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MD600 Series Compact AC Drive

Function Guide

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

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Preface

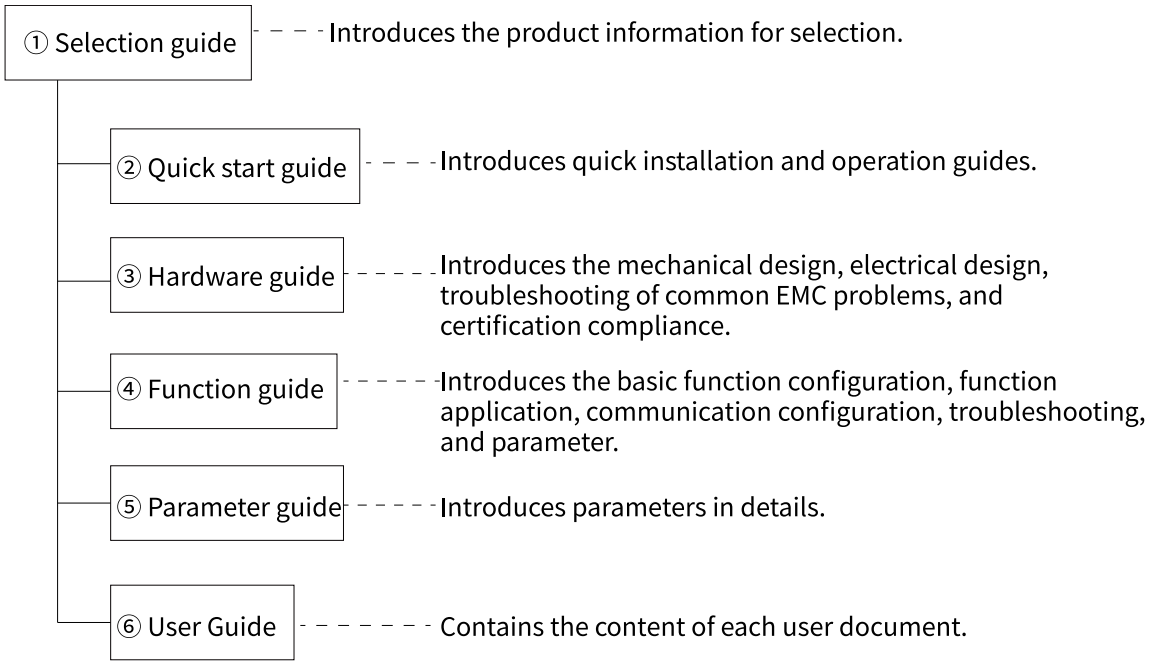
Introduction

The MD600 is a compact, general-purpose, and cost-effective AC drive for small automation equipment. Supporting Modbus RTU and CAN communication protocols, it features a compact size and high-performance open-loop vector control and can drive synchronous and asynchronous motors. The MD600 is widely used in small automation equipment in fields such as silicon, lithium, woodworking, logistics, cables, packaging, and machine tools.

This guide describes product selection, mechanical design, electrical design, common EMC problems and solutions, and product certifications and standards.

More Data

The following figure and table describe document codes and document introduction of the drive.



No.	Name	Date Code	Description
①	MD600 Series Compact AC Drive	19120393	This guide describes the product positioning, highlights, application scenarios, and selection specifications of the drive.
②	MD600 Series Compact AC Drive Quick Start Guide	19012337	This guide describes the installation and operation, common faults and troubleshooting, and parameter settings of the drive.
③	MD600 Series Compact AC Drive Hardware Guide	19012234	This guide describes product selection, mechanical design, electrical design, common EMC problems and solutions, and product certifications and standards.
④	MD600 Series Compact AC Drive Function Guide (This Guide)	19012238	This guide describes the basic function configuration, function application, communication configuration, troubleshooting, and parameters of the drive.

No.	Name	Date Code	Description
⑤	MD600 Series Compact AC Drive Parameter Guide	19012528	This guide describes parameters and fault codes.
⑥	MD600 Series Compact AC Drive User Guide	PS00012434	This guide describes product selection, mechanical design, electrical design, quick installation and operation, function application, communication configuration, troubleshooting, common EMC problems and solutions, and product certifications and standards.

Revision History

Revision Date	Version	Description
October 2024	C01	The document version corresponds to the following software version: A03 A2-22=L62.03/A2-23=L62.03/A2-24=000.00/A2-25=000.00. Update: • Updated *"8.4 List of Faults and Alarms" on page 526*
September 2024	C00	The document version corresponds to the following software version: A03 A2-22=L62.03/A2-23=L62.03/A2-24=000.00/A2-25=000.00. Added the following: • Added SVC control function. • Added section "Synchronous Motor Parameter Auto-tuning". • Added section "Torque Control". • Added section "Vector Control". • Added section "Torque Reference". • Added chapter "Data flow description". • Added chapter "List of Terms". • Added chapter "Commissioning Tools". • Added chapter "Commissioning and Trial Run". Updated the following: • Updated section "Command Source". • Updated section "Frequency Reference". • Updated section "Start/Stop Mode". • Updated section "Acceleration/Deceleration Time". • Updated section "DO Function". • Updated section "Asynchronous Motor V/f Control". • Updated chapter "Communication". • Updated section "Modbus Communication". • Updated the list of fault codes. • Updated section "Parameter List". • Made minor corrections.

Revision Date	Version	Description
March 2024	B01	**Added the following content:** Added information about MD-BP-M. **Modified the following content:** • Updated section “Parameter List”. • Updated *“10.1 Parameter List” on page 560* • Made minor corrections. The document version corresponds to the following software version: A02.08 A2-22=L60.02/A2-23=L61.02/A2-24=000.18/A2-25=000.22. Note: To support the MD-BP-M operating panel, the MD600 software version must be A2-22 = 60.02/A2-23 = 61.02/A2-24 = 0.28/A2-25 = 0.31 or later. If the current MD600 software version does not support the MD-BP-M, contact the service personnel of the manufacturer to upgrade the software.
December 2023	B00	**Added the following content:** Added chapter “Communication”. **Modified the following content:** • Updated the drawings in the section "Set Frequency Reference". • Updated the drawings in section “Motor Auto-Tuning”. • Updated the drawings in section “Control Interface”. • Updated the section "Troubleshooting" to include confirmation methods and optimize solutions. • Updated the Fault Code List section to add confirmation methods, add other fault code level A, L, and N display, and optimize solutions. • Updated *“10.1 Parameter List” on page 560* • Updated chapter “Parameter Description”. • Made minor corrections. • Updated the parameter settings. The document version corresponds to the following software version: A02.07 A2-22=L60.02/A2-23=L61.02/A2-24=000.18/A2-25=000.22.
June 2023	A00	First release.

Access to the Guide

This guide is not delivered with the product. You can obtain the PDF version by the following methods:

- Visit *http://www.inovance.com*, go to Support > Download, search by keyword, and then download the PDF file.
- Scan the QR code on the product with your smart phone.
- Scan the QR code below to install the app, where you can search for and download manuals.

Warranty Disclaimer

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. You need to pay charges beyond the warranty listed in the purchase order.

The warranty does not cover any defect caused by:

- Damage caused by operations not following the instructions in the user guide
- Damage caused by fire, flood, or unusual 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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Fundamental Safety Instructions

Safety Precautions

- 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 instructions may result in death, severe personal injuries, 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. Damage caused by improper usage is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions



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



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



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 by following the unpacking sequence. Do not strike the package violently. • Check whether there is damage, rust, or signs of bumping 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 transported by qualified professionals using specialized hoisting equipment. Failure to comply may result in personal injuries or equipment damage. • Before hoisting the equipment, ensure the components such as the front cover and terminal blocks are secured firmly with screws. Loosely-connected components may fall off and result in personal injury 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 will result in equipment damage. • Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration. • Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection. • Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation. • Never transport the drive with other equipment or materials that may harm or have negative impacts on the drive.

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 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 will result in mechanical hazards. • Do not wear loose clothes or accessories during installation. Failure to comply may result in an 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 product on an incombustible object such as metal and do not contact or attach the product with combustible objects. Failure to comply will cause fires.
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 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 executes 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 parts replacement must be performed only by professionals. • Before wiring, disconnect all the power supplies of the equipment. Wait as specified on the product warning sign before further operations because residual voltage exists after power-off. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply will result in an electric shock. • Never perform wiring at power-on. Failure to comply will result in an electric shock. • Check that the equipment is grounded properly. Failure to comply can result in an electric shock.
WARNING • Do not connect the input power supply to the output end of the equipment. Failure to comply can 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. • Fix the terminal screws with the tightening torque specified in the user guide. Improper tightening torque may overheat or damage the connecting part, resulting in 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 can result in equipment malfunction.

Power-on
DANGER • Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted. • Check that the power supply meets equipment requirements before power-on to prevent equipment damage or fire accident. • After power-on, do not open the cabinet door or protective cover of the equipment. Do not touch any terminals, or remove any part of the equipment at power-on. 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 injury.

Operation

DANGER

- The equipment must be operated only by professionals. Failure to comply can 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 can result in an electric shock.

WARNING

- Do not touch the equipment casing, fan, or resistor with bare hands to feel the temperature. Failure to comply may result in personal injuries.
- Prevent metal or other objects from falling into the equipment during operation. Failure to comply may result in a fire or equipment damage.

Maintenance

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power on. Failure to comply can result in 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.

WARNING

- Perform routine and periodic inspection and maintenance on the equipment according to maintenance requirements and keep a maintenance record.

Repair

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not maintain the equipment with power on. Failure to comply can result in 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.

WARNING

- Require for repair services in accordance with the product warranty agreement.
- When the fuse is blown or the circuit breaker or residual current device (RCD) 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 injury or equipment damage.
- When the equipment is faulty or damaged, the troubleshooting and repair work must be performed by professionals that follow the repair instructions, with repair records kept properly.
- Replace quick-wear parts of the equipment according to the replacement instructions.
- Do not operate on damaged equipment. Failure to comply may result in death, personal injury, 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 by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

For safe operation and maintenance, comply with the safety labels on the equipment. Do not damage or remove the safety labels. See the following table for descriptions 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.

List of Terms

The following table lists the terms used in this guide.

Function type	List of Terms	Explanation	Alias
Speed reference	Droop control	The operating frequency is automatically reduced when the load is heavy.	-
	Jump frequency	The set target frequency automatically jumps the resonance point.	Dangerous speed, jump speed
	Motor running direction	Switches the motor running direction without changing the positive and negative of the set frequency.	Motor phase sequence switchover, motor phase sequence
Vector control	Vector control	The three-phase UVW current is divided into id/iq and the flux and torque are controlled separately. Speed and torque can be controlled, with good accuracy and dynamic response performance. DTC control has similar performance.	Direct torque control
	FVC/SVC	Vector control with sensors / Vector control without sensors	Vector Control / Sensorless Vector Control
	Acceleration feedforward torque	Calculate the acceleration/ deceleration torque and perform compensation when speed reference changes, which can greatly reduce the demand for dynamic response of the speed loop Kp and Ti.	Acceleration feedforward, acceleration feedforward compensation, torque feedforward, acceleration compensation
	Kp	Proportional gain of the PI controller. The larger the Kp, the stronger the control effect, such as the SVC speed loop Kp.	Proportional gain
	Ti	Integral time of the PI controller. The smaller the Ti, the stronger the integral control effect, such as the speed loop Ti in the SVC mode.	Integral time
	Ki	Integral gain of the PI controller. The larger the Ki, the stronger the integral control effect is. Ki=Kp/Ti. Throughout this product manual, you may encounter references to both the integral gain (Ki) and the integral time (Ti). Pay attention to the difference.	Integral gain
	IF control	In the SVC control mode and at the zero speed, the set speed is used as the frequency of the output current. It is open-loop control. It improves the stability of the SVC mode at 0 speed.	Speed open-loop control
	Electromechanical time constant	Defines the time for the motor to accelerate to the rated speed with loads.	Mechanical time constant, rated motor start time
	Overspeed control	The overspeed controller runs after the motor overruns to prevent further acceleration.	Stall control

Function type	List of Terms		Explanation	Alias
Vector control	V/f control		Constant voltage frequency ratio control. This mode is not highly dependent on parameters. It is simple, reliable, but has relatively poor dynamic performance and speed accuracy.	Scaler control
	V/f control	Slip compen-sation	The rotor speed of the asynchronous motor is lower than the set speed after load is applied. The slip compensation can estimate the load size and automatically increase the frequency reference to improve the speed accuracy.	Slip compensation
		Overcur-rent Suppres-sion	When the output torque is large, the frequency reference is automatically adjusted to reduce the output current to prevent overcurrent during heavy load or acceleration/deceleration.	Overcurrent stall suppression
		Torque boost	Used to compensate the voltage loss on the stator resistor to ensure the constant flux (voltage/frequency) of the motor in the V/f mode, improving the load capacity of the motor at a low speed.	Torque compensation, voltage boost, IR compensation
		Oscillation suppres-sion	In the V/f control mode, oscillation may occur for motors with no load. Oscillation suppression prevents oscillation.	Resonance suppression

Function type	List of Terms		Explanation	Alias
Basic control	Wave generation	Shorting motor stator control	Synchronous motor control. The AC drive shorts the UVW output terminals together through IGBT control to form the braking torque. The higher the speed, the higher the braking torque. It prevents the motor from runaway, rotating at low speed and sliding freely for a long time.	Electronic motor stator shorting function, internal short-circuited braking
		Carrier frequency	Output pulse voltage frequency	Pulse frequency, switching frequency
		DPWM/ PWM	5-reference IGBT trigger: IGBT switch 4 times for one carrier cycle 7-reference IGBT trigger: IGBT switch 6 times for one carrier cycle.	5-reference IGBT trigger / 7-reference IGBT trigger
		Overmodulation	The output voltage in general control mode is low in the weak magnetic zone. Overmodulation can increase the output voltage by up to 5%. The output current can be reduced effectively under the same load. However, the output harmonics become slightly larger.	Edge modulation
		Carrier ratio	The carrier ratio is the number of pulses in a sinusoidal wave current cycle. A low carrier ratio means fewer pulses within a sinusoidal current period, and the waveform of the output current will not achieve the ideal sinusoidal shape. Therefore, the performance of motor control is affected, and the motor generates severe heat. The synchronous motor may demagnetization.	Carrier frequency / output frequency
		Random PWM	The carrier frequency changes randomly during running. The sharp electromagnetic noise of the motor caused by the carrier frequency is dispersed. After random PWM is enabled, the motor has relatively soft "rustling" sound.	Pulse frequency wobble
		Overvoltage Suppression	The motor deceleration time is automatically prolonged during deceleration and power generation to prevent overvoltage from motor power generation.	Vdc Max, overvoltage stall suppression, overvoltage control

Function type	List of Terms		Explanation	Alias
Basic control	Wave generation	Undervoltage suppression	The motor speed is automatically reduced during the voltage dip of power grid to generate power to keep the AC drive bus free from undervoltage. After the power grid is restored, normal operation is restored. During long-term power failure of the power grid, this function reliably stops the motor to prevent the motor from rotating freely.	Power dip ride-through, voltage dip resistance, Vdc Min, undervoltage stall suppression, undervoltage control
		Overexcitation	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
		Flying start	For V/f and SVC controlled motors that rotate freely, the motor speed must be obtained before starting normally. The flying start algorithm can estimate the motor speed at startup and start without disturbance.	Speed tracking startup
		Energy saving control	Energy-saving control of asynchronous motor, which automatically adjusts the output voltage according to the load size, reduces the output current to achieve energy-saving effect.	Efficiency optimization

Function type	List of Terms		Explanation	Alias
Basic control	Motor auto-tuning	Motor auto-tuning	In vector control mode, motor resistance, inductance, and other parameters shall be known to establish an accurate calculation model, which is used to calculate the flux, torque, and speed of the motor. Parameter auto-tuning must be performed in FVC/SVC control. It is also recommended to perform parameter auto-tuning in V/f control for better performance.	Auto-tuning, parameter auto-tuning
		Static auto-tuning	Auto-tuning for motors that do not need to rotate and is performed with load.	-
		Dynamic auto-tuning	Auto-tuning for motors that need to rotate and is performed without load.	-
		With-load auto-tuning	The motor can be auto-tuned with a load, and the motor may rotate.	-
		Magnetic pole position auto-tuning	Before the synchronous motor starts, search for the magnetic field position. The accurate magnetic field position ensures the motor to start with a load.	Phase searching, magnetic pole position identification
		Stator resistance, per-unit value of rotor resistance	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of resistance = rated motor voltage ÷ (1.732 x rated current) in Ω. Actual value of resistance value = Per-unit value of resistance x base value of resistance.	-
		Leakage induc-tance, mutual induc-tance, Ld/ Lq induc-tance per unit value	The per-unit value is generally in percentage. The actual motor parameters can be calculated according to the base value. Per-unit base value of inductance = Per-unit base value of resistance ÷ (2 x PI x rated frequency). The unit is H. Actual value of inductance = Per-unit value of inductance x base value of resistance.	-

Data Flow Description





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.



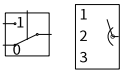
Calculate the differential



Calculate the integral



PID regulator



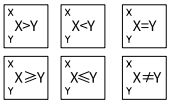
Selection switch. Select one output from several inputs based on the condition



Logic AND/OR/XOR



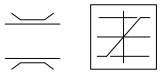
Logic NOT/OR/XOR



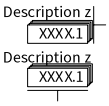
Compare the two input values



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



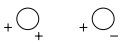
High-pass filter
with integral of small inertial element



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 Commissioning Tool

1.1 Commissioning Tool List

The MD600 supports three types of commissioning tools: local operating panel equipped with MD600 (hereinafter referred to as the operating panel), the MD-BP-M external operating panel, and the iFA Drive commissioning software.

Table 1–1 Commissioning tool list

Commissioning tool	Function description	Remarks
Operating panel	The operating panel is the standard LED operating panel equipped with MD600. • It provides functions such as status and data display, parameter settings, and fault information prompts. • It is installed to the AC drive by default and also can be disassembled as needed to facilitate commissioning.	Standard
MD-BP-M	The external MD-BP-M operating panel is a new-generation commissioning tool of Inovance for the AC drive. • It features functions such as value display, parameter setting, status monitoring, and frequency setting.	Accesso-ries
iFA Drive	iFA Drive is independently developed by Inovance and Inovance fully owns the intellectual property rights to it. It is commissioning software for Inovance general products, and can be used for control, commissioning, fault diagnosis, and operation status monitoring on products. The supported Inovance devices such as AC drives, servo drives, and electrohydraulic servo drives. iFA Drive supports parameter setting and waveform acquisition.	Accesso-ries

1.2 Operating Panel

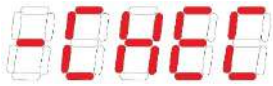
1.2.1 Overview

The operating panel of the MD600 series includes LED and membrane keys. There are 5-bit 8-segment LEDs and 6-bit membrane keys. The following functions shall be supported:

1. Parameter display: The LED displays parameters such as frequency reference, various monitoring data, and fault codes. The indicators indicate the current status and the unit of parameters.
2. 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 the left and right keys to switch between the bits you are operating on.
3. Status monitoring: When the AC drive is stopped or running, the operating panel displays the different status of the AC drive according to the parameter settings (A6-03 to A6-05).

1.2.2 Operating Panel Display

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.

Operating Panel Display	Meaning	Function Description	Status
	Parameter group F0		A0-10
	Parameter value 321.5		The parameter value is 0x000E.
	AC drive initialized		The AC drive is in the auto-tuning state.
	AC drive busy		The AC drive is in the auto-inspection state.
	Fault code (Exxx.y)		Alarm code (Axxx.x)
	Minor fault code (Lxxx.x)		Prompt code (Nxxx.x)

1.2.3 Parameter Settings and View

The LED operating panel adopts a three-level menu to perform operations such as parameter setting. It consists of the following menus:

- Level I: Parameter group
- Level II: Parameter
- Level III: Parameter value

After entering each level of the menu, when the display bit flashes, you can press  and to  modify the value of the bit. You can also switch to other display bits by using the  .

