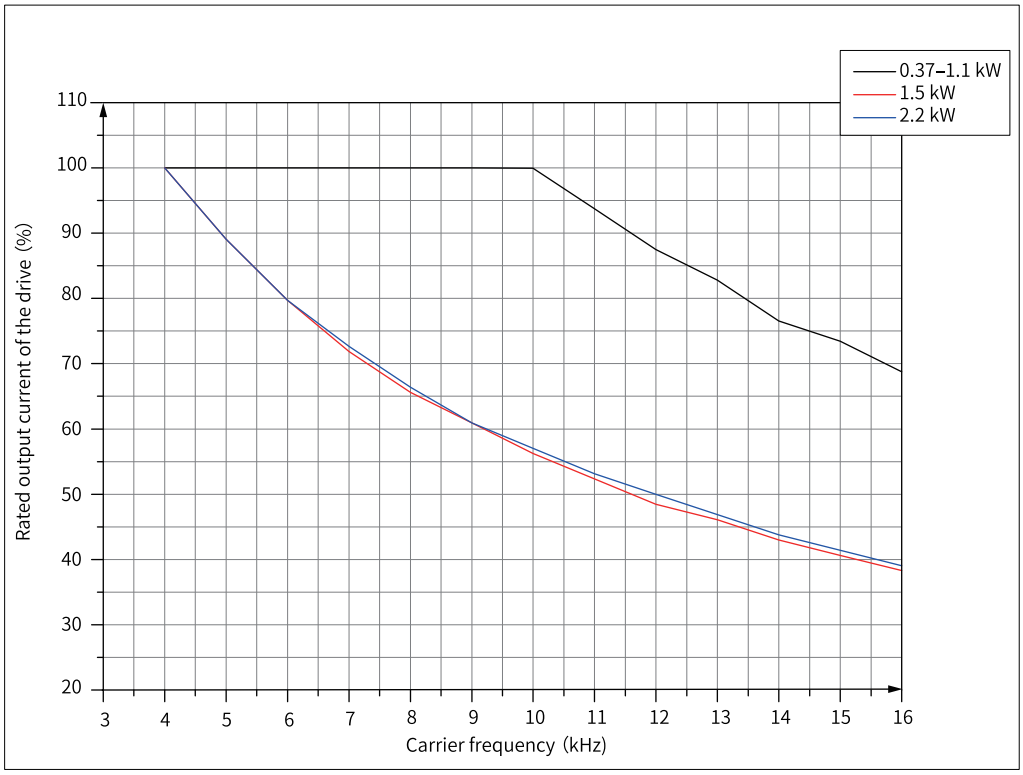


Figure 18-3 Curve for derating based on carrier frequency at low load

Structure	**Rated output (kW)**	Rated output current (A)	Derating based on carrier frequency (7 segments)												
			4 k	5 k	6 k	7 k	8 k	9 k	10 k	11 k	12 k	13 k	14 k	15 k	16 k
T1	0.37	1.5	100%	83.8%	72.1%	64.6%	58.5%	53.4%	49.2%	45.6%	43.1%	40.3%	38.3%	36.5%	34.4%
	0.55	2.0	100%	83.8%	72.1%	64.6%	58.5%	53.4%	49.2%	45.6%	43.1%	40.3%	38.3%	36.5%	34.4%
	0.75	2.4	100%	83.8%	72.1%	64.6%	58.5%	53.4%	49.2%	45.6%	43.1%	40.3%	38.3%	36.5%	34.4%
	1.1	3.1	100%	83.8%	72.1%	64.6%	58.5%	53.4%	49.2%	45.6%	43.1%	40.3%	38.3%	36.5%	34.4%
	1.5	4.1	100%	89.1%	80.4%	71.9%	64.1%	62.1%	57.7%	54.7%	51.9%	48.8%	46.6%	44.1%	42.3%
	2.2	6.0	100%	87.0%	76.9%	69.0%	63.2%	57.7%	54.1%	50.4%	47.6%	45.1%	42.9%	40.8%	38.7%

18.6.2 Environment-Based Derating

Current derating based on ambient temperature

The ambient temperature range of the drive is -20°C to +60°C. When the ambient temperature exceeds 50°C, derate 5% for every additional 1°C. The curve for derating based on ambient temperature is shown in the figure below.

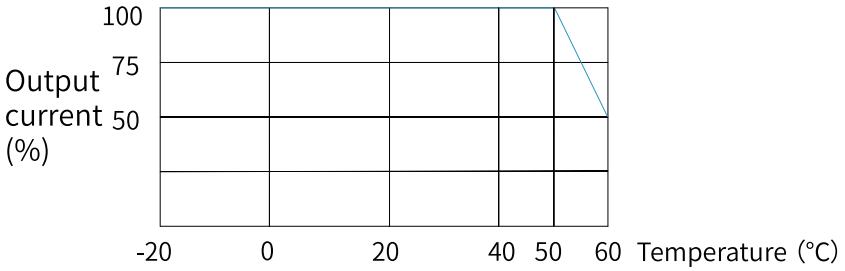


Figure 18-4 Curve for derating based on ambient temperature

Current derating based on installation altitude

Derating is not required for installation altitudes below 1000 m. For altitudes above 1000 m, derating 1% for every additional 100 m, up to a maximum of 3500 m. The curve for derating based on installation altitude is shown in the figure below.

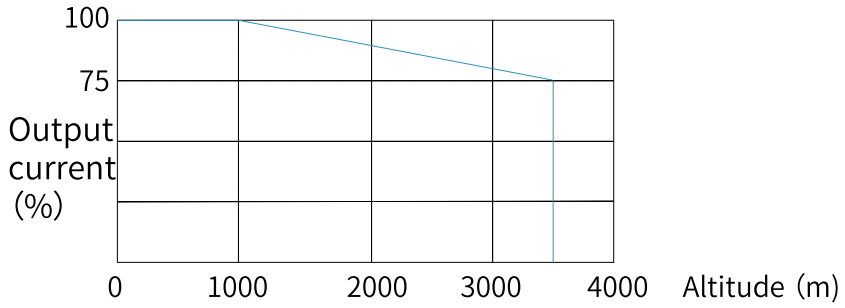
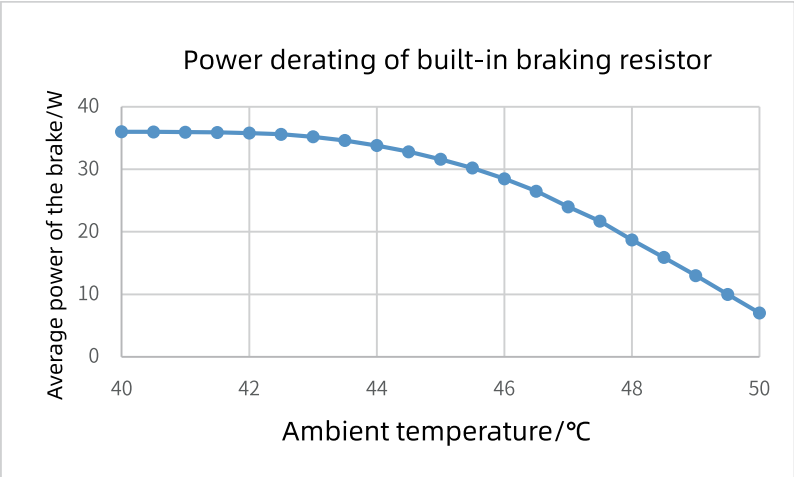