In the level 3 menu state, if the parameter is displayed without any blinking bit, this parameter cannot be modified. This may be caused by the following:

- The parameter is an unmodifiable parameter, such as the product type, actual measurement value, and operation log.
- The parameter is unmodifiable when the drive is running. In this case, to modify the parameter, stop the drive first.

You can return to Level II menu from Level III menu by pressing  or  . The difference between pressing the two keys is:

- After you press OK, the system saves the parameter setting first, and then returns to level-2 menu and shifts to the next parameter.
- Pressing returns to level II menu corresponding to the current parameter without saving the current parameter setting.

Here is the example of setting b5-01 (Digital setting of main frequency) to 30.00 Hz. The basic setting process through the operating panel is as follows.

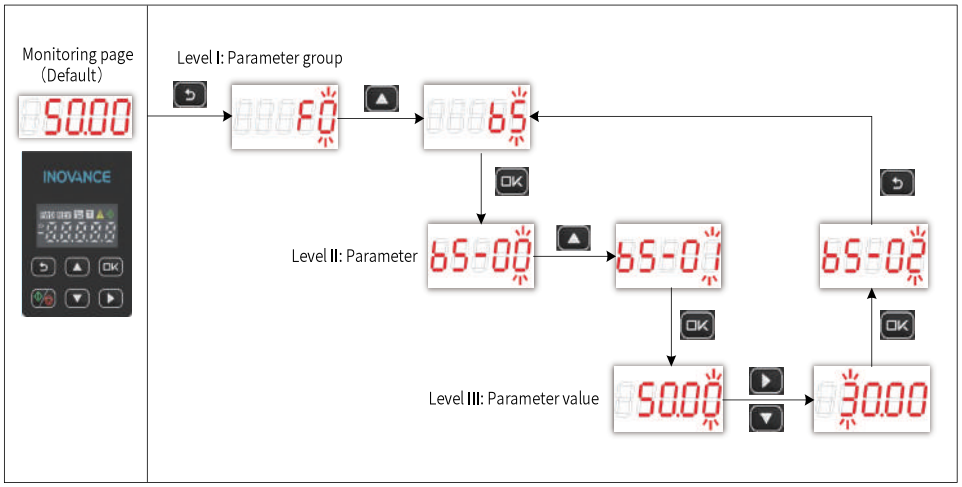


Figure 1-1 Parameter setting

1.2.4 Components

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



Figure 1-2 Operating panel

Table 1–2 Operating panel description

No.	Name	Description
①	Status display area	It displays the running state of the AC drive. For details, see *"Table 1–3" on page 29*
②	Parameter display area	It displays the current parameter of the AC drive.
③	Key area	For details, see *"Table 1–4" on page 29*
④	Connector model	Steady ON: Displays connector parameters.
⑤	Minus sign	Steady ON: Indicates that the current parameter is a negative value or indicates the opposite direction of the content displayed.

Table 1–3 Status description

Sign	Name	Function Description	Status
	FWD	Forward running	Steady on: The AC drive is running forwardly or the forward running mode is set.
	REV	Reverse run	Steady on: The AC drive is running reversely or the reverse running mode is set.
	Local/remote	Local/remote connection mode	• Off: local control • Steady on: Terminal control • Flashing: Communication control • Flashing quickly: User-defined control mode
	Torque control	Torque control mode	Steady on: Torque control mode Off: Speed control mode
	Alarm	Alarm or fault	Steady on: A fault or an alarm occurs.
	Operation	Running status	Steady on: The AC drive is running. Off: The AC drive does not run.
	Connector	Connector model	Steady ON: Displays connector parameters.
	Minus sign	Value sign	Steady ON: Indicates that the current parameter is a negative value or indicates the opposite direction of the content displayed.

Table 1–4 Key descriptions

Key	Name	Function
	Menu/Back key	In the monitoring interface, press the key to enter the parameter setting interface. In the parameter interface, press the key to return to the last interface or undo the operation. Long press the key to enter the multi-function menu.
	Confirm key	Press the key to enter the settings interface or confirm settings.

Key	Name	Function
	Up key	In the monitoring interface, press the key to increase the value of the potentiometer. In the parameter interface, press the key to increase the parameter number.
	Down key	In the monitoring interface, press the key to decrease the value of the potentiometer. In the parameter interface, press the key to decrease the parameter number.
	SHIFT key	In the monitoring interface, press the key to switch among monitoring objects. In the parameter interface, press the key to switch the operation position. In the multi-function menu interface, press the key to switch among the basic menu, user menu, calibration menu, and error record menu. In the error record menu, press the key to switch among historical fault records.
	Run/Stop	In the operating panel control mode, press the key to operate the drive. When the drive is running, press the key to stop the drive. When the drive is in the faulty state, press the key to perform a reset operation.



Do not repair or modify the drive by yourself. In case of any fault that cannot be rectified, contact the agent or Inovance for technical support.

1.2.5 Operating Panel Parameter Monitoring

The parameter monitoring function enables you to view the status of the AC drive via the operating panel. There are two ways to view the monitoring parameters, setting the LED display parameters (A6-03, A6-04, A6-05) and free mapping parameters (A6-07, A6-05, A6-08, A6-09, and A6-10).

1.2.5.1 Display Monitoring Parameters

In the stop or running state, use the shift key on the operating panel to switch the display of different monitoring parameters.

In the operation state, 32 operating status parameters are available. A6-03 and A6-04 determine whether to display the corresponding parameters. In the stop state, 16 stop status parameters are available. A6-05 determines whether the corresponding parameter is displayed.

The following table shows the relationship between A6-03, A6-04, and A6-05 and the dispaly.

Param.	Name	Default	Value Range	Descriptions
A6-03	Parameter 1 displayed on LED operating panel during operation	0x1F	Bit 0: Running frequency (Hz) Bit 1: Frequency reference (Hz) Bit 2: Bus voltage (V) Bit 3: Output voltage (V) Bit 4: Output current (A) Bit 5: Output power (kW) Bit 6: Output torque (%) Bit 7: DI input status Bit 8: DO output status Bit 9: AI1 voltage (V) Bit 10: Reserved Bit 11: Voltage of potentiometer MD-BP-M (V) Bit 12: Reserved Bit 13: Reserved Bit 14: Load speed Bit 15: PID reference Value description of Bit 0 to Bit 15: 0: Hidden 1: Displayed	Sets the contents of parameter 1 displayed on LED operating panel during operation. Additional information: This parameter specifies which parameters can be viewed (by pressing the left and right shift keys) on the LED operating panel when the AC drive is running. The value 1 of a bit indicates that the parameter is displayed, and the value 0 of the bit indicates that the parameter is hidden. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-04	Parameter 2 displayed on LED operating panel during operation	0x0	Bit 0: PID feedback Bit 1: PLC stage Bit 2: HDI pulse input frequency (kHz) Bit 3: Running frequency 2 (Hz) Bit 4: Remaining running time Bit 5: AI1 voltage before correction (V) Bit 6: Free mapping 0 Bit 7: Free mapping 1 Bit 8: Motor speed Bit 9: Current power-on time (hour) Bit 10: Current running time (min) Bit 11: HDI pulse input frequency (Hz) Bit 12: Communication setting value Bit 13: Encoder feedback speed Bit 14: Main frequency X Bit 15: Auxiliary frequency Y Value description of bit0 to bit15: 0: Hidden 1: Displayed	Sets the contents of parameter 2 displayed on LED operating panel during operation. Additional information: This parameter specifies which parameters can be viewed (by pressing the left and right shift keys) on the LED operating panel when the AC drive is running. The value 1 of a bit indicates that the parameter is displayed, and the value 0 of the bit indicates that the parameter is hidden. (Reserved bits are skipped during LED display.)

Param.	Name	Default	Value Range	Descriptions
A6-05	Parameter displayed on the LED operating panel upon stop	0x13	Bit 0: Frequency reference (Hz) Bit 1: Bus voltage (V) Bit 2: DI input status Bit 3: DO output status Bit 4: AI1 voltage (V) Bit 5: Reserved Bit 6: Voltage of potentiometer MD-BP-M (V) Bit 7: Reserved Bit 8: Reserved Bit 9: PLC stage Bit 10: Load speed Bit 11: PID reference Bit 12: HDI pulse input frequency (kHz) Bit 13: Reserved Bit 14: Free mapping 0 Bit 15: Free mapping 1 Value description of bit0 to bit15: 0: Hidden 1: Displayed	Sets the contents of parameter displayed on the LED operating panel upon stop Additional information: This parameter specifies which parameters can be viewed (by pressing the left and right shift keys) on the LED operating panel when the AC drive is stopped. The value 1 of a bit indicates that the parameter is displayed, and the value 0 of the bit indicates that the parameter is hidden. (Reserved bits are skipped during LED display.)

To set monitoring parameters, set the bit corresponding to the parameter to be displayed to 1, and then convert the 16-bit binary number to a hexadecimal value to input into the parameter. Then you can switch the display by using the shift key on the operating panel.

1.2.5.2 Free Mapping

The MD600 supports free mapping to display the word connector on the operating panel of certain format. Up to two free mapping parameters can be set. The parameter values can be obtained from word connectors and can be displayed on the operating panel in different units and different decimal places.

Free Mapping	Value Source	Format Source	Bit of Parameter Displayed in Stop State	Bit of Parameter Displayed in Running State
Free mapping 0	A6-07	A6-08	A6-05 bit14	A6-04 bit6
Free mapping 1	A6-09	A6-10	A6-05 bit15	A6-04 bit7

The following steps are generally followed when setting the free mapping display:

1. Select the word connector to be displayed in the value source.
   Select the connector address corresponding to the parameter to be displayed by parameters A6-07 (Address displayed by free mapping 0) and A6-09 (Address displayed by free mapping 1).

Param.	Name	Default	Value Range	Descriptions
A6-07	Address displayed by free mapping 0	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 0 Value description 0: Invalid address Other: K connector Additional information: This parameter is related to bit6 of A6-04 and bit14 of A6-05 (free mapping 0). After the bits are set to 1, the free mapping 0 can be displayed in the level 0 menu. The display is the connector value set by A6-07. It is inactive when A6-07 is set to 0.
A6-09	Address displayed by free mapping 1	0	0: Invalid address Other: K connector	Sets the address displayed by free mapping 1 Value description 0: Invalid address Other: K connector Additional information: This parameter is related to bit7 of A6-04 and bit15 of A6-05 (free mapping 1). After the bits are set to 1, the free mapping 1 can be displayed in the level 0 menu. The display is the connector value set by A6-09. It is inactive when A6-09 is set to 0.

2. In the format source parameters, set the display format of free mapping

   Set the display format through A6-08 and A6-10. The format options are as follows:

Bit	Property
Ones place	Indicates units. 0: / 1: Hz 2: A 3: rpm 4: V 5: Link 6: % 7: s 8: h 9: kW A: KWh B: °C
Tens place	Indicates different decimal places. 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places 3: 3 decimal places 4: 4 decimal places
Hundreds	0: Disable 1: Enable

Select the unit of the word connector display through the ones position of the parameter value. In the tens position, select the number of decimal places corresponding to the word connector display. Select whether the free mapping is enabled in the hundreds position. For example, to set the display format of free mapping 0 to a frequency value of two decimal places, select 1 in ones position, 2 in tens position, and 1 in hundreds position. That is, set A6-08 (Format displayed by free mapping 0) to 0x0121.

3. The bit corresponding to the free mapping in A6-04 or A6-05 is set to 1.
   Bit6 in A6-04 corresponds to free mapping 0 and bit7 corresponds to free mapping 1. Bit14 in A6-05 corresponds to free mapping 0 and bit15 corresponds to free mapping 1. Set the corresponding bits to 1 to display the connector parameters during stop or running.

   For example, to display L5-20 (Module temperature) on the operating panel at stop, and display it in two decimal places and in °C. Set A6-07 to L5-20 (Operating panel sets the connector number 1520), set A6-08 to 0x012B, and set bit 14 of A6-05 to 1.

   If the value of L5-20 is 3000, the value displayed on the operating panel is 30.00°C.

1.3 MD- BP- M External Operating Panel

1.3.1 Overview

The external MD-BP-M operating panel is a new-generation commissioning tool of Inovance for the AC drive. The following functions are supported:

- Parameter display: The LED displays parameters such as frequency reference, various 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 the left and right keys to switch between the bits you are operating on.
- Status monitoring: When the AC drive is stopped or running, the operating panel displays the different status of the AC drive according to the parameter settings (A6-03 to A6-05).
- Frequency setting: Set F0-29 (Main frequency source) to 10 (MD-BP-M potentiometer). You can modify the frequency setting of the AC drive by using the AI voltage regulator knob on the product.

1.3.2 Components

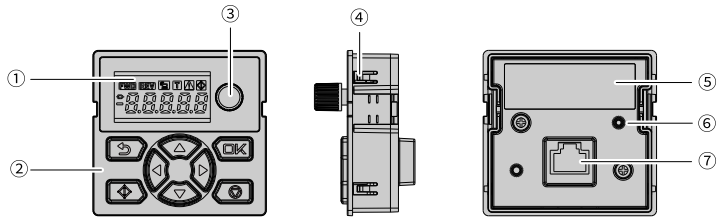


Figure 1-3 Components

Table 1–5 Component list

No.	Name	Components
①	Display	It displays the parameters and running state of the AC drive. For details, see *"Table 1–7" on page 37*.
②	Key	The keys are used to enter parameters. For details, see *"Table 1–6" on page 37*.
③	Knob	It is used to adjust the running frequency, multi-reference 0 input, and arithmetic module input of the AC drive.
④	Snap-fit joint	The snap-fit joints at both sides are used to fix the product to the mounting cabinet door.
⑤	Nameplate	The nameplate displays the product model and serial number.
⑥	Nut	Secure the product to the mounting cabinet door by means of lock screw.
⑦	RJ45 network port	The RJ45 network port is used to connect the product to the AC drive.

Table 1–6 Key descriptions

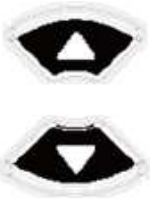
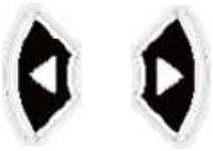
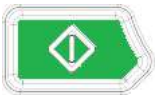
Key	Name	Function
	Menu/Back key	In the monitoring interface, press the key to enter the parameter setting interface. In the parameter interface, press the key to return to the last interface or undo the operation. Long press the key to enter the multi-function menu.
	Confirm key	Press the key to enter the settings interface or confirm settings.
	Up/Down key	In the monitoring interface, press the up/down key to increase/ decrease the value of the potentiometer. In the parameter interface, press the up/down key to increase/ decrease the parameter number.
	Left/Right shift key	In the monitoring interface, press the key to switch among monitoring objects. In the parameter interface, press the key to switch the operation position. In the multi-function menu interface, press the key to switch among the basic menu, user menu, calibration menu, and error record menu. In the error record menu, press the key to switch among historical fault records.
	RUN key	Used to start the AC drive under the start/stop control.
	Stop key	Stop the AC drive in the running state. Reset the fault when the drive is in the faulty state.

Table 1–7 Status description

Symbol	Name	Function Description	Status
	FWD	Forward running	Steady on: The AC drive is running forwardly or the forward running mode is set.
	REV	Reverse run	Steady on: The AC drive is running reversely or the reverse running mode is set.
	Local/remote	Local/remote connection mode	• Off: local control • Steady on: Terminal control • Flashing: Communication control • Flashing quickly: User-defined control mode
	Torque control	Torque control mode	Steady on: Torque control mode Off: Speed control mode
	Alarm	Alarm or fault	Steady on: A fault or an alarm occurs.

Symbol	Name	Function Description	Status
	Operation	Running status	Steady on: The AC drive is running. Off: The AC drive does not run.
	Connector	Connector model	Steady ON: Displays connector parameters.
	Minus sign	Value sign	Steady ON: Indicates that the current parameter is a negative value or indicates the opposite direction of the content displayed.
	Unit	Unit indicators	Indicate the unit of the value displayed in the LED.

Use of the knob

MD-BP-M supports the input of the potentiometer through knobs. The voltage value of the potentiometer controlled by the knob can be used as the input source of the main frequency, multi-reference, and PID setting. Some parameter values can be set to the MD-BP-M potentiometer. You can quickly adjust the input value of the parameters through the knob.

For example, you can modify the main frequency setting by turning the knob on the MD-BP-M. Set F0-29 (Main frequency source) to 10. Turn to the left to decrease the frequency value. Turning to the left to the end corresponds to the minimum frequency (0 Hz). Turn to the right to increase the frequency value. Turning to the right to the end corresponds to the maximum frequency.

1.3.3 Operating Panel Display

The main display area of the MD-BP-M external operating panel consists of five 8-segment LEDs. The numeric and status display are consistent with the AC drive operating panel. For details, see *"1.2.2 Operating Panel Display" on page 27*. The MD-BP-M operating panel includes indicators, which can display five commonly used units of parameters. The indicators are as follows.

Table 1–8 Unit indicator description

Unit indicator	Unit
	Speed unit: Revolution per minute
	Frequency unit: Hz
	Current unit: A
	Voltage unit: V
	Percentage

1.3.4 Connecting MD-BP-M to AC Drive

Connect the external operating panel interface (CN2) of the AC drive to the RJ45 network port on the back of the MD-BP-M using a standard network cable.

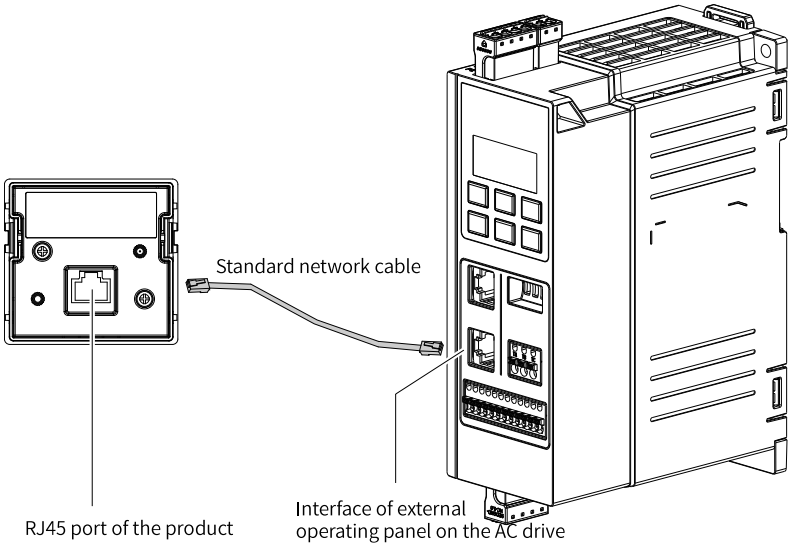


Figure 1-4 Wiring diagram

It is recommended to use a standard network cable with a transmission rate of 100 Mbps or above within a length of 10 m.

1.3.5 Parameter Settings and View

Both MD-BP-M and the operating panel adopt a three-level menu to perform operations such as parameter setting. The operation methods of the two are basically the same. MD-BP-M also supports the following functions:

- Switch the value with the left shift key and the right shift key .
- Perform the start/stop control through the RUN key and the STOP key , respectively.

Here is the example of setting F0-30 (Digital setting of main frequency) to 25.00 Hz. The basic setting process through MD-BP-M is as follows.