Figure 18-5 Altitude-based derating curve

18.7 Accessory Specifications

18.7.1 Braking Resistor

The drive is equipped with the built-in braking unit and braking resistor of low power as standard, which applies to applications with low braking frequency. The following figure shows the average power and ambient temperature of the built-in resistor. The average power of the built-in braking resistor under 40°C and below is 35 W.



When the internal braking resistor power is insufficient for the application scenario, it is necessary to switch to an external braking resistor. Open the upper cover of the drive, change the CN10 jumper on the terminal board (short pins 2-3), and set A4-06 to 1 after power-on to select the external braking resistor. The following provides selection criteria and recommended table for external braking resistors.

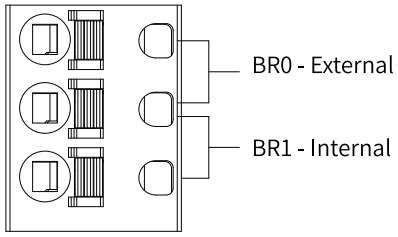


Figure 18-6 Connection of external braking resistor

Selecting the resistance of the braking resistor

The built-in braking unit of the drive processes the regenerative energy generated by the motor during deceleration. When the DC bus voltage exceeds the limit set by the software, the braking unit automatically turns on and connects the braking resistor to the DC bus. The braking resistor consumes the regenerative energy to keep the bus voltage within the safe range. The braking resistor is disconnected until the bus voltage drops below a certain range. The resistance of the braking resistor is calculated based on the following formula.

$$R = \frac{U_{BR}^2}{P_{BR}} = \frac{U_{BR}^2}{P_N \times k \times \eta_{motor} \times \eta_{inverter}}$$

Note

When the braking power is fed back from the motor to the U/V/W cable, and then fed back from the U/V/W cable to the DC bus of the drive, the braking power will be derated by the motor efficiency and the drive efficiency, respectively. Therefore, the braking power actually consumed by the braking resistor will be lower. The conversion coefficient is roughly estimated to be from 0.8 to 0.9.

R: Resistance of the braking resistor

U_{BR}: Starting braking voltage of the drive (three-phase 380 V to 480 V models: 760 VDC by default; the default values can be modified.)

P_{BR}: Braking power that needs to be consumed by the braking resistor on the DC bus of the drive

P_n: Rated power of the drive

k: Multiple of the braking torque to the rated torque, which is set to 1.25 generally and can be adjusted as needed

n_{motor}: Motor efficiency, which is generally set to 0.85 set based on the actual motor efficiency. It can also be estimated based on the efficiency of the four-pole motor energy efficiency class IE3 specified in the IEC 60034-30-2 standard.

$n^{inverter}$: Set to 0.98 generally

Selecting the power of the braking resistor

In theory, the power of the braking resistor and the braking power are the same. However, given that the braking resistor is naturally ventilated in the power supply distribution cabinet, power derating must be applied. Assume that the derating coefficient is α. You can select the rated power of the braking resistor according to the following formula:

$$P = \frac{P_{BR} \times D}{\alpha}$$

P: Rated power of the braking resistor

α: Power derating value of the braking resistor, which is 50% generally. Depending on the motor type and the actual cooling conditions of the resistor, a higher derating value is required if the temperature of the resistor rises. Otherwise, a fire caused by overheating of the resistor may occur. Select the power according to the actual application conditions.

D: Braking frequency, that is, percentage of the regenerative process to the whole working process.

The braking frequency D is determined based on actual applications. The following table lists the typical values in common applications.

Common applications	Elevator	Winding/ Unwinding	Centrifuge	Occasional braking load	Regular application
Value of the braking frequency	20% to 30%	20% to 30%	50% to 60%	5.0%	10 %

Table 18–2 Selection of braking resistors (three-phase 380 V to 480 V)

Structure	Drive model	Heavy-duty power (kW)	Braking unit	Specifications of the recommended external braking resistor (125% of braking torque (ED: 10% ; Max. 10s))	Quantity of braking resistors	Min. braking resistance (Ω)
T1	DT60N-4T1R6xx	0.37	Built-in as standard	500 W, 100 Ω	1	100
	DT60N-4T2R0xx	0.55				
	DT60N-4T2R4xx	0.75				
	DT60N-4T3R1xx	1.1				
	DT60N-4T4R1xx	1.5				
	DT60N-4T6R0xx	2.2				

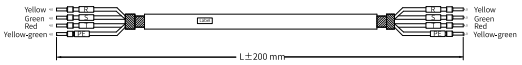
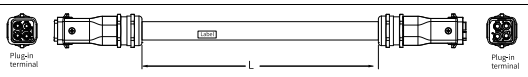
Note

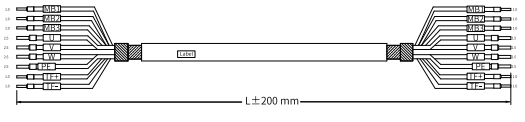
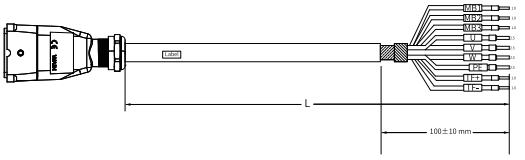
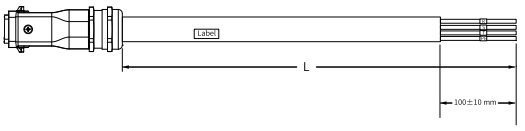
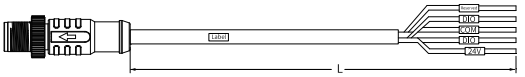
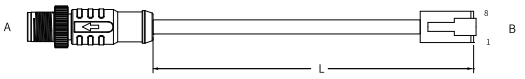
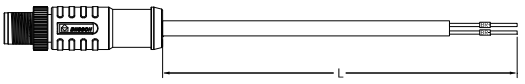
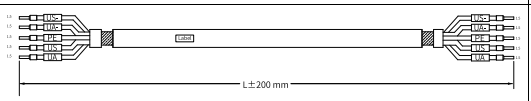
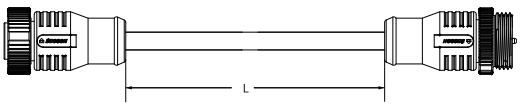
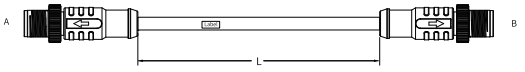
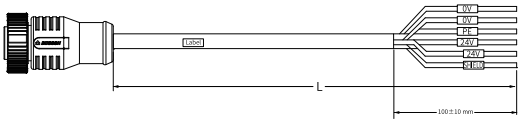
- The braking resistance in the preceding table is calculated based on the energy duty (ED) of 5% and 1s (max.) braking time.
- For models of 380 V to 480 V, the default starting braking voltage for the built-in braking unit is 760 V.
- The data in the preceding table is only for reference. You can select the resistance and power of the braking resistor as required. (Note that the resistance cannot be lower than the recommended minimum value, whereas the power can exceed the recommended value.) Select the braking resistor based on the generation power of the motor in the actual system, system inertia, deceleration time, and potential energy load.
- For systems featuring large inertia and requiring short deceleration time and frequency braking, select a braking resistor with high power and low resistance.

18.7.2 Cables

18.7.2.1 Power Cables

The recommended cable accessory models are listed in the table below.

Name	Length	Ordering model	Illustration	Cable specification
Three-phase AC input/ output parallel cable	5	DT60N-CAB-5.0-1		UL2586-12AWGx4C+TAB
	10	DT60N-CAB-10.0-1		
Three-phase AC input/ output parallel cable	5	DT60N-CAB-5.0-2		UL2586-12AWGx4C+TAB
	10	DT60N-CAB-10.0-2		

Name	Length	Ordering model	Illustration	Cable specification
Motor output cable	5	DT60N-CAB-5.0-3		UL2586-14AWGx4C +18AWGx4C +TAB
	10	DT60N-CAB-10.0-3		
Motor output cable	5	DT60N-CAB-5.0-4		UL2586-14AWGx4C +18AWGx4C +TAB
	10	DT60N-CAB-10.0-4		
Three-phase AC main input cable	5	DT60N-CAB-5.0-5		UL2586-12AWGx4C+TAB
	10	DT60N-CAB-10.0-5		
I/O and STO cables	5	DT60N-CAB-5.0-6		UL2517-22AWGx5C-AB
	10	DT60N-CAB-10.0-6		
LAN communication cable	5	DT60N-CAB-5.0-7		CAT5E-FTP-4Px24AWG
	10	DT60N-CAB-10.0-7		
Braking resistor cable	5	DT60N-CAB-5.0-8		UL2586-16AWGx2C
	10	DT60N-CAB-10.0-8		
24 V input/ output parallel cable	5	DT60N-CAB-5.0-9		UL2586-14AWGx5C
	10	DT60N-CAB-10.0-9		
24 V input/ output parallel cable	5	DT60N-CAB-5.0-10		UL2586-14AWGx5C
	10	DT60N-CAB-10.0-10		
LAN parallel communication cable	5	DT60N-CAB-5.0-11		CAT5E-FTP-4Px24AWG
	10	DT60N-CAB-10.0-11		
24 V main input cable	5	DT60N-CAB-5.0-12		UL2586-14AWGx5C
	10	DT60N-CAB-10.0-12		

Recommended power cable

For selection of power cables, follow national or regional regulations. The IEC cable selection is based on the following principles:

- Compliant with EN 60204-1 and IEC 60364-5-52 standards
- PVC insulated cables with copper conductors
- Heat resistance: maximum cable surface temperature not exceeding 70°C at an ambient temperature of 40°C (Note: Contact the manufacturer if the ambient temperature exceeds 40°C.)
- Symmetric cable with copper-braided shield

If the recommended cables for peripheral equipment or options are not suitable for the product, contact Inovance.

To comply with the EMC standards, use shielded cables. The shielded cables are divided into three-conductor cables and four-conductor cables, as shown below. If the conductivity of the shield of the three-conductor shielded cable cannot meet requirements, add an independent PE cable. Alternatively, use a four-conductor cable with one conductor as the PE cable. The shield of the shielded cable is comprised of coaxial cooper braids to suppress radio frequency interference. To enhance the shielding performance and conductivity, the braided density of the shield must be greater than 90%.

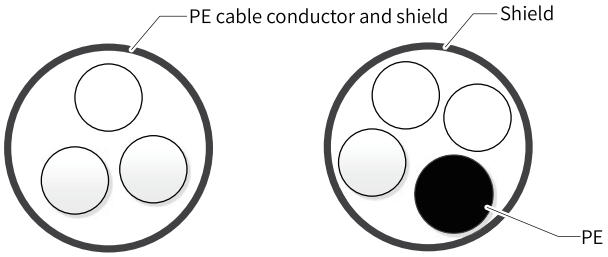


Figure 18-7 Recommended power cable

The recommended terminal manufacturers are TG-JT and TO series from KST.

Power cables

Table 18–3 Main input/output terminal cable specifications

Structure	Model	Power (kW)	Rated input current (A)	Rated output current (A)	R/S/T/PE				U/V/W/PE			
					IEC (mm²)		UL (AWG)		IEC (mm²)		UL (AWG)	
					Recommended cable [1]	Recommended terminal model	Recommended cable [2]	Recommended terminal model	Recommended cable [1]	Recommended terminal model	Recommended cable [2]	Recommended terminal model
T1	DT60N-4T1R6	0.37	25	1.6	4	E4010	10	E6012	2.5	E2510	14	E2510
	DT60N-4T2R0	0.55		2	4	E4010	10	E6012	2.5	E2510	14	E2510
	DT60N-4T2R4	0.75		2.4	4	E4010	10	E6012	2.5	E2510	14	E2510
	DT60N-4T3R1	1.1		3.1	4	E4010	10	E6012	2.5	E2510	14	E2510
	DT60N-4T4R1	1.5		4.1	4	E4010	10	E6012	2.5	E2510	14	E2510
	DT60N-4T6R0	2.2		6	4	E4010	10	E6012	2.5	E2510	14	E2510