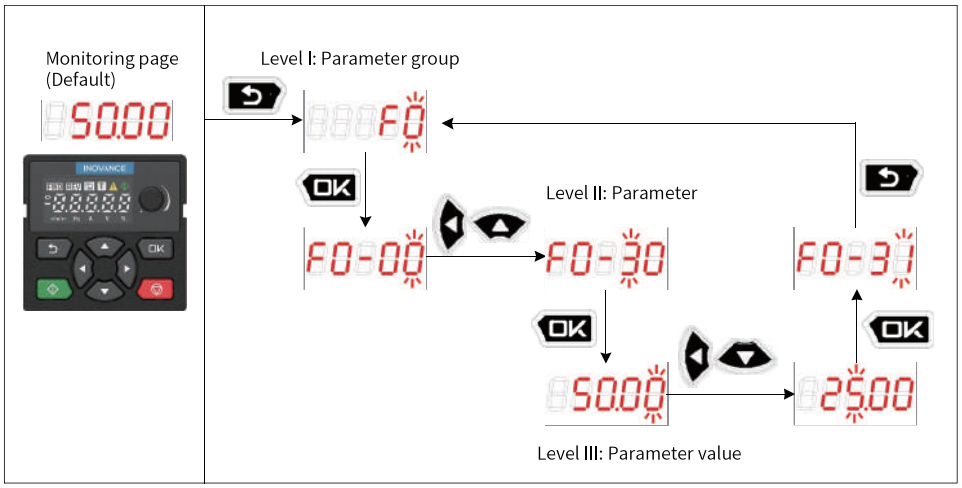


Figure 1-5 Setting parameters through BD-BP-M

The parameter display of the MD-BP-M is synchronized with the operating panel display. To enable the parameter monitoring, set the parameters according to *" Operating Panel Parameter Monitoring" on page 30*.

2 Commissioning and Trial Run

2.1 Parameter Introduction

2.1.1 Parameter Groups

Function Parameter Groups

Parameters of the AC drive are grouped by function and displayed in three levels of menus, as shown below:

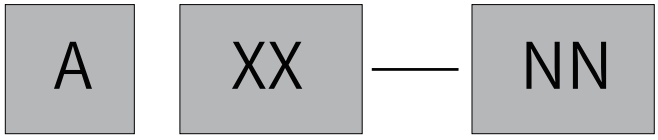


Figure 2-1 Parameter display

- A indicates the level-I menu, which is represented by one letter and corresponds to a group of complete functions. For example, group A corresponds to the system function and group b corresponds to the command channel.
- XX indicates the level-II menu, which is represented by one or two digits, corresponding to the function category when combined with level-I menus. For example, group A0 is related to parameter management, and group A2 is related to system information.
- NN indicates the level-III menu, which is represented by a a 2-digit number, corresponding to a certain parameter when combined with level-I and level-II menus. For example, A0-00 is related to parameter initialization.

Level-II and level-III menus are usually separated by the symbol “-”.

Parameters of the level-I menu are shown in the following table. For details on the parameter menu, see *“ Parameter Categories” on page 551*.

Table 2–1 Parameter group

Level-I Group Name	Level-I Group Description
F	Common parameter
A	System
b	Command Channel
C	Motor parameter
d	Motor control
E	Input/Output
H	Protection and auxiliary
n	Communication Configuration
o	Free function block
P	Application function
L	Connector
U	Common monitoring

Common parameter

This product supports common parameter group (Group F, which is combined by the common parameters from other groups. You can quickly configure common functions through group F parameters

If the parameters discussed in this manual are mapped to group F, their corresponding settings within group F are also introduced. Setting these parameters either in Group F or directly on the original parameters yields the same results,

Note

The product provides two control channels for setting running commands. Group F only includes parameters commonly used for running commands in channel 1 (default setting).

The product provides two set channels for setting frequency or torque reference. Group F only includes parameters commonly used for frequency or torque references in channel 1 (default setting).

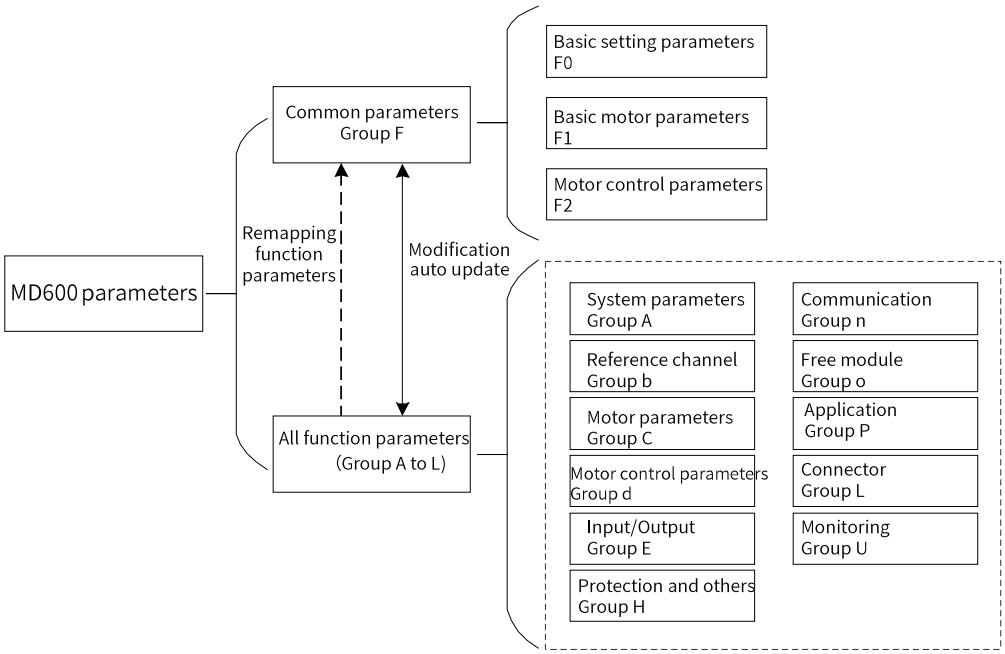


Figure 2-2 Parameter group diagram

2.1.2 Parameter Access Level

This product defines parameters into four levels: standard, expansion, expert, and factory. The following parameters are allowed to be read and written at different levels.

Table 2–2 Parameter access level

Parameter Access Level	Description	Remarks
1	Standard parameter	Default parameter access level, which allows you to access the basic function parameters of the AC drive.
2	Expansion parameter	Mainly include motor expansion function parameters, such as user-defined parameters and frequency detection parameters.

Parameter Access Level	Description	Remarks
3	Expert parameters	You can set passwords and complex motor performance commissioning parameters.
4	Factory parameter	Locked by password. Only the manufacturer can access this kind of parameters and the manufacturer can access all parameters.

The default parameter access level is standard. You can switch the parameter access level through A0-11. The parameter access level currently in effect are displayed in A0-10. Standard and expansion levels can be switched directly, and expert and factory levels can not be accessed unless entering the password. For details on switchover of parameter access levels, see *" Parameter Categories" on page 551*.

Table 2–3 Parameter access level

Parameter	Name	Default	Value Range
A0-10	System parameter access level	0	0: Standard 1: Expansion 2: Expert 3: Factory
A0-11	Parameter access level setting	0	0: Standard 1: Expansion 2: Expert

Note

- If the expert password status (A0-23) is locked, you cannot switch directly to expert level.
- The operating panel, commissioning software, and communication access rights are affected by A0-10

2.2 Basic Commissioning Flowchart

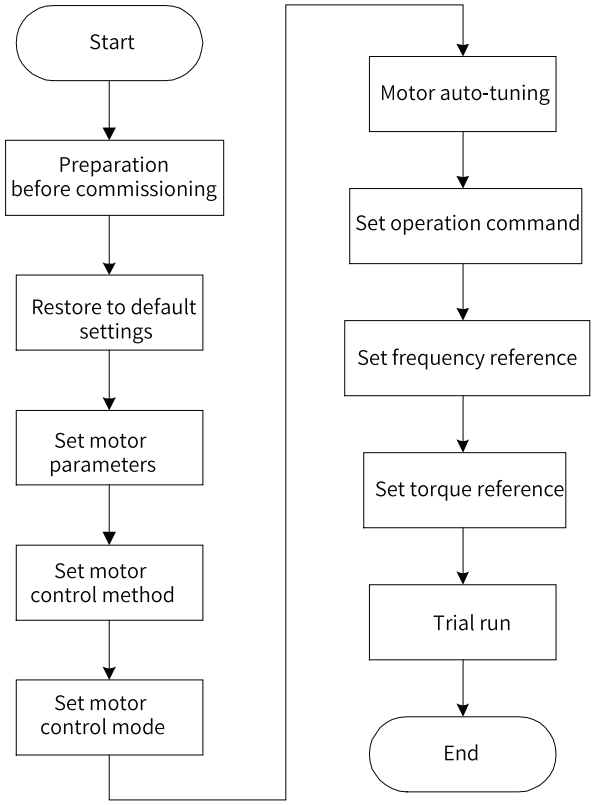


Figure 2-3 Commissioning Flowchart

The preceding system power-on commissioning process includes the basic steps for normal use of MD600 series products. You should carefully read the relevant sections and follow the commissioning steps.

2.3 Commissioning Tools

2.3.1 Checking Peripheral Connection

Before powering on and commissioning the control system, ensure that the preparation for power-on has been completed, and check each item in the table.

Table 2–4 Steps

Item	Operation	Passed	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 in 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 AC drive and motor are reliably grounded.	☐	☐

Item	Operation	Passed	Completed
5	The encoder is correctly connected, and the shield is properly processed.	☐	☐
6	The power input of the auxiliary circuit is correctly connected based on terminal labels (L1, L2, L3, and N).	☐	☐
7	Communication cables are correctly connected.	☐	☐
8	External interfaces such as I/O interfaces are correctly connected.	☐	☐

2.3.2 AC Drive Model Check

Equipment Information Check

The following table describes parameters used to check device information.

Table 2–5 Related Parameters

Parameter	Name	Parameter
A3-02	Rated AC drive power	This parameter displays the rated AC drive power.
A3-03	Rated AC drive current	This parameter displays the rated AC drive current.
A3-04	Rated AC drive voltage	This parameter displays the rated AC drive voltage.
A3-05	Maximum AC drive current	Sets the maximum current of the AC drive. The base value is the rated current of the AC drive

Note

If the product information such as the rated power, rated voltage, and rated current is inconsistent with that on the nameplate, contact the service personnel for technical support.

Load Mode Setting

Set the A3-01 parameter to select appropriate load characteristics. The load curve is used to protect the power module from overload. This is to avoid local temperature increases due to continuous overload conditions, and ensure that the power module can run reliably for long time. The selection of load mode must match the hardware selection design.

For applications with overload requirements, selecting the heavy overload mode can increase the maximum output current of the power module in a short time. The typical application for the heavy overload mode is that the drive runs at the heavy overload current for a period no shorter than 240 seconds and then runs at 1.5 times the heavy overload current for no more than 60 seconds. For applications with long-time stable load, the light overload mode is recommended to use the output capability of the power module to the maximum.

Heavy load application: Constant torque load. Such loads are conveyor belt and cranes, for example.

Light load application: variable-torque load, such as fans, water pumps, air conditioners, and air compressors.

Caution

Note: Applications with heavy-load operation below 5 Hz require AC drives supporting higher working conditions based on heavy-load models.

2.3.3 Software Version Check

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

Table 2–6 Parameters related to the software version

Parameter	Name	Description
A2-22	Performance software version	This parameter displays major version of the performance software.
A2-23	Function software version	This parameter displays major version of the function software.
A2-24	Performance software sub-version	This parameter displays the sub-version of the performance software.
A2-25	Function software sub-version	This parameter displays the sub-version of the function software.

2.4 Restoring Parameters to Default Settings

Set A0-00 (Parameter initialization) to 3 to restore parameters (including motor parameters) to default settings.

Table 2–7 Restore the default setting

Parameter	Name	Default	Value Range
A0-00	Parameters initialization	0: No operation	0: No operation 1: Restore parameters (excluding motor parameters) to default settings 2: Clear records 3: Restore parameters (including motor parameters) to default settings 4: Back up current user parameters 5: Clear fault information 501: Restore user backed-up parameters 503: Restore parameters including motor parameters to default settings and clear records

This parameter sets the parameter operation to be performed.

Value description

0: No operation

1: Restore parameters (excluding motor parameters) to factory settings AC drive parameters except factory parameters, motor parameters, and records are restored to default settings.

2: Clear records Fault records, cumulative running time, cumulative power-on time, and cumulative power consumption are cleared.

3: Restore parameters (including motor parameters) to factory settings Except the factory parameters and records, all other parameters of the AC drive are restored to factory settings. This differs from mode 1 in that the motor parameters are also restored.

4: Back up current user parameters The current parameter settings are backed up, which is the same as the function when A0-09 is set to 400.

5: Clear fault information The fault information recorded in group H6 to Hb is cleared.

501: Restore user parameters from backup Parameters backed up by setting A0-00 to 4 are stored, which is the same as the function when A0-08 is set to 500.

503: Restore parameters (including motor parameters) to factory settings and clear records Except the factory parameters, all other parameters of the AC drive are reset to the factory settings. This differs from mode 3 in that the records are cleared. Factory parameters include the model parameters, AI/AO correction parameters. Record information parameters include the fault record, cumulative running time, and cumulative power-on time.

Additional information: After the parameter operation is completed, this parameter is automatically restored to 0.

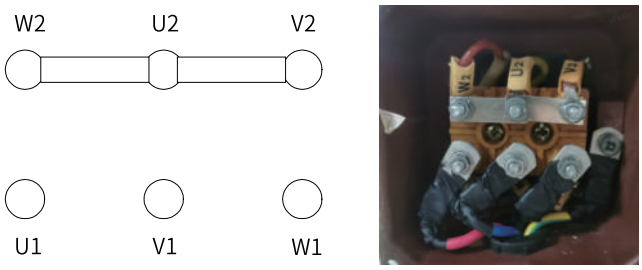
2.5 Motor Parameters Setting

The motor parameters on the nameplate determine whether the parameter auto-tuning is successful or not. The parameter setting of asynchronous motors and synchronous motors is different. First, determine the motor type. In some cases, the motor type is not indicated on the nameplate. You can confirm the motor type by using the following two methods:

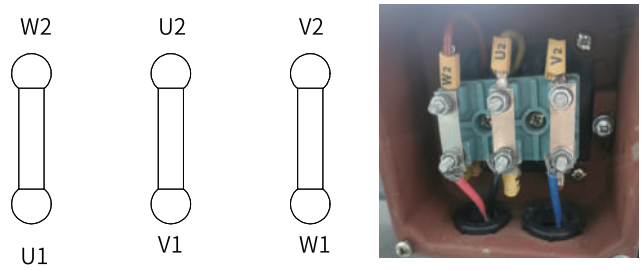
1. The asynchronous motor has slip, and the synchronous motor has no slip. The rated slip of the motor = rated frequency x 60 ÷ rated pole pairs - rated speed.
2. Short the UVW cable of the motor. The motor with obvious resistance when it is wobbled manually is synchronous motor. Otherwise, the motor type is asynchronous motor. This method can be used to determine whether the reluctance motor is magnet assisted synchronous reluctance motor. The resistance of the reluctance motor without assisted magnet will not increase.

Description: Parameters group F is the mapping of the first motor control parameters. The same parameters can be found in groups d0 to d7. After modifying parameters group F, the corresponding parameters of d0 to d7 will also be changed.

It is recommended to check whether the motor connection method (Y-type or△-type) is consistent with the motor nameplate. The wrong motor connection method will result in poor motor output force and high output current without carrying the load.



(a) Y-type motor connection



(b) △-type motor connection

Figure 2-4 Motor wiring

Some motors may have multiple groups of parameters on the nameplates. As shown in the following figure, it is recommended to select the motor parameter group 1 input to the AC drive as the rated parameters. The analysis is as follows:

V/f is directly proportional to the flux. The V/f of motor parameter group 1 and motor parameter group 2 is about 18.5, which is the rated flux coefficient. The V/f of motor parameter group 3 = 7.2, which is the field-weakening parameter. The V/f of motor parameter group 4 = 4.7, which is the field-weakening parameter. The rated motor parameters in the AC drive cannot be used to set the field-weakening parameters. Selecting motor parameter group 3 or 4 will result in insufficient motor output. Therefore, only group 1/2 can be selected. If the motor parameter group 2 is selected, the maximum output force at low frequency cannot meet the design requirements; therefore the motor parameter group 1 shall be selected. For the AC drive, the maximum output voltage is related to the bus voltage and is not related to the rated motor voltage. Do not worry that setting the motor group 1 parameters will result in insufficient output voltage.

duty type	n (1/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

2.5.1 Parameter Setting for Asynchronous Motor

When the motor type is asynchronous motor, the following table lists the motor parameters that need to be set according to the motor nameplate.

Parameter	Name	Parameter Value
F1-00 (C4-00)	Motor type	This parameter sets the motor type. Value description 0: Common asynchronous motor 2: Permanent magnet synchronous motor
F1-01 (C4-01)	Rated motor power	For applications where multiple motors are driven by one AC drive (multiple motors must be the same), set the rated power of a motor and set the number of parallel motors in C4-13 (Number of parallel motors). The rated motor power indicates the axis output power of the motor working in rated conditions. Select a motor with a proper power rating on the premise that the motor can meet the requirements of mechanical load. Take the motor heat dissipation, allowable overload capacity, and starting capacity into account.
F1-03 (C4-03)	Rated motor voltage	It is used to set the rated motor voltage in the unit of V. The rated motor voltage indicates the voltage of the motor during normal operation, which usually refers to the line voltage.
F1-04 (C4-04)	Rated motor current	Indicates the current of the motor during normal operation, which usually refers to the line current. Set the rated motor current. For applications where multiple motors are driven by one AC drive, set the rated current of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).
F1-06 (C4-06)	Rated motor frequency	It is used to set the rated motor frequency in the unit of Hz. The rated motor frequency indicates the frequency of the power supply connected to the stator winding under the rated operation conditions of the motor.
F1-07 (C4-07)	Rated motor speed	It is used to set the rated motor speed in the unit of rpm. The parameter indicates the rated rotor speed of the motor. For synchronous motors, synchronous speed is (rated frequency x 60 ÷ number of pole pairs), and for asynchronous motors, slip must be considered. Some motor nameplates do not include a rated speed or only list the synchronous speed, so the rated speed can be set according to the following base value.
F1-10 (C4-10)	Maximum motor frequency	It is used to set the allowed maximum frequency of the motor in the unit of Hz. The maximum motor frequency is the base value of the set frequency and acceleration/deceleration time. When the maximum set frequency is lower than the rated motor frequency, the effective maximum frequency is the rated motor frequency. If you want to set the speed limit, set it in F2-22 to F2-27.
F1-11 (C4-11)	Minimum motor frequency	It is used to set the allowed minimum frequency of the motor in the unit of Hz. Minimum motor frequency This parameter is not required for the motors that do not support low-speed operation.
F1-14 (C4-14)	Number of motor pole pairs (number of pole pairs/2)	This parameter defines the number of motor pole pairs. Remarks When this parameter is set to 0, the number is automatically calculated by the system and the effective value is displayed in F1-14. If the number of pole pairs does not exceed 12, the software automatically calculates the correct number of pole pairs. Note: The difference between the number of poles and the number of pole pairs is that the nmber of pole pairs = the number of poles ÷ 2.

Note

- The motor parameters in group F1 in the table are the mapping of motor parameters in group C4. The settings of the two groups are equivalent.
- Set the rated speed of the asynchronous motor based on synchronous speed: 1. See the following table for the recommended slip ratio based on the motor power. 2. Rated speed = Synchronous speed – Recommended slip ratio 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 ratio	6%	5%	4%	4%	3.5%	3%	2.5%

Power	30 kW	55kw	90kw	110kw	160kw	250kw	315kw
Recommend-ed slip ratio	2.5%	2%	1.5%	1.5%	1%	1%	0.67%

Power	400kw	500kw	630kw
Recommended slip ratio	0.67%	0.67%	0.67%

- After the settings according to the motor nameplate parameters, the output current may exceed the expected values when the motor is running without load in the V/f mode. You can reduce the rated voltage slightly by 10 V to 20 V before performing parameter auto-tuning. This adjustment can lead to improved control performance.

2.5.2 Parameter Setting for Synchronous Motor

When the motor type is synchronous motor, the following table lists the motor parameters that need to be set according to the motor nameplate.

Parameter	Name	Parameter Value
F1-00 (C4-00)	Motor type	This parameter sets the motor type. Value description 0: Common asynchronous motor 2: Permanent magnet synchronous motor
F1-01 (C4-01)	Rated motor power	It is used to set the rated motor power in the unit of kW. For applications where multiple motors are driven by one AC drive (multiple motors must be the same), set the rated power of a motor and set the number of parallel motors in C4-13 (Number of parallel motors). The rated motor power indicates the axis output power of the motor working in rated conditions. Select a motor with a proper power rating on the premise that the motor can meet the requirements of mechanical load. Take the motor heat dissipation, allowable overload capacity, and starting capacity into account.
F1-03 (C4-03)	Rated motor voltage	It is used to set the rated motor voltage in the unit of V. The rated motor voltage indicates the voltage of the motor during normal operation, which usually refers to the line voltage.
F1-04 (C4-04)	Rated motor current	Indicates the current of the motor during normal operation, which usually refers to the line current. Set the rated motor current. For applications where multiple motors are driven by one AC drive, set the rated current of a single motor and set the number of parallel motors in C4-13 (Number of parallel motors).

Parameter	Name	Parameter Value
F1-06 (C4-06)	Rated motor frequency	It is used to set the rated motor frequency in the unit of Hz. The rated motor frequency indicates the frequency of the power supply connected to the stator winding under the rated operation conditions of the motor.
F1-07 (C4-07)	Rated motor speed	It is used to set the rated motor speed in the unit of rpm. The parameter indicates the rated rotor speed of the motor. For synchronous motors, synchronous speed is (rated frequency x 60 ÷ number of pole pairs), and for asynchronous motors, slip must be considered. Some motor nameplates do not include a rated speed or only list the synchronous speed, so the rated speed can be set according to the following base value.
F1-10 (C4-10)	Maximum motor frequency	It is used to set the allowed maximum frequency of the motor in the unit of Hz. The maximum motor frequency is the base value of the set frequency and acceleration/deceleration time. When the maximum set frequency is lower than the rated motor frequency, the effective maximum frequency is the rated motor frequency. If you want to set the speed limit, set it in F2-22 to F2-27.
F1-11 (C4-11)	Minimum motor frequency	It is used to set the allowed minimum frequency of the motor in the unit of Hz. Minimum motor frequency This parameter is not required for the motors that do not support low-speed operation.
F1-12 (C4-12)	Synchronous motor back EMF	It is used to set the effective value of the linear back EMF of the synchronous motor at rated speed. The value is obtained through auto-tuning. The rated back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = F1-07 ÷ 1000 x 120 V. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.
F1-14 (C4-14)	Number of motor pole pairs (number of pole pairs/2)	This parameter defines the number of motor pole pairs. Additional information: When this parameter is set to 0, the number is automatically calculated by the system and the effective value is displayed in F1-14. If the number of pole pairs does not exceed 12, the software automatically calculates the correct number of pole pairs. Note: The difference between the number of poles and the number of pole pairs is that the nmber of pole pairs = the number of poles ÷ 2.

Note

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

2.5.3 Setting Carrier Frequency

Set the carrier frequency through A5-01. For high-speed motors, ensure that:

A5-01 > (12 x maximum output frequency)

Otherwise, during high-speed operation, oscillation and dissipation overcurrent may occur due to insufficient control frequency. A low carrier frequency setting 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.

Parameter	Name	Default	Value Range
A5-01	Set carrier frequency	4.0	0.8 kHz to 20.0 kHz

2.6 Setting the Motor Control Mode

You can set the motor control mode through F0-01 (Motor control mode).

Parameters	Name	Item	Application
F0-01 (d0-00)	Motor control mode	0: SVC Speed sensorless vector control (SVC)	0: SVC, which stands for sensorless vector control. It is an open-loop vector control mode, which is applicable to high-performance control applications. In this case, one AC drive can drive only one motor. This mode applies to such loads as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in the FVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters.
		2: V/f Voltage/ frequency control (V/f)	2: V/f, which stands for voltage/frequency control. It is an open loop control mode based on constant voltage and frequency ratio. This mode is applicable to scenarios without high requirements on load control performance, such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simply and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.

Note

- The motor parameter F0-01 in the table is the mapping of motor parameter d0-00. The settings of the two parameters are equivalent.
- This product does not support FVC (vector control with encoder).

2.7 Setting the Speed or Torque Control Mode

The product supports two motor control modes: speed control and torque control, which is set through F0-02 (Motor control mode).

Parameter	Name	Default	Value Range
F0-02 (d0-01)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector

Note

- The motor parameter F0-02 in the table is the mapping of motor parameter d0-01. The settings of the two parameters are equivalent.
- If F0-01 is set to the V/f control mode, only the speed control mode is supported.
- If the torque control mode is applied under normal operating conditions, switch to the speed control mode during initial commissioning for motor auto-tuning. After the auto-tuning is completed and running direction is adjusted, switch to the torque control mode again.

2.8 Motor Auto-tuning

2.8.1 Auto-Tuning Step

Unlike servo systems which use preset parameters, the AC drives need to be matched with different motors and require the motor parameter auto-tuning before operation The following scenarios are required for motor parameter auto-tuning.

1. Vector control
2. V/f control of asynchronous motor. (Static parameter auto-tuning is required if flying start is applicable.) Conventional V/f applications. (Parameter auto-tuning is recommended for better performance.)

The basic steps for parameter auto-tuning are as follows:

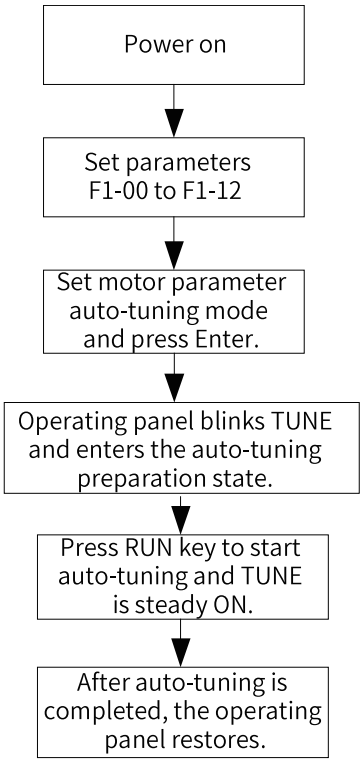


Figure 2-5 Auto-tuning step

Param.	Parameter Name	Default	Value Range	Descriptions
F1-69 (C2-00)	Motor parameter auto-tuning mode	0	0 to 14	Sets the motor auto-tuning mode. 0: No operation 1: Static partial auto-tuning of asynchronous motor It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Some motor parameters are auto-tuned. Other parameters use default values. 2: No-load dynamic auto-tuning of asynchronous motor It applies to scenarios where the motor can rotate at high speed without the load. It supports auto-tuning of all motor parameters under no-load and pure inertia load states. 3: Static complete auto-tuning of asynchronous motor It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Some motor parameters are auto-tuned. The auto-tuning precision is better than that when F1-69 is set to 1. 4: Inertia auto-tuning This mode is applicable to scenarios requiring high-speed operation. Auto-tuning can be performed without load or with light load (below 80% of the rated load) or pure inertia load. Parameters such as inertia ratio is tuned. 5: Dead zone auto-tuning This mode is used to tune the non-linear characteristics of the drive, thus improving the voltage output precision and operation efficiency. 11: Scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed Some motor parameters are auto-tuned. Other parameters use default values. 12: No-load dynamic auto-tuning of synchronous motor It applies to scenarios where the motor can rotate at high speed without the load. All motor parameters can be tuned. 13: Static partial auto-tuning of synchronous motor It applies to scenarios where the motor cannot be disconnected from the load and dynamic complete auto-tuning is not allowed. Some motor parameters are auto-tuned. The auto-tuning precision is better than that when the synchronous motor is tuned with load. 14: UV gain deviation auto-tuning The sampling deviation between output phase currents is auto-tuned. Specific auto-tuning parameters also depends on the setting of C2-01. Remarks Dynamic auto-tuning and inertia auto-tuning are suitable for occasions where the motor can rotate without load. If little load torque is output after the motor rotates, the scenario will be regarded as no load even through the motor does not completely disconnect from the load mechanism. Static auto-tuning is suitable for situations where the motor cannot rotate.

Note

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

2.8.2 Asynchronous Motor Parameter Auto-Tuning

1. When auto-tuning motors of the same model and AC drives, you can transfer the adjusted parameter file to a new AC drive.
2. During initial auto-tuning, if the motor can rotate freely, it is recommended to set F1-69 to 2 (No-load dynamic auto-tuning of asynchronous motor) to achieve optimal control performance.
3. If dynamic auto-tuning is not feasible but asynchronous motor mutual inductance and no-load current are known, set F1-69 to 1 (Static partial auto-tuning of asynchronous motor). After auto-tuning is completed, set the correct no-load current and mutual inductance to obtain good control performance.
4. In cases where the motor is immobile or the correct back EMF is not known, set F1-69 to 3 (Static complete auto-tuning of asynchronous motor). The motor can also run using this auto-tuning method.

For better ease of use and control performance, the commissioning priority is as follows: 1> 2> 3> 4.

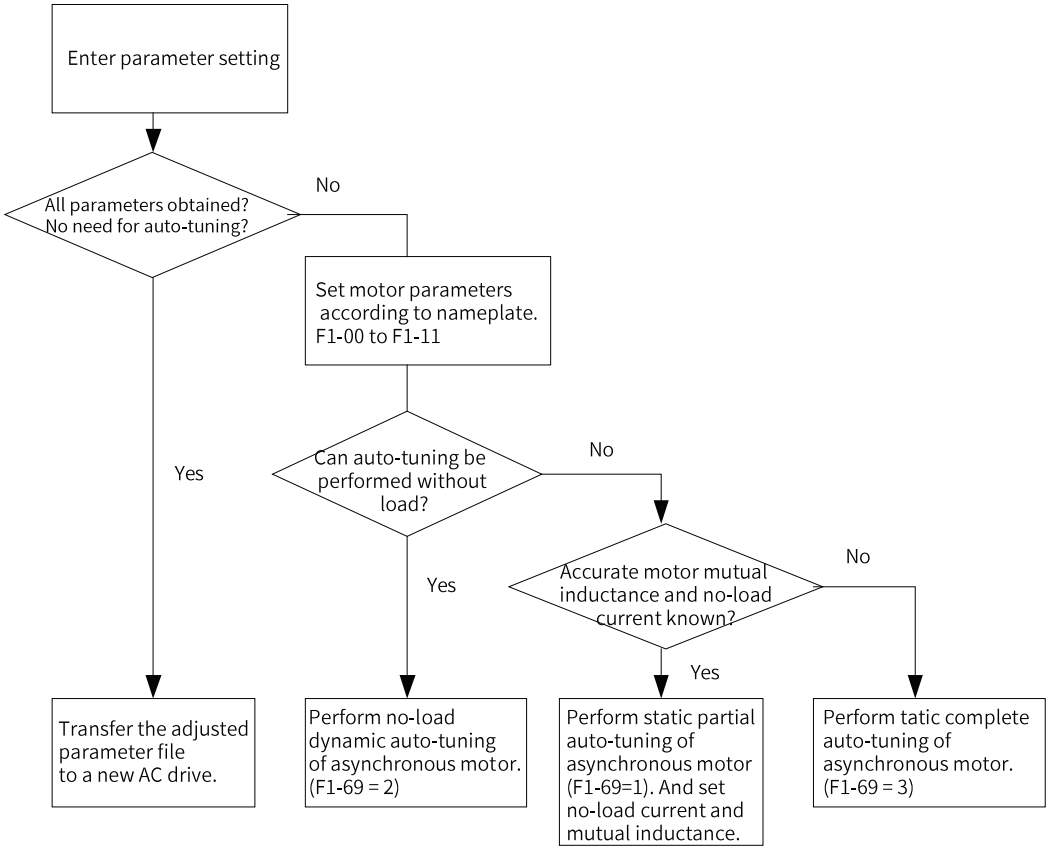


Figure 2-6 Asynchronous motor parameter auto-tuning mode

Parameter	Parameter 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	Descriptions
F1-20 (C4-20)	Motor stator resistance	✓	✓	✓	-	-
F1-22 (C4-22)	Asynchronous motor rotor resistance	✓	✓	✓	-	-
F1-24 (C4-24)	Asynchronous motor stator leakage inductance	✓	✓	✓	-	-
F1-28(C4-28) F1-30(C4-30)	Asynchronous motor mutual inductance and no-load current	-	✓	✓	-	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	-	✓	-	-	-
A3-31 to A3-46	Dead zone compensation curve	✓	✓	✓	-	The dead zone compensation curve is critical to the low-speed performance of the SVC mode. It must be included when downloading or setting all parameters.
F2-02 (d3 -02) F2-03 (d3 -03) F1-48(C4-62)	SVC speed loop Kp/Ti, inertia ratio	-	✓	-	✓	The system with fixed inertia can perform 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.

Note

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

2.8.3 Synchronous Motor Parameter Auto-tuning

The following figure shows the parameter auto-tuning process of synchronous motors. For better ease of use and control performance, the commissioning priority is as follows: 1> 2> 3.

1. When auto-tuning motors of the same model and AC drives, you can transfer the adjusted parameter file to a new AC drive.
2. During initial auto-tuning, if the motor can rotate freely, it is recommended to set F1-69 to 12 (No-load dynamic auto-tuning of synchronous motor) to achieve optimal control performance.
3. If dynamic auto-tuning is not feasible but the back EMF of the synchronous motor is known, set the F1-12 first, and then set F1-69 = 13 (Static complete auto-tuning of synchronous motor).
4. In cases where the motor is immobile or the correct back EMF is not known, remove the load and perform no-load dynamic auto-tuning.

The state change process during auto-tuning is as follows:

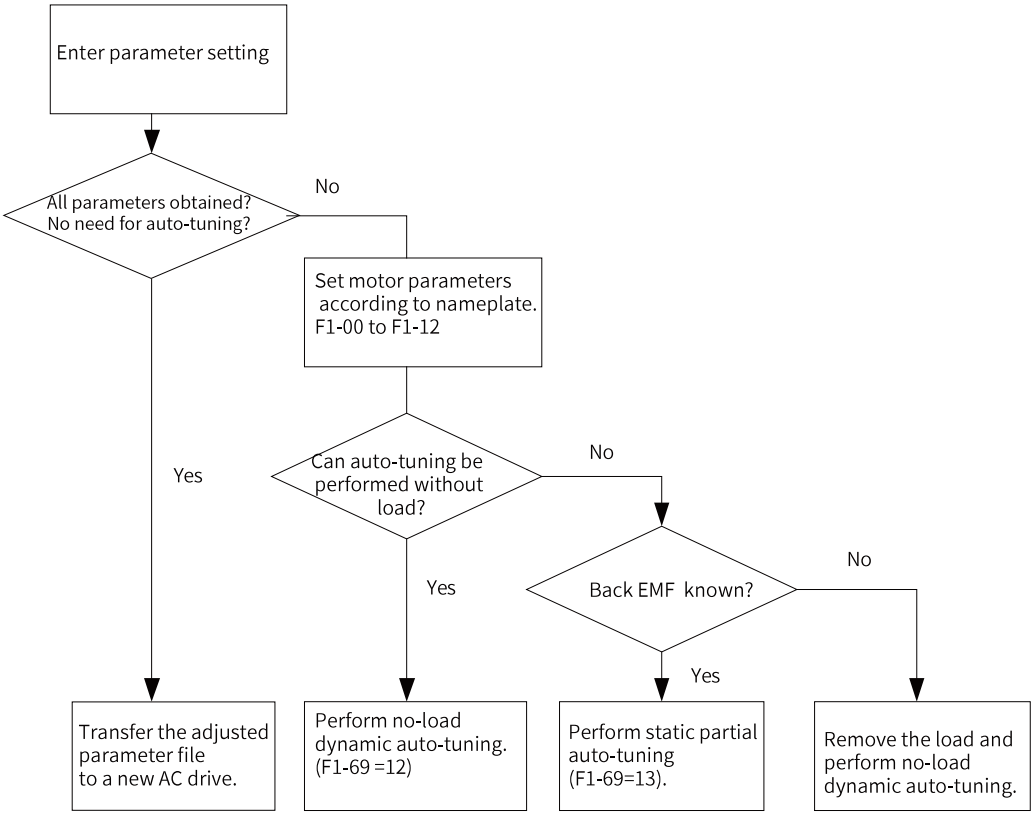


Figure 2-7 Synchronous motor parameter auto-tuning mode

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

Parameter	Name	Static partial auto-tuning of synchronous motor	No-load dynamic auto-tuning of synchronous motor	Static complete auto-tuning of synchronous motor	Inertia auto-tuning	Descriptions
F1-12 (C4-36)	Synchronous motor back EMF	-	✓	-	-	The back EMF is the back EMF (effective value of the line voltage) when the motor rotates at rated speed without load. It has a significant effect on low-speed performance. If the synchronous motor cannot be auto-tuned for no-load rotation, it is recommended to check the motor nameplate or ask the motor manufacturer to set the motor back EMF accurately. F1-12 is the back EMF at rated speed. If the effective value of the back EMF marked on the nameplate is 120 V/krpm, the rated back EMF = d0-05 ÷ 1000 x 120 V. Inovance back EMF is the effective value of the line voltage. If the back EMF is not known, the motor shaft must be disconnected for no-load dynamic auto-tuning. The above procedures only need to be performed once for motors with the same specification. After that, you can manually input the back EMF value.
F1-20 (C4-20)	Motor stator resistance	✓	✓	✓	-	-
F1-32(C4-32) F1-34(C4-34)	d-axis and q-axis inductance	✓	✓	✓	-	-
C5-30 to C5-55	Inductance saturation curve	✓	✓	✓	-	Inductance saturation curve is important to SVC performance. It must be included when downloading or setting all parameters.
A3-30 to A3-46	Dead zone compensation curve	✓	✓	✓	-	The dead zone compensation curve is critical to the low-speed performance of the SVC mode. It must be included when downloading or setting all parameters.
F2-02 (d3-02) F2-03 (d3-03) F1-48(C4-62)	SVC speed loop Kp/Ti, inertia ratio	-	✓	-	✓	The system with fixed inertia can perform 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.

Note

The parameter group F in the table is the mapping of parameters group C and d. The settings of the two groups are equivalent.

2.9 Operation Command Setting

2.9.1 Selecting Control Channel

Start/stop command also can be called command source. The command source is the source or input mode of commands to control the startup, stop, forward running, reverse running, jogging, and fault reset of the AC drive.

The AC drive has two control channels. Each control channel can be used to set the AC drive command source. As shown in the following figure, control channel 1 is active in default mode. In this case, you can set the command source of control channel 1 through the parameter group F0. For details on the control channel, see *"3.1.1 Control Channel and Operation Command" on page 83*.