Table 18–4 24 V input/output terminal cable specifications

Structure	Model	Power (kW)	24V-IN/24V-OUT			
			IEC (mm^2)		UL (AWG)	
			Recommended cable [1]	Recommended terminal model	Recommended cable [2]	Recommended terminal model
T1	DT60N-4T1R6	0.37	2.5	E2510	14	E2510
	DT60N-4T2R0	0.55	2.5	E2510	14	E2510
	DT60N-4T2R4	0.75	2.5	E2510	14	E2510
	DT60N-4T3R1	1.1	2.5	E2510	14	E2510
	DT60N-4T4R1	1.5	2.5	E2510	14	E2510
	DT60N-4T6R0	2.2	2.5	E2510	14	E2510

Table 18–5 Specifications of braking terminal cables

Structure	Model	Power (kW)	BR+/BR-			
			IEC (mm^2)		UL (AWG)	
			Recommended cable [1]	Recommended terminal model	Recommended cable [2]	Recommended terminal model
T1	DT60N-4T1R6	0.37	1.5	E1510	16	E1510
	DT60N-4T2R0	0.55	1.5	E1510	16	E1510
	DT60N-4T2R4	0.75	1.5	E1510	16	E1510
	DT60N-4T3R1	1.1	1.5	E1510	16	E1510
	DT60N-4T4R1	1.5	1.5	E1510	16	E1510
	DT60N-4T6R0	2.2	1.5	E1510	16	E1510

Note

Notes for standards in China:

This note applies to Table 17-3, Table 17-4, and Table 17-5.

- [1] Applies to the standards in China, where the code "4" represents a single-phase line with one 4 mm^2 conductor.
- The preceding recommended cable lugs are E series lugs from KST.
- Observe national or regional regulations during selection. The above tables are recommended based on:
  -
    - PVC insulation and copper conductor;
    - 70°C/75°C max. cable surface temperature under 50°C (105°C rated cables recommended). (Remarks: When the ambient temperature exceeds 50°C, contact Inovance.)
    - Cable layout type E is adopted (see IEC 60204-1).
  - If the conditions vary, select the model according to actual conditions.

Table 18–6 UL-compliant cable for 125% overload conditions

Structure	Model	Power (kW)	Rated Input Current	Rated output current	R/S/T/PE		U/V/W/PE/24V-IN/ 24V-OUT		BR+/BR-	
					Cable (AWG)[2]	Recommended terminal model	Cable (AWG)[2]	Recommended terminal model	Cable (AWG)[2]	Recommended terminal model
T1	DT60N-4T1R6	0.37	25	1.6	8	E10-12	14	E2510	16	E1510
	DT60N-4T2R0	0.55		2	8	E10-12	14	E2510	16	E1510
	DT60N-4T2R4	0.75		2.4	8	E10-12	14	E2510	16	E1510
	DT60N-4T3R1	1.1		3.1	8	E10-12	14	E2510	16	E1510
	DT60N-4T4R1	1.5		4.1	8	E10-12	14	E2510	16	E1510
	DT60N-4T6R0	2.2		6	8	E10-12	14	E2510	16	E1510

Note

Remarks for US standards:

- [2] Applicable to standards in US, where the code "10" indicates a single-phase line with one 10AWG conductor.
- The preceding recommended cable lugs are E series lugs from KST.
- Observe national or regional regulations during selection. The above tables are recommended based on:
  -
    - PVC insulation and copper conductor;
    - 70°C/75°C max. cable surface temperature under 50°C (105°C rated cables recommended). (Remarks: When the ambient temperature exceeds 50°C, contact Inovance.)
    - Cable layout type E is adopted (see IEC 60204-1).
- If the conditions vary, select the model according to actual conditions.

18.7.2.2 Control Cables

Note

Observe the requirements in standard EN 60204-1 during connecting control circuit cables.

To ensure that I/O signal cables are not affected by peripheral interference and noise, use shielded cables as signal cables. Install the signal shield bracket at each end of the shield to bond the shield to the drive 360 degrees. Use separate shielded cables for different analog signals. It is recommended to use shielded twisted pair (STP) cables for digital signals.

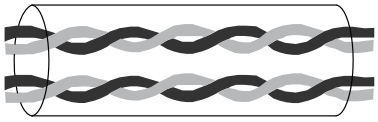


Figure 18-8 Diagram of shielded twisted pairs

18.7.2.3 Cable Lug

It is recommended to use the pre-insulated tubular cable lug (E-type) manufactured by KST.

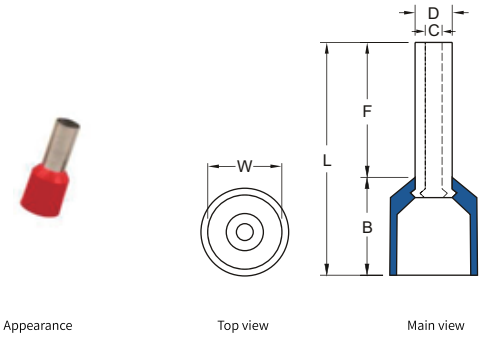


Figure 18-9 Appearance and dimensions of the pre-insulated tubular cable lug (E-type)

Table 18–7 Specifications and dimensions of the pre-insulated tubular cable lug (E-type)

Cross-sectional area	Model	Dimensions (mm)					Insulation sheath color (1) For Germany (2) For France	Crimping tool
		F	L	W	D	C		
A.W.G.14 2.5 mm^2	E2508	8.0	15.4	4.2	2.5	2.2	(1) Blue (2) Gray	
A.W.G.14 2.5 mm^2	E2510	10.0	17.4	4.2	2.5	2.2	(1) Blue (2) Gray	OPT AN-04WF
12AWG 4.0 mm^2	E4010	10.0	17.0	4.8	3.2	2.8	(1) Gray (2) Orange	
8AWG 10 mm^2	E10-12	12.0	22.5	7.7	5.05	4.7	(1) Milk white (2) Brown	OPT AN-16WF

18.7.2.4 Assignment of AC Drive Terminals

Table 18–8 PWR-IN terminal assignment (applicable only to heavy-duty quick-connector version)

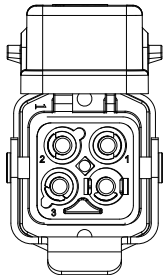
Diagram	Pin	Assignment	Description	External wiring color coding
	1	R	3-Phase Input R	Yellow
	2	S	3-Phase Input S	Green
	3	T	3-Phase Input T	Red
	4	PE	PE	Yellow-green

Table 18–9 PWR-OUT terminal assignment (applicable only to heavy-duty quick-connector version)

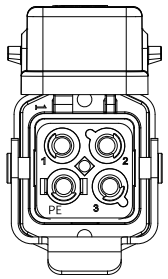
Diagram	Pin	Assignment	Description	External wiring color coding
	1	R	3-Phase Input R	Yellow
	2	S	3-Phase Input S	Green
	3	T	3-Phase Input T	Red
	4	PE	PE	Yellow-green