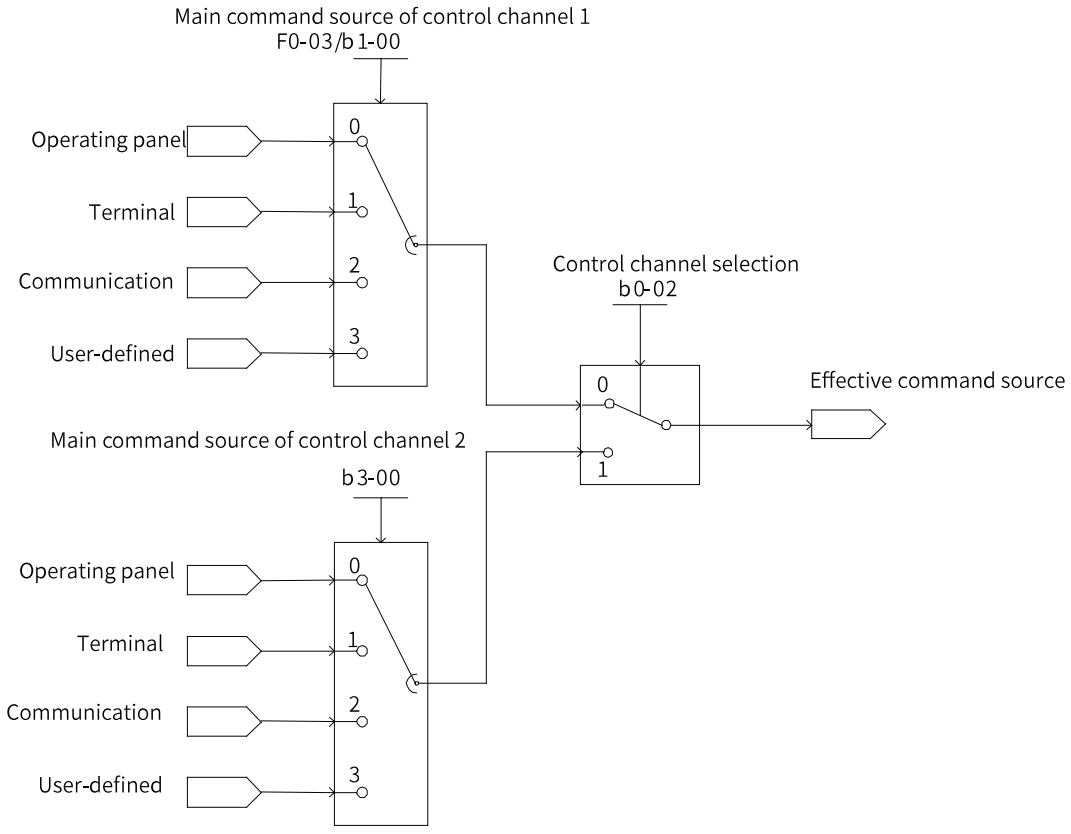


Figure 2-8 Selecting control channel

F0-03 (Main command source of control channel) allows you to select the command source setting mode as the operating panel, terminal, communication, or user-defined mode.

Table 2–8 Command source selection

Parameter	Name	Default	Value Range
F0-03 (b1-00)	Command source of control channel 1	0: Operating panel	0: Operating panel 1: Terminal 2: Communication 3: User-defined

Note

The motor parameter F0-03 in the table is the mapping of motor parameter b1-00. The settings of the two parameters are equivalent.

2.9.2 Control Operation Through the Operating Panel

Set F0-03 (Main command source of control channel 1) to 0 to select the operating panel as the AC drive command source. You can control the AC drive start/stop through the operating panel.

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

2.9.3 Control Operation Through Terminals

Set F0-03 (Main command source of control channel 1) to 1 to select the terminals as the active command 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. You need to select the terminal mode and DI terminal functions. For details on setting operation commands through terminals, see *"3.1.3 Setting Operation Commands Through Terminal" on page 87*.

After the terminal mode and each DI terminal function are configured, start/stop and fault reset can be performed on the AC drive through the DI terminal.

Parameter	Name	Default	Value Range
F0-07 (b9-01)	Mode of terminal start/stop module A	3	0: Enable 1: IN1 start 2: IN1 start, IN2 direction 3: IN1 start in forward direction, IN2 start in reverse direction 4: IN1P (rising edge) start, IN2 stop 5: IN1P (rising edge) start, IN2 stop, IN3 direction 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop
F0-10 (E0-00)	DI1 function selection	1	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1(JOG1) 5: Terminal start/stop module A jog 2(JOG2) 9: Fault reset (RESET)
F0-11 (E0-01)	DI2 function selection	4	
F0-12 (E0-02)	DI3 function selection	9	
F0-13 (E0-03)	DI4 function selection	12	
F0-14 (E0-04)	DI5 function selection (for MD600A)	0	

Note

1. F0-07, F0-10 to F0-14 are the mapping of parameters b9-07, E0-00 to E0-04. The settings of the two groups of parameters are equivalent.
2. The function of the DI terminal cannot be repeated with other terminals.

2.9.4 Control Operation Through Communication

Set F0-03 (Main command source of control channel 1) to 2 to select the communication as the active command source.

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. For details on the communication configuration method and communication address, see *" Communication" on page 457*.

The 7311H is one of the communication addresses supported by the AC drive. It is defined as follows:

Communication Address		Description
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop

For example, write 1 to 7311H to control the forward running of the AC drive. Write 0 to 7311H to stop the AC drive according to the mode set in F2-17 (OFF1 stop mode).

2.9.5 Setting Operation Commands Through User-Defined Channel

The AC drive includes user-defined main command source in control channels 1/2. By default, control channel 1 is active. You can set customized commands through parameter groups b1 and b2.

The control commands that can be set in the user-defined mode are:

- ON_OFF1 (Start/Stop): Invalid when the value is 0, valid when the value is 1. The AC drive starts and stops controlled by OFF2 in combination with ON_OFF1 and OFF3. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered during the rising edge from 0 to 1. When the stop command is triggered by the falling edge from 1 to 0, the AC drive stops in the mode set by d0-04 (OFF1 stop mode).
- OFF2 (Coast to stop): Inactive when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF3. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d0-05 (OFF2 stop mode).
- OFF3 (Quick stop): Invalid when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF2. When ON_OFF1 is active and the OFF2 command is inactive and no fault occurs, the OFF3 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d0-06 (OFF3 stop mode).
- Jog 1 (JOG1): Invalid when the value is 0, valid when the value is 1. When it is valid, the AC drive runs at the frequency set by jog 1.
- Jog 2 (JOG2): Invalid when the value is 0, valid when the value is 1. When it is valid, the AC drive runs at the frequency set by jog 2.
- Speed inversion: Invalid when the value is 0, valid when the value is 1. Controls whether the running speed direction of the AC drive is opposite to the set direction.
- Operation permitted: Invalid when the value is 0, and valid when the value is 1. The AC drive operates normally when it is set to 1.
- Fault reset: Invalid when the value is 0, valid when the value is 1. When the AC drive has a fault, the fault reset command is triggered during the rising edge from 0 to 1. Set F0-03 (Main command source of control channel 1) to 3 to set the parameters set by the user-defined channel as the active

command source. For details on how to configure user-defined commands, see *"3.1.5 Setting Operation Commands Through User-Defined Channel" on page 102*.

Recommended settings for user-defined commands are as follows.

User-Defined Mode	Value Range
ON_OFF1 (start/stop)	0: The start command is triggered during the rising edge from 0 to 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 permitted	1: The AC drive is allowed to running.
Fault reset	0: The fault reset command is inactive.

2.10 Frequency Reference Setting

2.10.1 Select Set Channel

The AC drive supports two channels, which can be used to set the frequency source of the AC drive. Set channel 1 is active in default mode. The frequency source of set channel 1can be set through group F0 or group b5. See *" Frequency reference source" on page 106* for detailed settings.

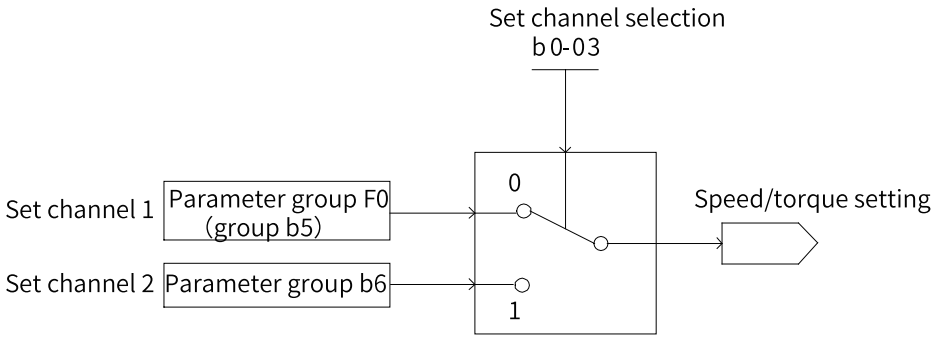


Figure 2-9 Set channel selection

When F0-02 (Motor control mode) = 0 (Speed control), set the frequency reference. The frequency source indicates the input source of the running frequency.

F0-29 (Main frequency source) allows you to select the frequency source setting method, such as the parameter, AI, multi-reference, and communication.

Parameter Code	Parameter Name	Default	Value Range
F0-29 (b5-00)	Main frequency source	0	0: Set by the parameter (F0-30) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector

Note

- The motor parameter F0-29 is the mapping of motor parameter b5-00. The settings of the two parameters are equivalent.
- When the main frequency source is set to 0, the main frequency set by parameters is in the unit of Hz. When the main frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by the frequency per unit value of A2-04.

2.10.2 Setting Frequency Through Parameter

After setting F0-29 (Main frequency source) to 0 (F0-30), the value of F0-30 (Digital setting of main frequency) is the active frequency.

Parameter	Name	Default	Value Range
F0-30 (b5-01)	Digital setting of main frequency	50.00 Hz	0.00 Hz to A2-17 (Effective value of maximum motor frequency)

Note

The motor parameter F0-30 in the table is the mapping of motor parameter b5-01. The settings of the two parameters are equivalent.

When the main frequency source is set by parameters, in addition to directly modifying the value of the parameters to set the frequency, you can also set the frequency by using the UPDOWN keys. For details on the UPDOWN function, see *"3.2.2.3 Setting Main Frequency Through Operating Panel" on page 110*.

When the AC drive is stopped or running, You can increase the set frequency by pressing the  key on the operating panel. Using  key to decrease the frequency setting. The two keys help to set the frequency to the target value in real time.

2.10.3 Setting Frequency Through AI

After setting F0-29 (Main frequency source) to 2, the AI is used as the active frequency source.

When AI is used as the frequency source, the relationship curve between AI and frequency setpoint needs to be set. The product supports multiple AI curve settings. Curve 1 to curve 3 are two-point curves, and curve 4 and curve 5 are four-point curves. By default, curve 1 of the AI is active and is a two-point curve. In this case, 0 V to 10 V (Analog input voltage) corresponds to 0% to 100% (frequency setpoint). The related parameters are as follows.

Parameter	Name	Default	Value Range
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V
E2-43	Percentage corresponding to maximum input of AI curve 1	100.0%	-800.0% to 800.0%

2.10.4 Setting Frequency Through Multi-Reference

After F0-29 (Main frequency source) is set to 6 (Multi-reference), the multi-reference is used as the active frequency source.

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 group F parameters. For detailed configuration, see *"3.2.2.6 Setting Main Frequency Through Multi-reference" on page 115*.

Table 2–9 Set frequency through multi-reference

Parameter	Name	Default	Value Range
F0-10 (E0-00)	DI1 function selection	1	12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4
F0-11 (E0-01)	DI2 function	4	
F0-12 (E0-01)	DI3 function selection	9	
F0-13 (E0-01)	DI4 function selection	12	
F0-14 (E0-01)	DI5 function selection (for MD600A)	0	
F0-38 (b8-08)	Multi-reference 0 setting mode	0	0: Set by the parameter (F0-39) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01) for the current valid channel Others: F connector
F0-39 (b8-09)	Multi-reference 0	0.0%	b8-43 to b8-42
F0-40 (b8-10)	Multi-reference 1	0.0%	b8-43 to b8-42
F0-41 (b8-11)	Multi-reference 2	0.0%	b8-43 to b8-42
F0-42 (b8-12)	Multi-reference 3	0.0%	b8-43 to b8-42

Note

- The function of the DI terminal cannot be repeated with other terminals. By default, DI4 is assigned with multi-reference terminal 1.
- The parameters F0-10 and F0-39 are the mapping of parameter groups E0 and b8. The settings of the two groups of parameters are equivalent.

2.10.5 Setting Frequency Through Communication

After F0-29 (Main frequency source) is set to 9 (Communication), communication is set as the active frequency source.

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 *" Communication" on page 457*.

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Address		Description of the communication address
Communication speed setting value 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H speed setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

In default settings, when n0-14 = 1 is set, write 1000 to 7310H to set the main frequency to 10.00 Hz. Write -1000 to set the main frequency to -10.00 Hz.

2.10.6 Setting Frequency Through External Operating Panel

Set F0-29 (Main frequency source) to 10 to set the MD-BP-M potentiometer of the external operating panel as the active frequency source.

In this case, you can modify the main frequency setting by turning the knob on the MD-BP-M. Turn to the left to decrease the frequency value. Turning to the left to the end corresponds to the minimum frequency (0 Hz). Turn to the right to increase the frequency value. Turning to the right to the end corresponds to the rated motor frequency (F1-06).

If the frequency setting of the potentiometer on the external operating panel is not zero when the knob is turned to the left to the end, increase the value of A6-40 [MD-BP-M overzero threshold] to set the minimum frequency setting to zero.

2.11 Define Torque Reference

2.11.1 Select Set Channel

When F0-02 (Motor control mode) = 1 (Torque control), set the torque reference. The torque reference is the source of the output torque setpoint. The AC drive supports two channels, which can be used to set the torque reference of the AC drive. Set channel 1 is active in default mode. b5-13 (Torque reference source) allows you to select the torque setting method, such as digital setting, AI, multi-reference, and communication, which is similar to frequency reference source. See *" Torque reference" on page 173* for full parameter setting of torque control.

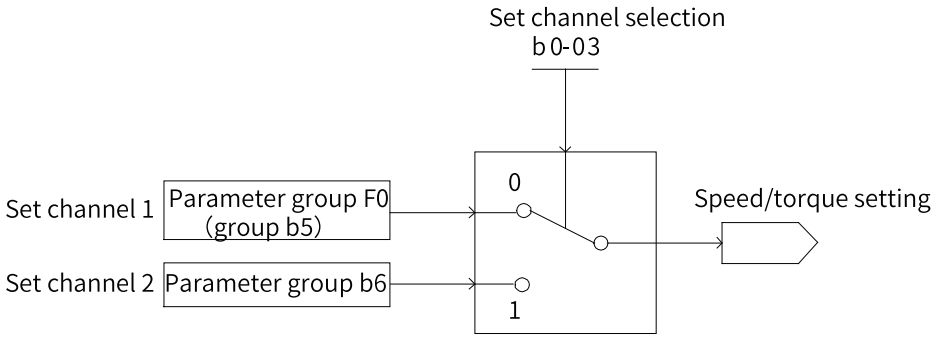


Figure 2-10 Set channel selection

Parameter	Name	Default	Value Range
b5-13	Torque reference source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector

The torque reference is in percentage format. Its base value (100%) is determined based on the per-unit base value of frequency (A2-06).

2.11.2 Setting Torque Through Digital Setting

Set b5-13 (Torque reference source) to 0 to select the value of b5-14 as the torque source.

Parameter	Name	Default	Value Range
b5-14	Torque reference digital setting	0	-800.0% to 800.0%

2.11.3 Setting Torque Through AI

Set b5-13 (Torque reference source) to 2 to select AI as the torque source.

When AI is used as the torque source, the relationship curve between AI and torque setpoint needs to be set. The product supports multiple AI curve settings. Curve 1 to curve 3 are two-point curves, and curve 4 and curve 5 are four-point curves. By default, curve 1 of the AI is active and is a two-point curve. In this case, 0 V to 10 V (Analog input voltage) corresponds to 0% to 100% (torque setpoint). The related parameters are as follows.

Parameter	Name	Default	Value Range
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V
E2-43	Percentage corresponding to maximum input of AI curve 1	100.0%	-800.0% to 800.0%

See *"3.7.6 Analog Input Terminal (AI)" on page 270* for detailed settings.

2.11.4 Setting Torque Through Multi-Reference

Set b5-13 (Torque reference source) to 6 to select the multi-reference as the torque source.

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 group F parameters. For detailed configuration, see *"3.3.5 Setting Torque Through Multi-Reference" on page 179*.

Table 2–10 Multi-reference parameter setting

Parameter	Name	Default	Value Range
F0-10 (E0-00)	DI1 function selection	1	12: Multi-reference terminal 1 13: Multi-reference terminal 2 14: Multi-reference terminal 3 15: Multi-reference terminal 4
F0-11 (E0-01)	DI2 function	4	
F0-12 (E0-01)	DI3 function selection	9	
F0-13 (E0-01)	DI4 function selection	12	
F0-14 (E0-01)	DI5 function selection (for MD600A)	0	
F0-38 (b8-08)	Multi-reference 0 setting mode	0	0: Set by the parameter (F0-39) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01) for the current valid channel Others: F connector

Parameter	Name	Default	Value Range
F0-39 (b8-09)	Multi-reference 0	0.0%	b8-43 to b8-42
F0-40 (b8-10)	Multi-reference 1	0.0%	b8-43 to b8-42
F0-41 (b8-11)	Multi-reference 2	0.0%	b8-43 to b8-42
F0-42 (b8-12)	Multi-reference 3	0.0%	b8-43 to b8-42

Note

- The function of the DI terminal cannot be repeated with other terminals. By default, DI4 is assigned with multi-reference terminal 1.
- The parameters F0-10 and F0-39 are the mapping of parameter groups E0 and b8. The settings of the two groups of parameters are equivalent.

2.12 Commissioning Parameters

2.12.1 Parameters Related to V/f Curve

When F0-01 (Motor control mode) = 2 (V/f), V/f-related parameters need to be set. V/f control is divided into V/f curve and V/f separation modes, and V/f curve includes multiple selections, such as linear V/f and multi-point V/f curve. For details, see *" V/f Curve Setting" on page 357*.

Parameter	Name	Default	Value Range
d2-00	V/f curve type	0	0: Linear V/f curve 1: Multi-point V/f curve 10: Separated V/f
d2-02	Frequency point 1 on a multi-point V/f curve	0.0 Hz	0–d2-03
d2-03	Frequency point 2 on a multi-point V/f curve	0.0 Hz	d2-02 to d2-04
d2-04	Frequency point 3 on a multi-point V/f curve	0.0 Hz	d2-03 to 600.0 Hz
d2-08	Voltage point 1 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-09	Voltage point 2 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-10	Voltage point 3 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V
d2-47	Upper limit of V/f separation voltage	100.0%	50.0% to 200.0%
d2-48	Voltage source of V/f separation	0	0: Set by the parameter (d2-49) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector

Parameter	Name	Default	Value Range
d2-49	Digital setting of V/f separation voltage	0V	0 V to C4-03
d2-50	Voltage acceleration time of V/f separation	0.0s	0.0s to 1000.0s
d2-51	Voltage deceleration time of V/f separation	0.0s	0.0s to 1000.0s
d2-52	Frequency RFG time of V/f separation	1	0: 0 1: Preset RFG time
d2-53	Stop mode selection of V/f separation	2	0: The frequency and the voltage decline to 0 separately. 1: Te frequency declines to 0 after the voltage declines to 0. 2: Coast to stop

2.12.2 SVC Parameters

When F0-01 (Motor control mode) = 0 (SVC), SVC-related parameters need to be set. 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. For details, see *"4.1.1 SVC control" on page 292*.