Table 18–10 BRAKE terminal assignment (applicable only to heavy-duty quick-connector version)

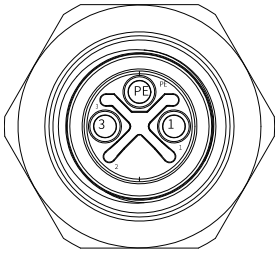
Diagram	Pin	Assignment	Description	External wiring color coding
	1	BR+	Braking resistor +	Red
	3	BR-	Braking resistor -	Black
	PE	/	Not connected	/

Table 18–11 MOTOR terminal assignment (applicable only to heavy-duty quick-connector version)

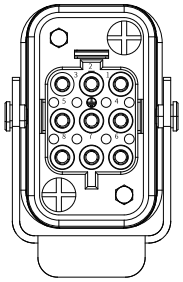
Diagram	Pin	Assignment	Description	External wiring color coding
	1	U	Motor phase U	Yellow
	2	MB2	Motor brake 2	Blue
	3	W	Motor phase W	Red
	4	MB1	Motor brake 1	Black
	PE	PE	Grounding	Yellow-green
	5	TF+	Motor temperature detection +	Gray
	6	MB3	Motor brake 3	Brown
	7	V	Motor phase V	Green
	8	TF-	Motor temperature detection -	White

Table 18–12 24V-IN terminal assignment (applicable only to heavy-duty quick-connector version)

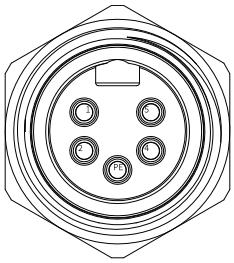
Diagram	Pin	Assignment	Description	External wiring color coding
	1	US_0V	DI and 24 V power supply reference ground	Black
	2	UA_0V	DO power supply reference ground	Blue
	PE	PE	System ground, connected to the drive enclosure	Yellow-green
	4	US_24V	DI and 24 V power supply (for the system as well)	Brown
	5	UA_24V	Dedicated +24 V power supply for DO (Switched_24 V)	White

Table 18–13 24V-OUT terminal assignment (applicable only to heavy-duty quick-connector version)

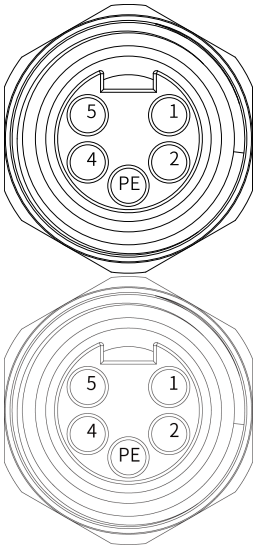
Diagram	Pin	Assignment	Description	External wiring color coding
	1	US_0V	DI and 24 V power supply reference ground	Black
	2	UA_0V	DO power supply reference ground	Blue
	PE	PE	System ground, connected to the drive enclosure	Yellow-green
	4	US_24V	DI and 24 V power supply (for the system as well)	Brown
	5	UA_24V	Dedicated +24 V power supply for DO (Switched_24 V)	White

Table 18–14 IO1 terminal definition

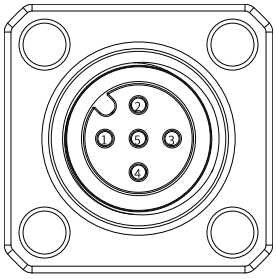
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24 V	24 V power supply (+)	Red
	2	DI1	Digital input 1	Black
	3	COM	24 V reference ground	Yellow
	4	DI2	Digital input 2	Orange
	5	/	Not connected	

Table 18–15 IO2 terminal assignment

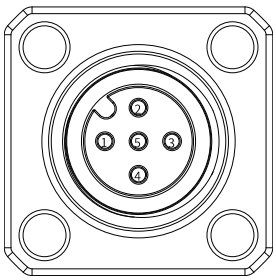
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24 V	24 V power supply (+)	Red
	2	DI3	Digital input 3	Black
	3	COM	24 V reference ground	Yellow
	4	DI4	Digital input 4	Orange
	5	/	Not connected	

Table 18–16 IO3 terminal definition

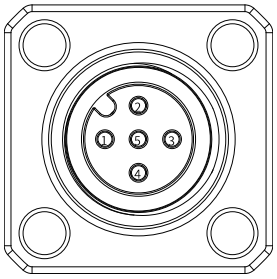
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24 V	24 V power supply (+)	Red
	2	DI5/DO1	Digital output 5/ Digital output 1	Black
	3	COM	24 V reference ground	Yellow
	4	DI6/DO2	Digital output 6/ Digital output 2	Orange
	5	/	Not connected	

Table 18–17 IO4 terminal definition

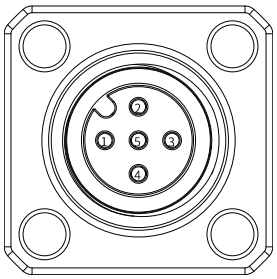
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24 V	24 V power supply (+)	Red
	2	DI7/DO3	Digital output 7/ Digital output 3	Black
	3	COM	24 V reference ground	Yellow
	4	DI8/DO4	Digital output 8/ Digital output 4	Orange
	5	/	Not connected	

Table 18–18 IO5 terminal definition

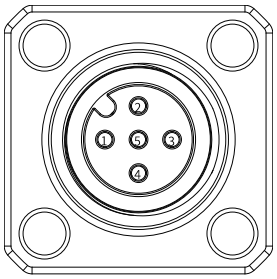
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24 V	24 V power supply (+)	Red
	2	DI9/DO5	Digital output 9/ Digital output 5	Black
	3	COM	24 V reference ground	Yellow
	4	DI10/DO6	Digital output 10/Digital output 6	Orange
	5	/	Not connected	

Table 18–19 STO terminal assignment

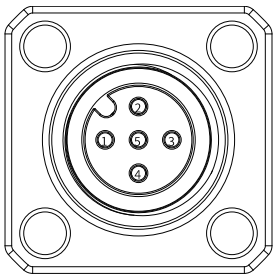
Diagram	Pin	Assignment	Description	External wiring color coding
	1	24VS	24 VS power supply (+)	Red
	2	STO1	STO channel 1	Black
	3	COM	24VS reference ground	Yellow
	4	STO2	STO2	Orange
	5	/	Not connected	

Table 18–20 LAN1 terminal definition

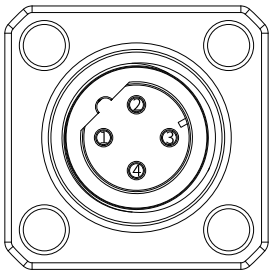
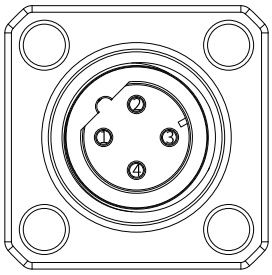
Diagram	Pin	Assignment	Description	External wiring color coding
	1	TD1+	TD1+ output (Differential high side)	Orange white
	2	RD1+	RD1+ input (Differential high side)	Green white
	3	TD1-	TD1- output (Differential low side)	Orange
	4	RD1-	RD1- input (Differential low side)	Green

Table 18–21 LAN2 terminal definition

Diagram	Pin	Assignment	Description	External wiring color coding
	1	TD2+	TD2+ output (differential high side)	Orange white
	2	RD2+	RD2+ input (differential high side)	Green white
	3	TD2-	TD2- output (differential low side)	Orange
	4	RD2-	RD2- input (differential low side)	Green

18.7.3 Mounting Bracket

Table 18–22 Options of the mounting bracket

Model	Description	Material code
DT60N-AZJ-A1T1	Compatible mounting bracket 1	2018K930
DT60N-AZJ-A1T2	Compatible mounting bracket 2	2018K931

Onboard mounting supports optional mounting bracket A/mounting bracket B and multiple assembly methods.

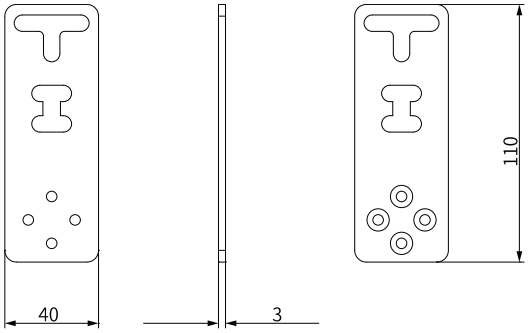


Figure 18-10 Mounting bracket A (unit: mm)

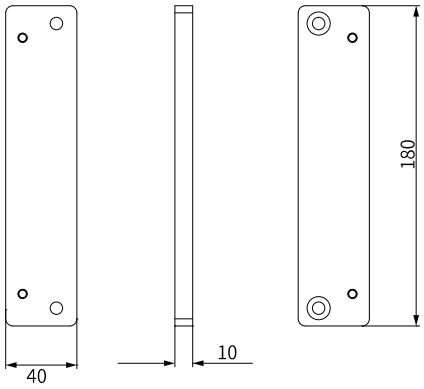


Figure 18-11 Mounting bracket B (unit: mm)

19 Solutions to Common EMC Problems

The drive draws power from the grid in a pulsating, intermittent manner, which causes the drive to emit significant harmonic currents. When high grid quality is required, take corrective measures shown in *"19.1 Harmonic Suppression Measures" on page 1314*.

The drive can generate strong interference. Electromagnetic noise interference such as coupling interference and common ground impedance may occur among cables in the drive system in the case of improper wiring inside the cabinet, improper grounding, or improper system configuration, resulting in function failure or performance degradation of the system, such as malfunction of the residual current device, I/O signal bouncing, high-speed pulse I/O count error, and communication interruption. When the drive disturbs or is disturbed by other devices, take the measures shown in *"19.2 Malfunction of Residual Current Device " on page 1315*, *"19.3.2 Common I/O Signal Interference" on page 1317*, and *"19.4 EtherNet/IP and PROFINET Communication Interference" on page 1318*.

19.1 Harmonic Suppression Measures

The drive draws power from the grid in a pulsating, intermittent manner, and this pulsating current, together with the impedance along the power grid, creates a pulsating voltage drop that superimposed to the grid voltage, causing voltage distortion.

Harmonics generated by the drive can lead to power loss and interference, as shown below.

- Increase in the overall RMS value of input current (up to 50%)
- Voltage distortion in the power supply (voltage harmonics)
- Reduction in power factor
- Overload, noise, vibration of transformers, cables, and other electrical components...
- Interference with sensitive equipment nearby
- Risk of resonance: risk of causing local parallel and series resonance in the public power grid, thereby amplifying harmonics

Therefore, harmonic suppression is required in the following cases:

- Compliance with relevant standards
- High requirements for on-site power grid quality
- Requirements for equipment power factor

No.	Requirements	Description
1	Compliant with requirements in IEC 61800-3/IEC 61000-3-12 Class A or Table 4	-
2	High harmonic requirements, such as IEEE519, GB/T14549, or user-defined requirements with harmonics below 10%	Passive harmonic filters are recommended.

19.2 Malfunction of Residual Current Device

To prevent malfunction, select a correct type of residual current device (RCD) first. During the operation of the drive, high-frequency leakage currents caused by IGBT can affect the RCD. Therefore, select an RCD with a tripping current equal to or higher than 100 mA for each drive.

When parallel drives share one RCD, the tripping current of the RCD cannot be lower than 300 mA.

It is recommended to use Chint or Schneider RCDs.

When the RCD trips or current leakage occurs, see the following table for recommended solutions.

Table 19–1 Measures against current leakage

Symptom	Possible cause	Solution
The RCD trips at the moment of power-on.	The anti-interference performance of the RCD is weak.	1 .Use RCDs of recommended brands. 2 .Use a RCD with a higher tripping current. 3 .Move the unbalanced load to the upstream side of the residual current device. 4 .Disconnect the EMC screw or the grounding terminal of the external EMC filter to reduce the ground capacitance of the input end.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	An excessive ground capacitance exists in the upstream side of the drive.	
The RCD trips during operation.	The anti-interference performance of the RCD is weak.	1 .Use RCDs of recommended brands. 2 .For a single drive, check that the EMC screw is securely tightened, as shown below. 3 .For multiple drives, disconnect the EMC selective grounding screw, as shown below. 4 .Install a simple filter on the input side of the drive and wind LN and RST cables around the ferrite ring, as shown below. 5 .Use a RCD with a higher rated tripping current. 6 .Reduce the carrier frequency without compromising the performance. 7 .Use shorter motor cables.
	The tripping current of the RCD is excessively low.	
	An unbalanced load is connected to the downstream side of the RCD.	
	The distributed capacitance to ground of the motor cable and motor is excessively high.	