Parameter	Name	Default	Value Range
F2-02 (d3-02)	Speed loop Kp in SVC mode	5.00	0.00 to 100.00
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 correction factor	100.0%	0.0% to 1000.0%
F2-06 (d3-08)	Zero speed Ti correction factor	100.0%	0.0% to 1000.0%
F2-07 (d3-09)	Low speed switchover frequency	10.0%	0.0% to d3-12
F2-08 (d3-10)	Low speed Kp correction factor	100.0%	0.0% to 1000.0%
F2-09 (d3-11)	Low speed Ti correction factor	20.0%	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 correction factor	100.0%	0.0% to 1000.0%
F2-12 (d3-14)	High speed Ti correction factor	100.0%	0.0% to 1000.0%

Note

Th parameters in group F2 in the table are the mapping of parameters in group d3. The settings of the two groups are equivalent.

2.12.3 Motor Phase Sequence Switchover

Unlike the speed reverse function, the direction of the speed is not changed when the motor phase sequence is switched, but the actual running direction of the motor changes to the reverse direction.

Parameter	Name	Default	Value Range
F2-14 (d0-14)	Motor running direction selection	0	It is used to set the motor running direction. Value description 0: The motor runs in the current direction. 1: The motor runs in the direction opposite to the set direction. Additional information: Unlike the speed reverse function, the direction of the speed is not changed when the motor phase sequence is switched, but the actual running direction of the motor changes to the reverse direction.

Note

The parameter F2-14 in the table is the mapping of motor parameter d0-14. The settings of the two parameters are equivalent.

2.12.4 Acceleration/deceleration time

For details on the acceleration/deceleration parameters, see *"3.5.1 Acceleration/Deceleration Time Setting" on page 231*.

Parameter	Name	Default	Value Range
F0-46 (b7-01)	Ramp acceleration/deceleration time base frequency	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference
F0-48 (b7-04)	Ramp 1 acceleration time	20.0s	0.0s to 6500.0s
F0-49 (b7-05)	Ramp 1 deceleration time	20.0s	0.0s to 6500.0s
F0-50 (b7-06)	Ramp 1 acceleration start arc	0.00s	0.00s to 650.00s
F0-51 (b7-07)	Ramp 1 acceleration end arc	0.00s	0.00s to 650.00s

Parameter	Name	Default	Value Range
F0-52 (b7-08)	Ramp 1 deceleration start arc	0.00s	0.00s to 650.00s
F0-53 (b7-09)	Ramp 1 deceleration end arc	0.00s	0.00s to 650.00s

Note

The parameter group F in the table is the mapping of parameter group b. The settings of the two groups are equivalent.

2.12.5 Frequency Limits

For the definition of frequency upper and lower limits and the setting method, see *"3.2.6 Frequency Reference Limits" on page 160*.

Parameter	Name	Default	Value Range
F2-22 (d1-03)	Digital setting of positive frequency upper limit 1	800.0%	F2-26 to 800.0%
F2-23 (d1-04)	Digital setting of reverse frequency upper limit 1	-800.0%	-800.00% to F2-27
F2-24 (d1-05)	Source of forward frequency upper limit 2	0	0: 800% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector
F2-25 (d1-06)	Source of reverse frequency upper limit 2	0	0: -800% 1: Opposite to the forward frequency upper limit 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector
F2-26 (d1-07)	Digital setting of forward frequency lower limit 1	0.0%	0.0% to F2-22
F2-27 (d1-08)	Digital setting of reverse frequency lower limit 1	0.0%	F2-23 to 0.0%

Note

The motor parameters in group F2 in the table are the mapping of motor parameters in group d1. The settings of the two groups are equivalent.

2.12.6 Common Protection Parameter

For details on setting the protection parameters, see *" V/f Overvoltage Suppression" on page 361*and *" V/f Overcurrent Suppression" on page 366* .

Parameter	Name	Default	Value Range
F2-37 (d2-26)	Overcurrent suppression	1	0: Enable 1: Disable
F2-38 (d2-27)	Overcurrent suppression point	200%	80% to 300%
F2-39 (d1-54)	Overvoltage suppression	1	0: Enable 1: Disable
F2-40 (d1-55)	Overvoltage suppression action voltage	770.0V	330.0 V to 800.0 V

Note

The parameter group F in the table is the mapping of parameter group d. The settings of the two groups are equivalent.

2.12.7 Startup Parameters

For details on setting startup parameters, see *" Start Mode" on page 213*.

Parameter	Name	Default	Value Range
F2-15 (d0-02)	Start mode	0	0: Direct start 1: Flying start
d0-23	Startup frequency	0.00 Hz	0.00 Hz to 10.00 Hz
d0-24	(Startup frequency holding 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 startup	50%	0% to 100%

Note

The parameter F2-15 in the table is the mapping of parameter d0-02. The settings of the two parameters are equivalent.

2.12.8 Stop Mode

For details on setting startup parameters, see *"3.4.2 AC Drive Stop Mode" on page 219*.

Parameter	Name	Default	Value Range
d0-04	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability
d0-05	OFF2 (coast to stop) stop mode	0	0: Coast to stop
d0-06	OFF3 (quick stop) stop mode	0	0: Quick stop 1: Stop at maximum capability
d0-27	Starting frequency for DC braking at stop	0.0 Hz	0.0 Hz to 600.0 Hz
d0-28	DC braking waiting time for 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%	0.0% to 300.0%

2.12.9 I/O Parameters

Parameter	Name	Default	Value Range
F0-10 (E0-00)	DI1 function selection	1	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1(JOG1) 5: Terminal start/stop module A jog 2(JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Running pause (controlled by terminals) 11: 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 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC state reset 29: Torque control inhibited 30: Pulse frequency input (valid only for DI4) 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enable 35: Opposite to the PID action direction 36: External stop terminal 1 38: PID integral pause (To be continued)
F0-11 (E0-01)	DI2 function selection	4	
F0-12 (E0-02)	DI3 function selection	9	
F0-13 (E0-03)	DI4 function selection	12	
F0-14 (E0-04)	DI5 function selection (for MD600A)	0	

Parameter	Name	Default	Value Range
F0-10 (E0-00)	DI1 function selection	1	Continued 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control selection 47: Emergency stop 49: Deceleration DC braking 50: Clear the current running time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1(JOG1) 65: Terminal start/stop module 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: Set channel selection 72: Terminal module A/B selection 77: Running enable (all modes) 78: Forward running enable 79: Reverse running enable 80: Set RFG input to zero
F0-11 (E0-01)	DI2 function	4	
F0-12 (E0-02)	DI3 function selection	9	
F0-13 (E0-03)	DI4 function selection	12	
F0-14 (E0-04)	DI5 function selection (for MD600A)	0	

Parameter	Name	Default	Value Range
F0-17 (E1-00)	RO1 output function selection	2	0: No output 1: AC Drive running 2: Fault 3: Frequency level detection FDT1 output 4: Frequency reach 5: Running at zero speed (no output at stop) 6: Motor overload pre-warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Accumulative running time reach 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication 23: Running at zero speed 2(output at stop) 24: Accumulative power-on time reach 25: Frequency level detection FDT2 output 26: Frequency 1 reach 27: Frequency 2 reach 28: Current 1 reach 29: Current 2 reach 30: Timing duration reached 31: AI1 input limit exceeded 32: Three phase loss 33: Reverse running 34: Zero current state 35: IGBT temperature reached 36: Software current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Abnormality (fault/minor fault/warning) 40: Current running time reach 41: Fault (excluding undervoltage) 43: Minor fault or warning Others: B connector
F0-21 (E1-04)	DO1 output function selection	1	
F0-22 (E1-05)	DO2 function selection (for MD600A)	4	
E2-00	AI hardware source selection	0	Ones: AI1 source 0: hardware sampling. The AI value is sourced from hardware sampling. 1: Forced value. AI1 voltage is set forcibly through E2-01.
E2-01	AI1 forced value	0.00 V	-10.00 V to 10.00 V
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42

Parameter	Name	Default	Value Range
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V
E2-43	Percentage corresponding to maximum input of AI curve 1	100.0%	-800.0% to 800.0%
E3-00	AO1 output function selection	0	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 12: Communication 13: Motor speed 14: Output current (100.0% corresponds to 1000.0 A) 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output torque (actual value) Others: F connector

Note

The parameter group F in the table is the mapping of parameter group E. The settings of the two groups are equivalent.

2.13 General Monitoring Parameters

2.13.1 Basic Monitoring Parameters

You can view the monitoring parameter values through Group U parameters on the operating panel. The following table lists the commonly used monitoring parameters of this product. For details and complete parameters of Group U, see *"10.1 Parameter List" on page 560*.

Parameter	Name
U0-02	Bus voltage
U0-03	Output voltage
U0-04	Output current
U0-05	Output power
U0-06	Output torque
U0-35	Target torque
U0-65	Torque upper limit
U2-01	Current control channel
U2-02	Current set channel

2.13.2 Speed Monitoring Parameters

Parameter	Name
U0-00	Operating frequency
U0-01	Frequency reference
U0-14	Load speed display
U0-19	Actual motor frequency
U0-30	Digital setting of main frequency
U0-31	Digital setting of auxiliary frequency
U0-59	Frequency reference (%)
U0-60	Operating frequency (%)
U0-69	Actual motor frequency (signed)
U0-70	Actual motor speed (signed)
U0-75	Actual motor frequency (unsigned)

2.13.3 I/O Monitoring Parameters

Parameter	Name
U0-07	DI input state
U0-08	DO output state
U0-09	AI1 voltage
U0-21	AI1 voltage before calibration
U2-69	AI1 input setting proportion
U2-73	AO1 input proportion
U2-75	AO1 output (before correction)
U2-77	AO1 output (after correction)
U0-18	HDI pulse input frequency (kHz)
U0-27	HDI pulse input frequency (Hz)
U2-72	HDI input setting proportion

2.13.4 Data Received During Communication

Parameter	Name
U0-28	Communication setpoint
U3-23	Communication speed setting value 1 (0x1000)
U3-16	Communication speed setting value 2 (0x7310)
U3-33	Communication setting control word 1 (0x7321)
U3-17	Communication setting control word 2 (0x7311)

2.13.5 Other Common Parameters

Parameter	Name
U0-15	PID reference
U0-16	PID feedback
U0-17	PLC stage

Parameter	Name
U2-05	Current multi-reference selection
U2-06	Current multi-reference effective value
U2-68	Module temperature

2.14 Trial Run

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

3 Common Function

3.1 Command Source

3.1.1 Control Channel and Operation Command

Control channel

The AC drive has two control channels that are used to set AC drive operation commands to start/stop the AC drive or implement other relevant control. This product supports applications that use a single source of operation commands, or applications that need to be switched between two groups of operation command sources.

In the parameters,

- Groups b1 (Main command word of control channel 1) and b2 (Main command word of control channel 2) are used to set control channel 1.
- Groups b3 (Main command word of control channel 2) and b4 (Main 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). 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.

Parameter	Name	Default	Value Range	Descriptions
b0 - 02	Control channel	0	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Set the active control channel. If this parameter is 0, control channel 1 is selected. If this parameter is 1, control channel 2 is selected. Value description 0: Channel 1 is selected. 1: Channel 2 is selected. 3 to 7: DI1 to DI5 - The channel selected depends on the terminal state of the DI. Other: B connector - The channel selected depends on the other B connector. Additional information: 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 (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

Operation command source

In each control channel, operation commands are used to control start, stop, forward run, reverse run, jog, and fault reset of the AC drive. Commands can be given by the operating panel, terminal, communication, or user-defined method. Select an input mode of operation commands through parameter b1-00 or b3-00.

- Operating panel: The AC drive can be started/stopped through the built-in LED operating panel or the external keypad.
- Terminal: The start/stop control of the AC drive can be achieved through the function of the terminal start/stop module in group b9.
- Communication: The values can be written to the specified communication address in the specified data format through communication to enable control of the AC drive, such as start and stop.
- User-defined: You can directly set the control command signal source of the AC drive to enable control of the AC drive, such as start/stop, to support more complex and flexible configuration.

Related parameters are as follows.

Parameter	Name	Default	Value Range	Descriptions
b1-00 (F0-03)	Command source of control channel 1	0	0: Operating Panel 1: Terminal 2: Communica-tion 3: User-defined	It is used to set the main command source of control channel 1. Value description 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/ STOP keys on the keypad. 1: Select the main command source of control channel 1 as terminal. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC 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 equipment. 3: The source is user-defined. The control commands can be set by b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b3‑00	Command source of control channel 2	0	0: Operating Panel 1: Terminal 2: Communica-tion 3: User-defined	It is used to set the main command source of control channel 2. Value description 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/ STOP keys on the keypad. 1: Terminal - Select the main command source of control channel 1 as terminal. The DI can be assigned with different functions such as start/stop, forward/ reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC 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 equipment. 3: The source is user-defined. The control commands can be set by b3-01 to b3-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

Note

The motor parameter F0-03 in the table is the mapping of motor parameter b1-00. The settings of the two parameters are equivalent.

Data Flow Diagrams

The data flow of the control channel is as follows.

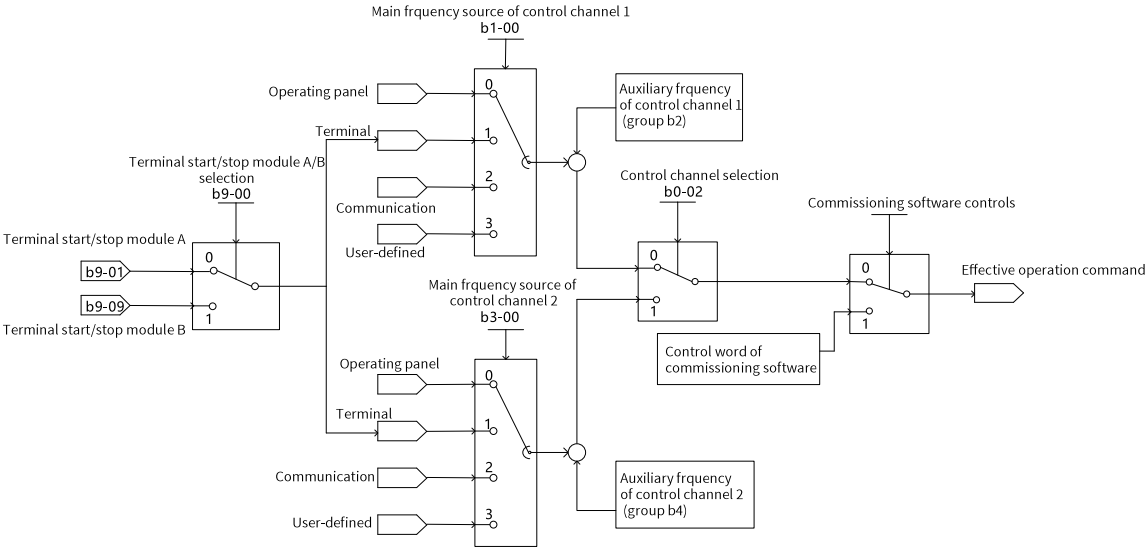


Figure 3-1 Setting control channel

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.

3.1.2 Setting Operation Command Through the Operating Panel

Description

The AC drive supports external operating panels such as MD-BP-M and the operating panel provided with the AC drive. For details, see *" Commissioning Tools" on page 26*. You can select the keypad as the main command source of the AC drive by setting F0-03 (Main comand source of control channel 1) to 0 (Keypad). The following figure shows the operating panel.



Figure 3-2 Operating Panel

Steps

The following takes the operating panel as an example. The steps for setting running commands through the operating panel are as follows:

1. Set F0-03 to 0 and press  to set the command source of control channel 1 to the operating panel.
2. Set F0-30 to 10.00 Hz. Press the  key again to display the set frequency to 10 Hz.
3. Press  to start the AC drive (the RUN indicator is on). Then the AC drive runs at the frequency of 10 Hz.
4. When the AC drive is running, press  to stop the AC drive. The RUN indicator becomes off.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
b1-00 (F0-03)	Command source of control channel 1	0	0: Operating panel 1: Terminal 2: Communica-tion 3: User-defined	It is used to set the main command source of control channel 1. Value description 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/ STOP keys on the keypad. 1: Select the main command source of control channel 1 as terminal. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC 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 equipment. 3: The source is user-defined. The control commands can be set by b1-01 to b1-09, ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).
b5-01 (F0–30)	Digital setting of main frequency	50	0.00 Hz to A2-17	Used to set the target frequency. It takes effect when the main frequency source is digital setting.

Note

The parameters F0-03 to F0-30 are the mapping of parameters b1-00 to b5-01. The settings of the two groups of parameters are equivalent.

3.1.3 Setting Operation Commands Through Terminal

Description

The AC drive supports two terminal start/stop modules: terminal module A and terminal module B. The two modules have the same functions and can be switched over through b9-00. Only one module can be activated at a time. The two modules are configured with different control modes, which can be switched over, to control the start, stop, and forward rotation function of the AC drive. In default settings, the terminal start/stop module that is valid is terminal module A.

Terminal module A is used as an example in this section if no notes are provided.

Param.	Name	Default	Value Range	Description
b9-00	Terminal start/stop module A/B selection	0	0: Module A 1: Module B Others: B connector	Selects the terminal start/stop module. If the terminal start/stop module selection signal is 0, module A is active. If the terminal start/stop module selection signal is 1, module B is active. Value description 0: Select the terminal start/stop module A. 1: Select the terminal start/stop module B. Other: B connector - The value of this parameter is derived from other B connectors. Additional information: After the DI terminal is assigned with function 72 (Terminal module A/B selection), the value of b9-00 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

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 modules. 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.

Param.	Name	Default	Value Range	Description
b9-01 (F0-07)	Mode of terminal start/stop module A	3	0: Disable 1: IN1 start 2: IN1 start, IN2 direction 3: IN1 start in forward direction, IN2 start in reverse direction 4: IN1P (rising edge) start, IN2 stop 5: IN1P (rising edge) start, IN2 stop, IN3 direction 6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop	Sets the mode of terminal start/stop module A. This parameter is valid for IN1/IN2/IN3 in the terminal function. Value description 0: The terminal is invalid, and IN1/IN2/IN3 are invalid. 1: In this mode, a DI terminal is connected. Set function IN1 to control forward rotation and start/stop. 2: In this mode, two DI terminals are connected - Functions IN1/IN2 are set, and IN1 is used to control forward rotation and start/stop. IN2 is used to control the running direction. 3: In this mode, two DI terminals are connected - Set functions IN1/IN2, and IN1 is used to control the forward rotation and start/stop. IN2 is used to control reverse rotation and start/stop. The AC drive stops when IN1 and IN2 are both active. 4: In this mode, two DI terminals are connected - Functions IN1/IN2 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. 5: In this mode, three DI terminals are connected - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction. 6: In this mode, three DI terminals are connected - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control reverse rotation and start. IN3 is used to control the Stop.
b9-09	Mode of terminal start/stop module B	3		

Note

The parameter F0-07 is the mapping of parameter b9-01. The settings of the two parameters are equivalent.

- **One-wire mode**

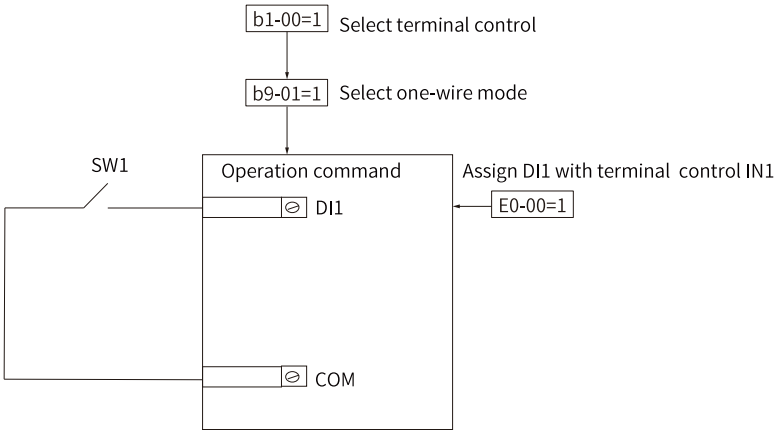
  One-wire mode: b9-01 (Mode of terminal start/stop module A) = 1 (IN1 start), with one DI terminal connected, and IN1 used to control operation commands. For example, DI1 is allocated with the operation command function. Set the parameters as follows. Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1) to allow DI1 to control operation command.

Param.	Name	Value Range	Description
b9‑01 (F0-07)	Mode of terminal start/stop module A	1 [IN1 start]	In this mode, a DI terminal is connected. Set function IN1 to control forward rotation and start/stop.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/stop module A_IN1	Operation command

Note

The parameters F0-07 and F0-10 are the mapping of parameters b9-01 and E0-00. The settings of the two groups of parameters are equivalent.

When SW1 is closed, the motor runs. When SW1 is open, the motor does not run. See the following figure.



SW1	Operation Command
1	Run
0	Stop

Figure 3-3 Wiring and parameter settings for one-wire mode

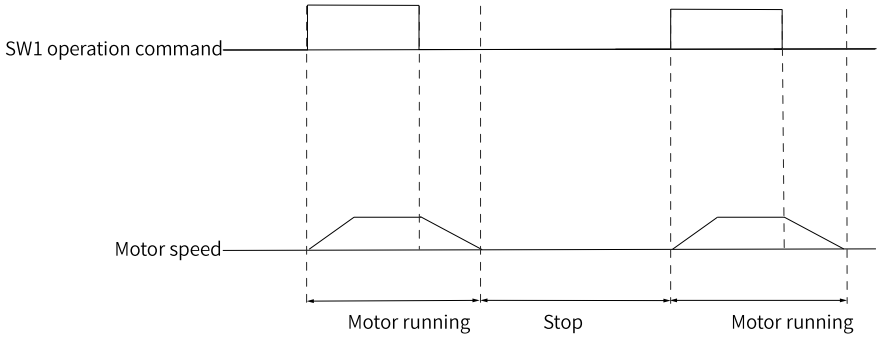


Figure 3-4 One-wire mode time sequence

- **Two-wire mode 1**

  One-wire mode: set b9-01 (Mode of terminal start/stop module A) = 2 (IN1 start, IN2 direction), with two DI terminals connected, IN1 used to control operation commands, and IN2 used to control operating direction.

  For example, DI1 is allocated with the operation function, and DI2 is allocated with the forward and reverse running function. Set the parameters as follows.

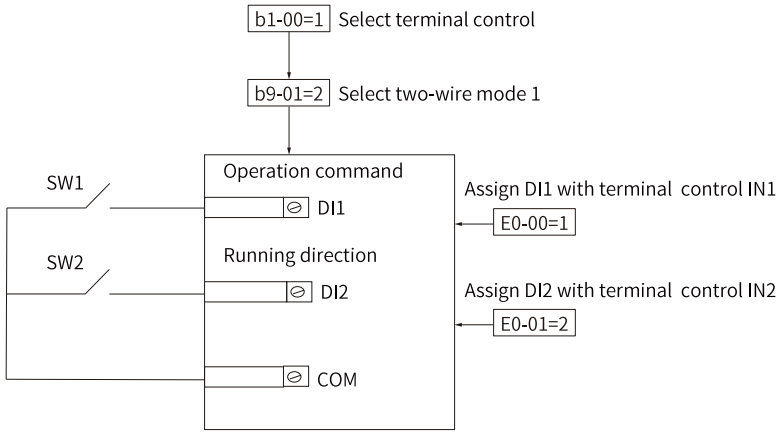
  Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1) and E0-01 (DI1 function selection) to 2 (Terminal start/stop module A_IN2) to make DI1 control running commands and DI2 control running direction.

Param.	Name	Value Range	Description
b9‑01 (F0-07)	Mode of terminal start/stop module A	2 [IN1 start, IN2 direction]	In this mode, two DI terminals are connected - Functions IN1/IN2 are set, and IN1 is used to control forward rotation and start/stop. IN2 is used to control the running direction.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/stop module A_IN1	Operation command
E0-01 (F0-11)	DI2 function selection	2: Terminal start/stop module A_IN2	Operating direction

Note

F0-07, F0-10, F0-11, and F0-12 are the mapping of parameters b9-01, E0-00, E0-01, E0-02. The settings of the two groups of parameters are equivalent.

When SW1 is closed, the motor starts to run. When SW2 is open, the motor runs in the forward direction. When SW2 is closed, the motor runs in the reverse direction. When SW1 is open, the motor does not run regardless of the status of SW2. See the following figure.



SW1	SW2	Operation Command
1	0	Forward run
1	1	Reverse run
0	0	Stop
0	1	Stop

Figure 3-5 Wiring and parameter settings for two-wire mode 1

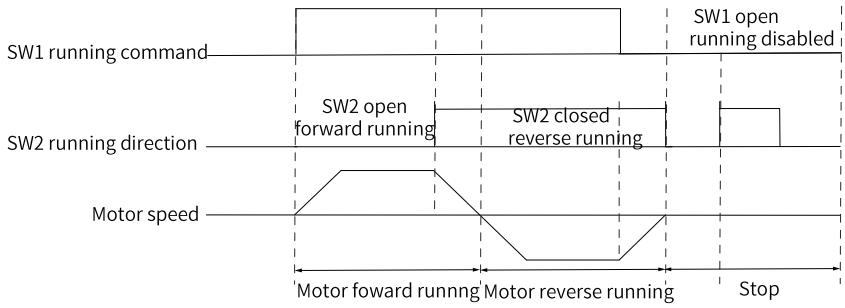


Figure 3-6 Two-wire mode 1 time sequence

Two-wire mode 2

Two-wire mode 2: set b9-01 [Terminal start/stop module A mode] = 3 [IN1 forward start, IN2 reverse start]. Two DI terminals are connected - Set functions IN1/IN2, and IN1 is used to control the forward rotation and start/stop. IN2 is used to control reverse rotation and start/stop. The AC drive stops when IN1 and IN2 are both active.

For example, DI1 is allocated with the forward operation command, and DI2 is allocated with the reverse operation command. Set the parameters as follows.

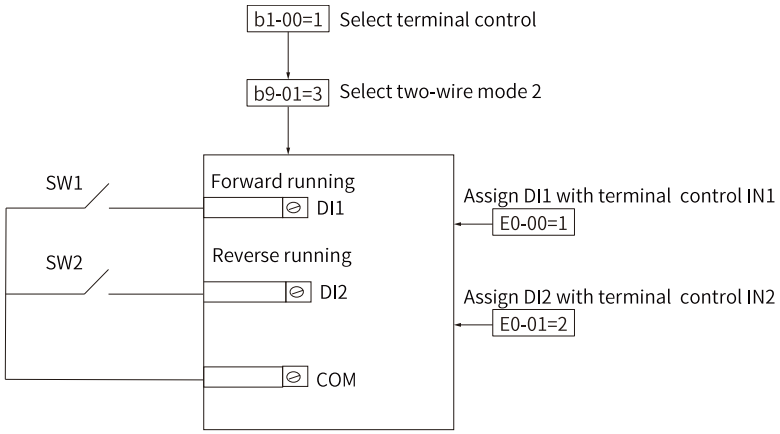
Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1) and E0-01 (DI1 function selection) to 2 (Terminal start/stop module A_IN2) to enable DI1 control forward running and DI2 control reverse running.

Param.	Name	Value Range	Description
b9‑01 (F0-07)	Mode of terminal start/stop module A	3: IN1 forward start, IN2 reverse start	3: In this mode, two DI terminals are connected - Set functions IN1/IN2, and IN1 is used to control the forward rotation and start/stop. IN2 is used to control reverse rotation and start/stop. The AC drive stops when IN1 and IN2 are both active.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/stop module A_IN1	Forward run
E0-01 (F0-11)	DI2 function selection	2: Terminal start/stop module A_IN2	Reverse run

Note

F0-07, F0-10, F0-11, and F0-12 are the mapping of parameters b9-01, E0-00, E0-01, E0-02. The settings of the two groups of parameters are equivalent.

When SW1 is closed and SW2 is open, the motor rotates in forward direction. When SW1 is open and SW2 is closed, the motor rotates in reverse direction. When SW1 and SW2 are both open or closed, the motor stops. The following figure shows the details.



SW1	SW2	Operation Command
1	0	Forward run
0	1	Reverse run
1	1	Stop
0	0	Stop

Figure 3-7 Wiring and parameter settings for two-wire 2

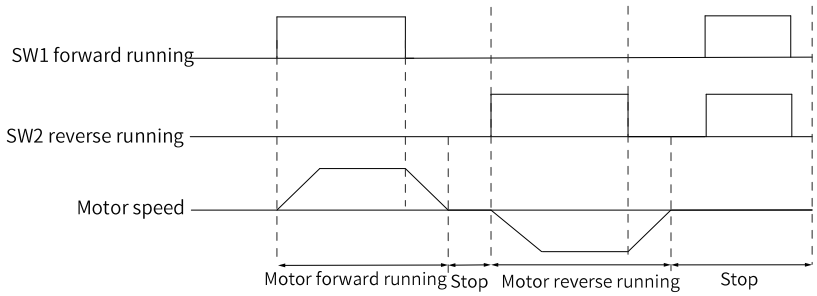


Figure 3-8 Time sequence (normal) for two-wire mode 2

When the terminal functions are not set correctly, the motor does not run when SW1 is closed. When SW1 is open and SW2 is closed, the motor does not run. When SW1 and SW2 are both open or closed, the motor does not run, as shown in the following figure.

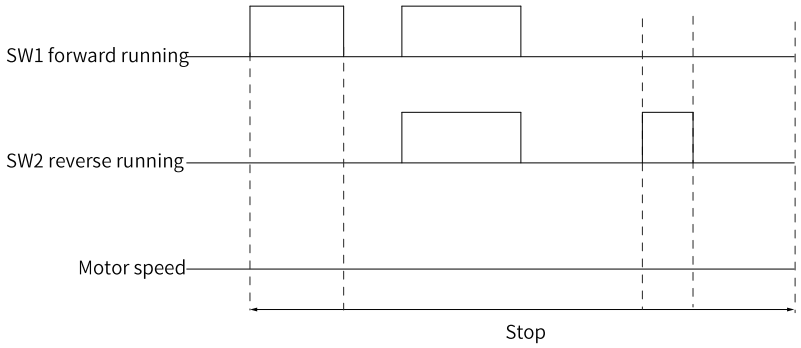


Figure 3-9 Time sequence (abnormal) for two-wire mode 2

Two-wire mode 3

Two-wire mode 3: set b9-01 (Terminal start/stop module A mode) = 4 (IN1P (rising edge) start, IN2 stop). In this mode, two DI terminals are connected - Functions IN1/IN2 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop.

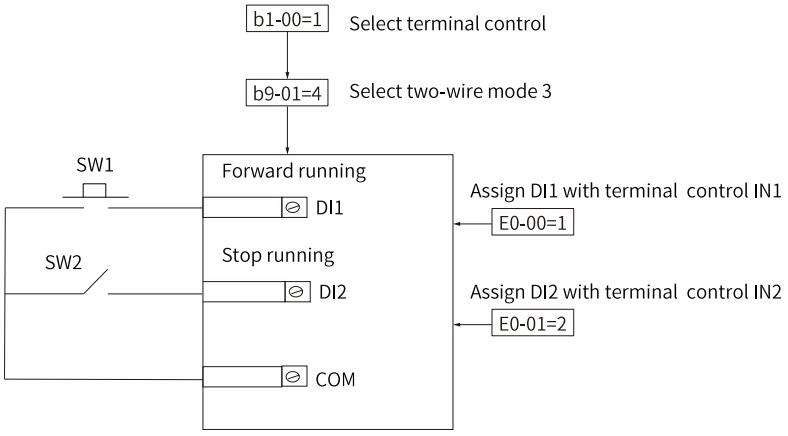
For example, DI1 is allocated with the stat and operation command, and DI2 is allocated with the stop command. Set the parameters as follows. Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1) and E0-01 (DI1 function selection) to 2 (Terminal start/stop module A_IN2) to enable DI1 control start and operation and DI2 control stop command.

Param.	Name	Value Range	Description
b9‐01 (F0-07)	Mode of terminal start/stop module A	IN1P (rising edge) start, IN2 stop】	In this mode, two DI terminals are connected - Functions IN1/IN2 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/stop module A_IN1	Operation Command
E0-01 (F0-11)	DI2 function selection	2: Terminal start/stop module A_IN2	Stop running

Note

F0-07, F0-10, F0-11, and F0-12 are the mapping of parameters b9-01, E0-00, E0-01, E0-02. The settings of the two groups of parameters are equivalent.

SW2 is a normally-closed (NC) button, whereas SW1 is normally-open (NO) button. When SW1 and SW2 are closed, the motor runs. When SW2 is opened, the motor stops. See the following figure.



SW1	SW2	Operation Command
X	0	Stop
	1	Run

Figure 3-10 Wiring and parameter settings for two-wire 3

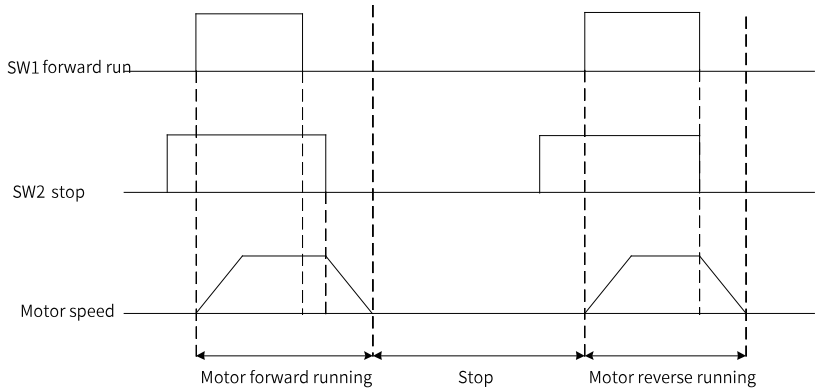


Figure 3-11 Time sequence (normal) for two-wire mode 3

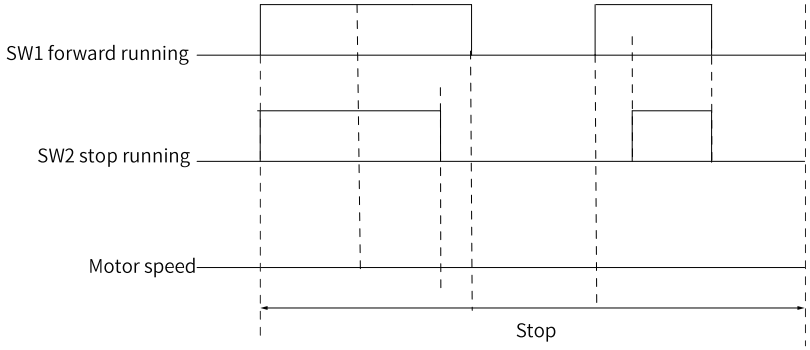


Figure 3-12 Time sequence (abnormal) for two-wire mode 3

Three-wire mode 1

Three-wire mode 1: set b9-01 (Terminal start/stop module A mode) = 5 (IN1P (rising edge) start, IN2 stop, IN3 direction). In this mode, three DI terminals are connected. - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction.

For example, DI1 controls the forward start, DI2 is assigned with the stop function, and DI3 controls the running direction. The parameters are set as follows.

Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1), E0-01 (DI1 function selection) to 2 (Terminal start/stop module A_IN2), and E0-02 (DI3 function selection) = 3 (Terminal start/stop module A_IN3) to enable DI1 control forward operation, DI2 control stop command, and DI3 control the running direction.

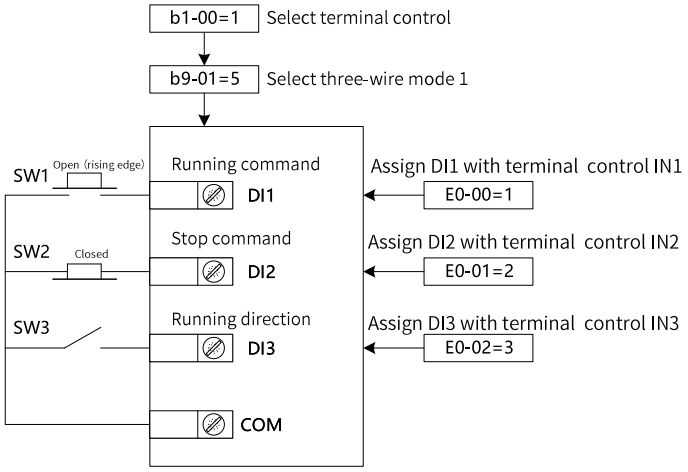
Param.	Name	Value Range	Description
b9‑01 (F0-07)	Mode of terminal start/stop module A	5: IN1P (rising edge) start, IN2 stop, IN3 direction	In this mode, three DI terminals are connected - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/ stop module A_IN1	Operation Command

Param.	Name	Value Range	Description
E0-01 (F0-11)	DI2 function selection	2: Terminal start/ stop module A_IN2	Stop running
E0-02 (F0-12)	DI3 function selection	3: Terminal start/ stop module A_IN3	Operating direction

Note

F0-07, F0-10, F0-11, and F0-12 are the mapping of parameters b9-01, E0-00, E0-01, E0-02. The settings of the two groups of parameters are equivalent.

SW2 is a normally-closed (NC) button, whereas SW1 and SW3 are normally-open (NO) buttons. When SW2 and SW1 are closed, the AC drive starts to run. If SW3 is open, the motor rotates in the forward direction. If SW2 is closed, the motor rotates in reverse direction. The drive stops immediately at the moment when SW3 becomes open. SW2 must remain closed during normal start and running. A signal from SW1 takes effect once SW1 is closed.



SW1	SW2	SW3	Operation Command
X	0	X	Stop
	1	0	Forward run
	1	1	Reverse run

Figure 3-13 Wiring and parameter settings for three-wire mode 1

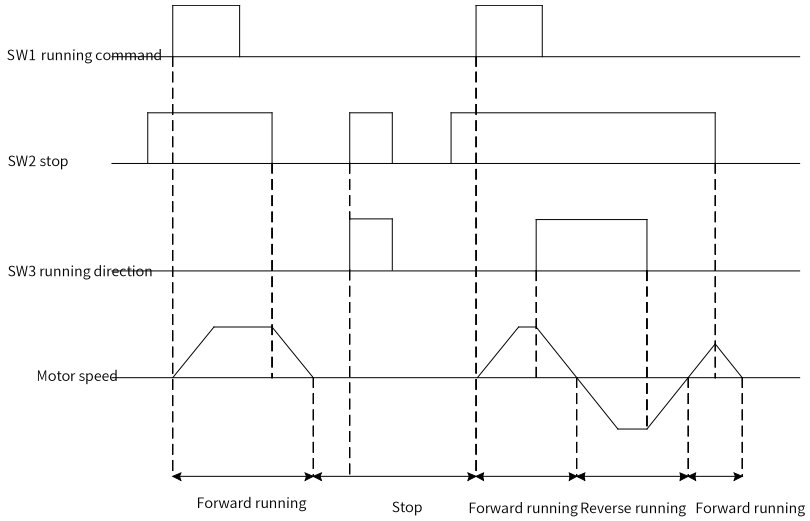


Figure 3-14 Three-wire mode 1 time sequence

Three-wire mode 2

Three-wire mode 2: set b9-01 [Terminal start/stop module A mode] = 6 [IN1P (rising edge) forward start, IN2P (rising edge) reverse start, IN3 stop] In this mode, three DI terminals are connected - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control reverse rotation and start. IN3 is used to control the Stop.