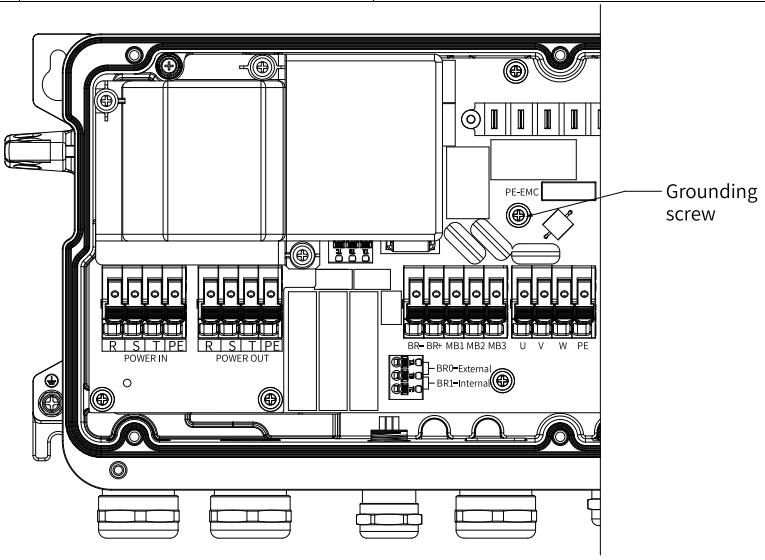


Figure 19-1 Disconnect the EMC selective grounding screw.

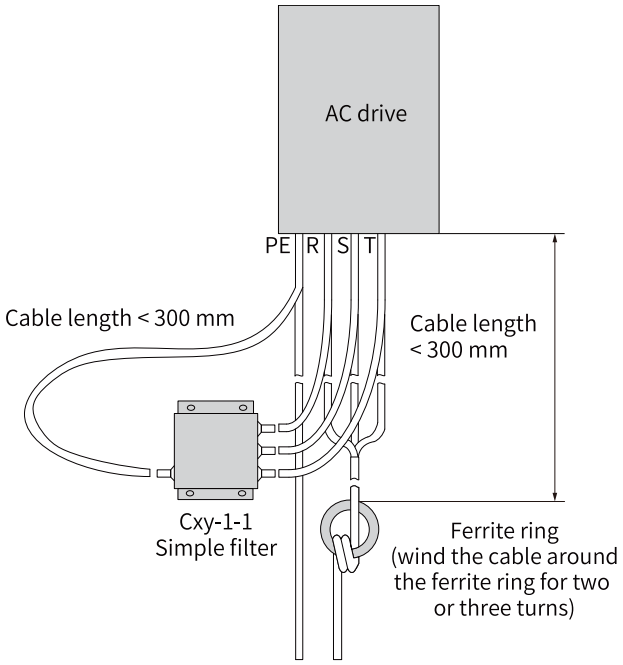


Figure 19-2 Installing simple filter and ferrite ring on the input side

19.3 I/O Signal Interference

19.3.1 High-Speed Pulse Interference

See the following table for how to rectify high-speed pulse interference.

No.	Step
1	Used shielded twisted pair cables with both ends grounded (see *" Control Circuit Connection" on page 74*).
2	Connect the motor enclosure to the PE terminal of the drive.
3	Connect the PE terminal of the drive to the PE of the power grid.
4	Separate signal cables from power cables with a distance of at least 30 cm.
5	Install ferrite ring to the signal lines, or wind the signal cable around the ferrite ring by 2 to 4 turns (see the magnetic ring installation method diagram).
6	Wind U/V/W cables around the ferrite ring by 2 to 4 turns (see the ferrite ring installation diagram).
7	Use shielded power cables and ground the shield properly.

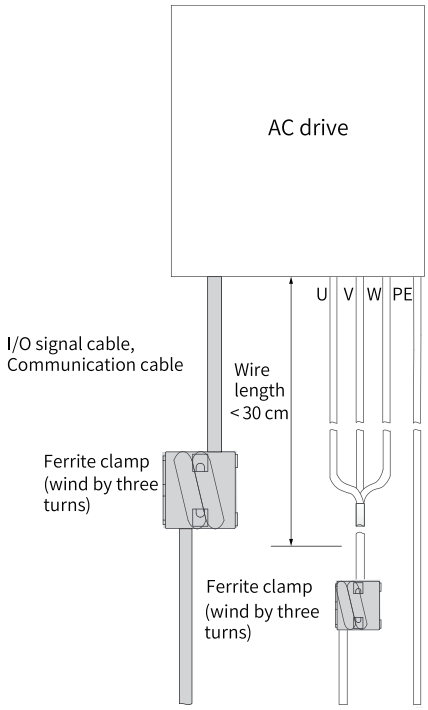


Figure 19-3 Installing the ferrite ring

19.3.2 Common I/O Signal Interference

Rectify regular I/O signal interference based on the following table.

No.	Step
1	Use shielded cables as the I/O signal cables and connect the shield to the PE terminal (as shown in " *Control Circuit Connection" on page 74*).
2	Connect the PE of the motor to the PE terminal of the drive, and connect the PE terminal of the drive to the PE terminal of the power grid.
3	Wind U/V/W cables around the ferrite ring by 2 to 4 turns (see the ferrite ring installation diagram in *"19.3.1 High-Speed Pulse Interference" on page 1316*).
4	Increase capacitance filtering for low-speed DI terminals. The recommended maximum value is 0.1 μF (see details in the diagram for I/O signal cables with capacitance filtering increase).
5	Wind the signal cable around the ferrite clamp or ferrite ring by one or two turns (see ferrite ring installation diagram in *"19.3.1 High-Speed Pulse Interference" on page 1316*).
6	Use shielded power cables and ground the shield properly.

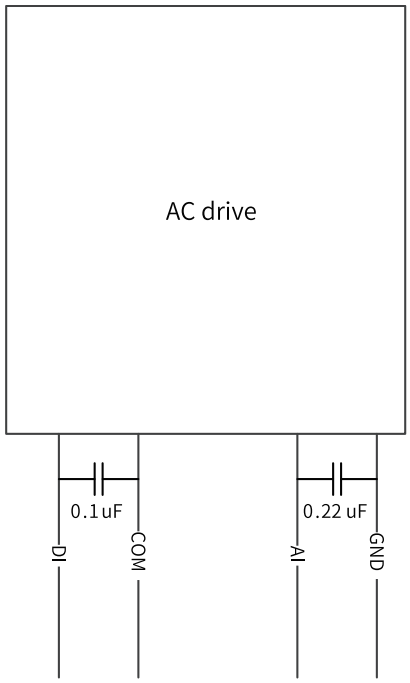


Figure 19-4 I/O signal cables with capacitance filtering increased

19.4 EtherNet/IP and PROFINET Communication Interference

See the following table to rectify the interference in EtherNet/IP and PROFINET communication.

No.	Step
1	Ensure the communication cable is a shielded Cat 5e cable.
2	Ensure communication ports are secure and in good contact.
3	Separate communication cables from power cables with a distance of at least 30 cm.
4	The maximum cable length allowed between two nodes is 100 m.
5	Wind both sides of the communication cable around the ferrite ring by one or two turns (see ferrite ring installation diagram in *"19.3.1 High-Speed Pulse Interference" on page 1316*).
6	Wind U/V/W cables around the ferrite ring by 2 to 4 turns (see the ferrite ring installation diagram in *"19.3.1 High-Speed Pulse Interference" on page 1316*).
7	Use shielded power cables and ground the shield properly.

20 Certifications and Standards Requirements

20.1 Compliance List

The following table lists the certifications, directives, and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product nameplate.

Certification	Directive		Standard
CE	EMC Directive	2014/30/EU	EN IEC 61800-3
	LVD Directive	2014/35/EU	EN 61800-5-1
	RoHS directive	2011/65/EU	EN 50581
UL/cUL Certification	-		UL61800-5-1
			C22.2 No.274-17
KC certification	Radio Waves Act of the Republic of Korea		KN 11
Functional safety certification (STO)	Machinery directive	2006/42/EC	EN ISO 13849-1:2015 EN 61508:2010 EN 61800-5-2:2017 EN IEC 62061:2021

Note

The product meets the requirements of the latest instructions and standards of the CE/UL/cUL/KC/STO certification.

20.2 CE Certification

20.2.1 Precautions for Compliance with European Standards



Figure 20-1 CE Mark

- The CE mark indicates compliance with the Low Voltage Directive (LVD), Electromagnetic Compatibility (EMC), and Restriction of Hazardous Substances (RoHS) directives for commercial trades (production, import, and sales) in Europe.
- The CE mark is mandatory for engaging in commercial business (production, importation, and distribution) in Europe.
- The drive complies with LVD, EMC, and RoHS directives and carries the CE mark.
- Machines and devices integrated with this drive must also comply with CE requirements for distribution in Europe.
- The integrator who integrates this drive into other products and attaches CE mark to the final assembly has the responsibility of ensuring compliance with CE certification.

20.2.2 Requirements for Compliance with EMC

- This drive, which is applicable to the First environment and Second environment, complies with EMC Directive 2014/30/EU and standard EN IEC 61800-3.

Caution

If the product is used in the first environment, it may generate radio interference. In addition to CE compliance requirements, measures should be taken to prevent interference when necessary.

- As required by EMC Directive and standard, install an EMC filter on the input side and use shielded cables on the output side. Ensure the filter is grounded properly and the shield of the output cable is grounded 360 degrees.

Caution

The manufacturer of the system integrated with this drive is responsible for ensuring compliance with EMC directives and EN IEC 61800-3 based on the application environment of the system.

EMC specifications

The drive complies with EN IEC 61800-3. The maximum length of the motor cable allowed by the conducted and radiated emission is shown in the following table.

Power grid	Structure	Max. motor cable length allowed by conducted emission				Max. motor cable length allowed by radiated emission			
		C2		C3		C2		C3	
		Built-in filter	External EMC filter	Built-in filter	External EMC filter	Built-in filter	External EMC filter	Built-in filter	External EMC filter
Three-phase 380 V to 480 V	T1	25 m	-	25 m[1*]	-	25 m	-	25 m[1*]	-

Introduction to EMC standards

Electromagnetic compatibility (EMC) describes the ability of electrical and electronic devices or systems to work properly in the electromagnetic environment without introducing electromagnetic interferences that disturb the operation of other local devices or systems. Therefore, EMC includes the following requirements:

- 1. The electromagnetic interference generated by the device or system during normal operation must be within a certain limit.
- 2. The device or system must have sufficient immunity to the electromagnetic interference in the environment.

EN IEC 61800-3 defines the following two types of environments.

- First environment: Environment that includes domestic premises, and establishments directly connected without intermediate transformers to a low-voltage power supply network which supplies buildings used for domestic purposes
- Second environment: Environment that includes all establishments other than those directly connected to a low-voltage power supply network which supplies buildings used for domestic purposes

Devices are divided into the following four categories based on the intended application environment.

- Category C1: Power drive systems with the rated voltage less than 1000 V, intended for use in the first environment.
- Category C2: Power drive systems with the rated voltage lower than 1000 V, which is neither a plug-in device nor a movable device and is intended to be installed and commissioned only by professionals when used in the first environment.
- Category C3: Power drive systems with the rated voltage lower than 1000 V, which is intended for use in the second environment and not intended for use in the first environment
- Category C4: Power drive systems with the rated voltage equal to or higher than 1000 V or rated current equal to or higher than 400 A, or intended for use in complex systems in the second environment

20.2.3 Requirements for Compliance with LVD

The drive has been tested in accordance with EN61800-5-1 to determine compliance with LVD. Observe the following requirements to enable machines and devices integrated with this drive to comply with the LVD.

Installation location

Install the drive in a place with overvoltage category III and pollution degree 1 or 2 as specified by IEC 60664-1.

Installation environment

For installation environment requirements, see relevant content in the "Mechanical Design - Standard Environmental Durability Requirements" section in the "DT60 Series Distributed AC Drive User Guide".

Installation protection requirements

- The drive must be installed in a fireproof cabinet with doors that provide effective electrical and mechanical protection. The installation must conform to local and regional laws and regulations and relevant IEC standards.
- Drives (IP20) intended to be installed inside the cabinet must be installed in a structure that prevents intrusion of unwanted objects from the top and the front.

Wiring requirements for main circuit terminals

For main circuit terminal wiring requirements, see the relevant content in the "Electrical Design - Connection of Main Circuit Terminals, Power Supplies, Motor, and Braking Resistor" in the "DT60 Series Distributed AC Drive User Guide".

20.3 KC Certification



20.4 Functional Safety Certification

EU directives and standards

Low Voltage Directive 2014/35/EU Standard EN 61800-5-1

Electromagnetic Compatibility Directive 2014/30/EU, EN 61800-3:2018

Machinery Directive 2006/42/EC (Safety Functions) Standard IEC 61800-5-2

Service and Support

Should you encounter a safety accident during the use or operation of the product, or face challenges in operating and maintaining the equipment, which remain unresolved after the relevant documentation is consulted, we provide multiple channels to ensure prompt resolution:

- Channel #1: Contact service@inovance.com.
- Channel #2: Visit https://www.inovance.com/global to access document downloads, after-sales support, spare parts ordering, repair applications, and authenticity verification services.
- Channel #3: Download My Inovance app (https://zshc-eu.inovance.com/download-pc/) where you can access products info and documentation, and query product parameters.

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