For example, DI1 controls the forward start, DI2 is assigned with reverse start function, and DI3 controls the stop function. The parameters are set as follows.

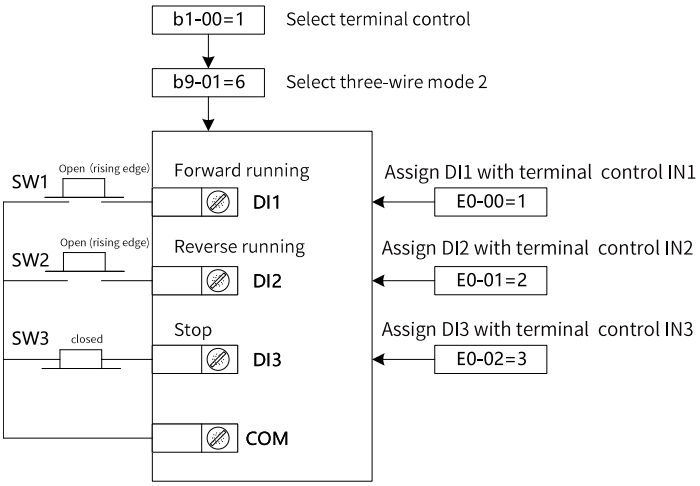
Set E0-00 (DI1 function selection) to 1 (Terminal start/stop module A_IN1), E0-01 (DI1 function selection) to 2 (Terminal start/stop module A_IN2), and E0-02 (DI3 function selection) = 3 (Terminal start/stop module A_IN3) to enable DI1 control forward operation, DI2 control reverse operation, and DI3 control the stop command.

Param.	Name	Value Range	Description
b9‑01 (F0-07)	Mode of terminal start/ stop module A	6: IN1P(rising edge) start, IN2P(rising edge) start in reverse direction, IN3 stop	In this mode, three DI terminals are connected - Functions IN1/ IN2/IN3 are set. The rising edge status of IN1 is used to control forward rotation and start. IN2 is used to control stop. IN3 is used to control the operation direction.
E0-00 (F0-10)	DI1 function selection	1: Terminal start/stop module A_IN1	Forward start
E0-01 (F0-11)	DI2 function selection	2: Terminal start/stop module A_IN2	Reverse start
E0-02 (F0-12)	DI3 function selection	3: Terminal start/stop module A_IN3	Stop running

Note

F0-07, F0-10, F0-11, and F0-12 are the mapping of parameters b9-01, E0-00, E0-01, E0-02. The settings of the two groups of parameters are equivalent.

SW3 is a normally closed (NC) button, whereas SW1 and SW2 are normally open (NO) buttons. If SW3 is closed, the motor rotates in the forward direction when you press down SW2, and it rotates in the reverse direction when you press down SW2. The motor stops immediately when SW3 opens. SW3 must remain closed during normal start and running. A signal from SW1 or SW2 takes effect once SW1 or SW2 is closed.



SW1	SW2	SW3	Operation Command
X	X	0	Stop
	X	0	Forward run
X		1	Reverse run

Figure 3-15 Wiring and parameter settings for three-wire mode 2

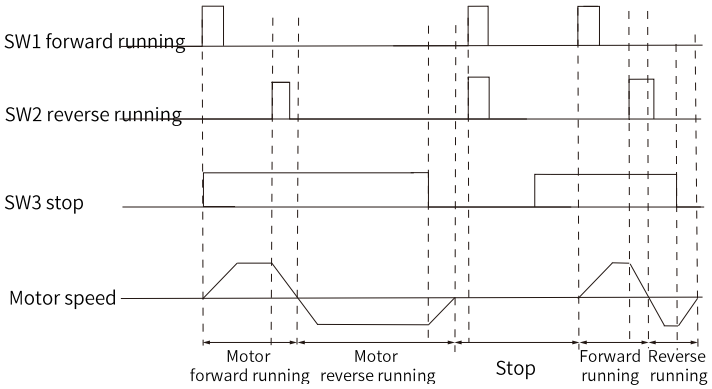


Figure 3-16 Three-wire mode 2 time sequence

Steps

Set operation commands through terminals:

1. Set b1-00 (Main command source of control channel 1) to 1, which is terminal control.
2. Set b9-00 (Terminal start/stop module A/B selection) to 0, which is to select terminal start/stop as module A.
3. Set b9-01 (Mode of terminal start/stop module A) to 0.

4. Set DI1 to DI5 (MD600A) as the control terminals of IN1 to IN3.
5. Enable the DI terminal. The AC drive runs at the set frequency.

3.1.4 Setting Operation Commands Through Communication

Description

When b1-00 is set to 2, the operation commands such as start and stop of the AC drive are issued through communication. The AC drive supports two communication protocols, all of which are onboard modules, as shown in the following table.

Supported Protocol	Communication Hardware	Models
Modbus	RS485 communication interface of MD600 series AC drive	MD600S
	CN1 (RJ45) interface of MD600 series AC drive	MD600S, MD600A
CANopen/CANlink	CN1 (RJ45) interface of MD600 series AC drive	MD600A

Related Parameters

When the AC drive model is MD600S, that is, A3-06 (AC drive hardware type) = 4, Modbus communication is available. Set related communication parameters in group n2. For details about the Modbus communication protocol, see *" Modbus Communication" on page 470*.

Param.	Name	Default	Value Range	Descriptions
n2-00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n2-01	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Additional information: Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n2-02	Modbus local address	1	1 to 247	Sets the Modbus local address. Additional information: The local address must be unique in the range of 1 to 247, which is the basis for point-point communication between the AC drive and the host controller.

Param.	Name	Default	Value Range	Descriptions
n2-03	Modbus response delay	2 ms	0 ms to 20 ms (valid for Modbus)	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller. Additional information: If the response delay is shorter than the system processing time, the system processing time prevails. This means that the system processes data and then sends the data to the host controller. If the response delay is longer than the system processing time, the system processes data and waits for the response delay time. After the time elapses, the system sends the data to the host controller.
n2-04	Modbus communi-cation timeout time	0.0s	0.0 (invalid) 0.1s to 60.0s	Sets Modbus timeout time. Additional information: When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. When it is set to a non-zero value, if the interval between the current communication and the next communication exceeds the Modbus communication timeout time (n2-04), the system reports a communication fault.

When the AC drive model is MD600A, that is, A3-06 (AC drive hardware type) = 0, Modbus communication is available. Set related communication parameters in group n3.

Param.	Name	Default	Value Range	Descriptions
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n3-01	CAN communica-tion enable	1	0: Enable 1: Disable	Set whether CAN communication is enabled. Value description 0: Disable 1: Enable
n3-02	CAN station number	1	1 to 247	Sets the CAN communication station number.
n3-10	CAN communica-tion protocol selection	2	1: CANopen 2: CANlink	This parameter is used to select a CAN communication protocol.
n3-14	CANopen mode	0	0: Default mode 1: Expert mode	Used to set CANopen user control mode.

Param.	Name	Default	Value Range	Descriptions
n3-15	CANopen inhibit time	0	0μs to 65535μs	This parameter sets the inhibit time in CANopen expert mode in the unit of 100 μs.
n3-16	CANopen event time	0	0 ms to 65535 ms	Used to set the event time of CANopen expert mode in ms.

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 AC drive according to the communication protocol, you can control the start, stop, forward rotation, reverse rotation, jog, and fault reset of the AC drive. For details on the communication configuration method and communication address, see *" Communication" on page 457*.

The following table lists the control command communication addresses supported by the AC drive. You can control the start, stop, forward rotation, reverse rotation, jog, and fault reset of the AC drive by sending commands to any of the following control command addresses.

Communication Address		Description
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop according to the stop mode set by F2-17 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop according to the stop mode specified by F2-17 7: Reset upon fault 8: Emergency stop For example, write 1 to 7311H to control the forward running of the AC drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. bit00: ON_OFF1; 0: stop, 0 to 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.

3.1.5 Setting Operation Commands Through User-Defined Channel

Description

The AC drive includes user-defined main command source in control channels 1/2. This section takes 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 of the AC drive through parameter group b1. The control commands that can be set in the user-defined mode are:

- ON_OFF1 (Start/Stop): Invalid when the value is 0, valid when the value is 1. The AC drive starts and stops controlled by ON_OFF1 in combination with OFF2 and OFF3. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered during the rising edge from 0 to 1. When the stop command is triggered by the falling edge from 1 to 0, the AC drive stops in the mode set by d0-04 (OFF1 stop mode).
- OFF2 (Coast to stop): Inactive when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF3. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d0-05 (OFF2 stop mode).
- OFF3 (Quick stop): Invalid when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF2. When ON_OFF1 is active and the OFF2 command is inactive and no fault occurs, the OFF3 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d0-06 (OFF3 stop mode). Jog 1 (JOG1): Invalid when the value is 0, valid when the value is 1. When it is valid, the AC drive runs at the frequency set by jog 1. Jog 2 (JOG2): Invalid when the value is 0, valid when the value is 1. When it is valid, the AC drive runs at the frequency set by jog 2.
- Speed inversion: Invalid when the value is 0, valid when the value is 1. Controls whether the running speed direction of the AC drive is opposite to the set direction.
- Operation permitted: Invalid when the value is 0, and valid when the value is 1. The AC drive operates normally when it is set to 1.
- Fault reset: Invalid when the value is 0, valid when the value is 1. When the AC drive has a fault, the fault reset command is triggered during the rising edge from 0 to 1.

Recommended settings for user-defined commands are as follows.

User-Defined Mode	Value Range
ON_OFF1 (start/stop)	0: The start command is triggered during the rising edge from 0 to 1.
OFF2 (Coast to stop)	1: The stop command of OFF2 is inactive.
OFF3 stop mode	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 permitted	1: The AC drive is allowed to running.
Fault reset	0: The fault reset command is inactive.

The user-defined start/stop commands in the AC drive include ON_OFF1, OFF2, and OFF3. You can set the values of ON_OFF1, OFF2 and OFF3 to enable the start/stop control of the AC drive. The following table describes the user-defined start/stop commands.

Table 3–1 User-defined start/stop command

Operation Mode	Command	Value Range	Result
Start	Normal Start	ON_OFF1: 0 to 1	The AC drive starts normally.
		OFF2: 1	
		OFF3: 1	
Stop	OFF1 stop command	ON_OFF1: 1 to 0	The AC 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 AC drive stops according to the mode set by OFF2 (Coast to stop).
		OFF2: 1 to 0	
		OFF3: 1	
	OFF3 stop command	ON_OFF1: 1	The AC drive stops according to the OFF1 setting. The OFF1 stop mode includes quick stop and stop with maximum capacity.
		OFF2: 1	
		OFF3: 1 to 0	

Related Parameters

Param.	Name	Default	Value Range	Descriptions
b1-00 (F0-03)	Command source of control channel 1	0	0: Keypad 1: Terminal 2: Communication 3: User-defined	It is used to set the main command source of control channel 1. Value description 0: Select the main command source of control channel 1 as the LED operating panel or external operating panel. You can control the motor by pressing RUN/STOP keys on the keypad. 1: Select the main command source of control channel 1 as terminal. The DI can be assigned with different functions such as start/stop, forward/reverse run, jog, and multi-reference. 2: Select the main command source of control channel 1 as communication, such as Modbus. The AC 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 equipment. 3: The source is user-defined. 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 source	0	0: Disabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined ON_OFF1 (start/stop) source. The bit signal value of 0 indicates STOP, and the bit signal value of 1 indicates RUN. Value description 0: This command is invalid. 3 to 7: DI1 to DI5 - Whether the control command is enabled depends on the terminal state of the DI. Other: B connector - Whether the control command is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b1-02	User-defined OFF2 (coast to stop) source 1	1	0: Enable 1: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined OFF2 (coast to stop) source 1. The bit signal value of 0 indicates coast to stop, and the bit signal value of 1 indicates that the coast to stop command is inactive. Value description 0: Coast to stop 1: The coast to stop command is inactive. 3 to 7: DI1 to DI5 - Whether the control command is enabled depends on the terminal state of the DI. Other: B connector - Whether the control command is enabled depends on other B connectors. You can select other B connectors through the pop-up window. Additional information: There are three sources of OFF2 (free stop) of control channel 1: b1-02, b2-00, and b2-01. If any source is active, the OFF2 command is active.
b1-03	User-defined OFF3 (quick stop) source 1	1	0: Enable 1: Disable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined OFF3 (quick stop) source 1. The bit signal value of 0 indicates quick stop, and the bit signal value of 1 indicates that the quick stop command is inactive. Value description 0: Quick stop 1: The quick stop command is inactive. 3 to 7: DI1 to DI5 - Whether the control command is enabled depends on the terminal state of the DI. Other: B connector - Whether the control command is enabled depends on other B connectors. You can select other B connectors through the pop-up window. Additional information: There are three sources of OFF3 (quick stop) of control channel 1: b1-03, b2-02, and b2-03. If any source is active, the OFF3 command is active.
b1-04	User-defined operation permission source	1	0: Operation inhibited 1: Operation allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined operation permission source. The bit signal value of 0 indicates that the operation is not allowed, and the bit signal value of 1 indicates operation is allowed. Value description 0: Operation inhibited 1: Operation allowed 3 to 7: DI1 to DI5 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b1-05	User-defined fault reset command source 1	0	0: Disabled 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined fault reset command source 1. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Indicates that the reset is invalid. 1: Indicates that the fault reset command is active and can be reset. 3 to 7: DI1 to DI5 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window. Additional information: There are three sources of user-defined fault reset for control channel 1: b1-05, b2-04, and b2-05. Any source is valid, and the user-defined fault reset command is valid.
b1-06	User-defined JOG1 (jogging) source	0	0: Disabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets user-defined JOG1 (jogging) source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Disabled. 0: Indicates that jog is invalid. 3 to 7: DI1 to DI5 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-07	User-defined JOG2 (jogging) source	0	0: Disabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets user-defined JOG2 (jogging) source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 7: DI1 to DI7 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b1-08	User-defined speed inversion source	0	0: Disabled 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the user-defined speed inversion source. When the bit signal is 0, the command is disabled and the speed is not inverted. When the bit signal is 1, the command is enabled and the speed is inverted. Value description 0: Indicates that speed inversion is invalid. 1: Indicates that speed inversion is valid. 3 to 7: DI1 to DI5 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-09	Jog/ON_ OFF1 priority mode selection	0	0: No priority 1: Jog preferred 2: ON_OFF1 (start/stop) preferred	Used to select the priority level of jog and normal operation commands. Value description 0: No priority The AC drive responds only to the operation command that arrives first. 1: Priority for JOG The jog command can interrupt normal operation. 2: Priority for ON_OFF1 (start/stop) Normal operation commands can interrupt jogging.

Note

The motor parameter F1-03 is the mapping of motor parameter b1-00. The settings of the two parameters are equivalent.

3.2 Frequency Reference

This section describes the channel parameters of the AC drive and the setting of frequency references such as the main frequency reference and auxiliary frequency reference.

3.2.1 Set Channel and Frequency Reference

Description

The AC drive has two channels for setting the motor frequency reference, which can change the motor running state. Parameter group b5 corresponds to set channel 1, and group b6 corresponds to set channel 2.

Select different set channels to switch between two different frequency references and dynamically change the frequency reference source. For example, you can set b5-00 (Main frequency source) = 2 (AI1) to choose analog input as the speed reference of the set channel 1, and b6-00 (Main frequency source) = 9 (Communication reference) to set communication as the speed reference of the set channel 2.

Set the current active set channel through b0-03. When set channel 1 is selected, group b5 is activated, and AI is set as the speed reference. When set channel 2 is selected, group b6 is activated. Communication is used as the speed source. For details, see the following table.

Table 3–2 Set channel selection

b0 - 03	Group b5	Group b6
0: Set channel 1	Active	-
1: Set channel 2	-	Active

Each set channel frequency reference source are the main frequency and auxiliary frequency reference. Main frequency reference x main frequency reference gain coefficient = valid main frequency reference. Auxiliary frequency reference x auxiliary frequency reference gain coefficient = valid auxiliary frequency reference. After the operation of the valid main frequency reference and valid auxiliary frequency reference, the value serves as the input of the ramp function generator. After the acceleration/deceleration time, the actual frequency reference is generated. See *"3.2.2.1 Selecting Source for Main Frequency Reference" on page 107* to *"3.2.4 Selecting Source of Main Frequency and Auxiliary Frequency Superposition" on page 145* for details on the main frequency setting.

In addition to the main frequency and auxiliary frequency, each set channel has two jog frequencies. Jog frequency 1 is valid only when jog command 1 is active, and jog frequency 2 is valid only when jog command 2 is active. For details, see *"3.2.5 Jog Frequency and Additional Frequency" on page 153*.

Additional frequencies are also available. Set b5-04 and b6-04 to set the additional frequency of two set channels, which is used for speed adjustment without acceleration/deceleration time. The additional frequency takes effect only during normal operation. The effective value is superimposed directly to the output of the ramp function generator. For details, see *"3.2.5 Jog Frequency and Additional Frequency" on page 153*.

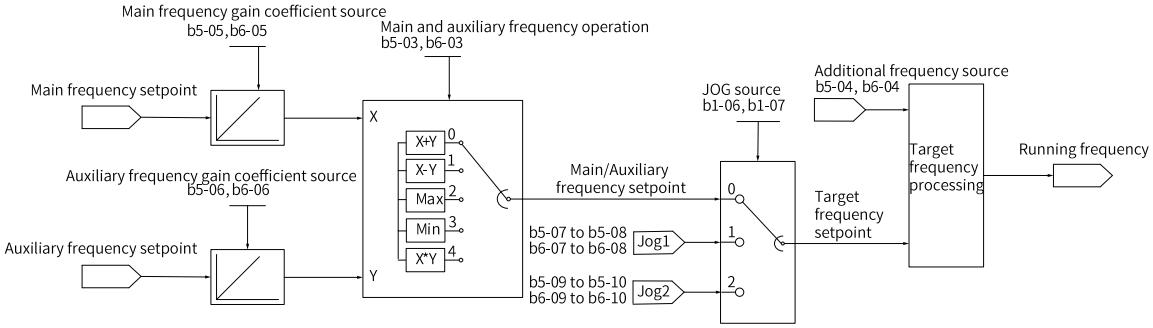


Figure 3-17 Frequency reference channel

3.2.2 Select Set Channel

3.2.2.1 Selecting Source for Main Frequency Reference

There are multiple main frequency reference sources including digital setting, AI1, pulse input, multi-reference, simple PLC, PID, communication setting, potentiometer MD-BP-M,and F connector. You can select b5-00 (main frequency source) and b6-00 (main frequency source) to set.

Table 3–3 Related parameters about main frequency source

Param.	Name	Default	Value Range	Descriptions
b5-00 (F0-29)	Main frequency source	0: Set by the parameter (b5-01) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	Set the main frequency source. Value description 0: The main frequency is the value of the parameter (b5-01) (Digital setting of main frequency). The frequency can be changed by using the ▲ and ▼ keys on the keypad or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered off and then powered on, whether the frequency adjusted by using UP/DOWN keys is saved depends on the configuration of "retain values set by using UP/DOWN keys". The "clear values adjusted by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key" function of the DI allows you to clear values set by using UP/DOWN keys or multi-functional input terminal functioning as the UP/DOWN key. 2: AI1. The frequency is input by current or voltage signal through the AI1. The frequency is calculated according to the preset AI curve. 5: HDI pulse. The frequency is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies 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. 10: Potentiometer MD-BP-M. The main frequency is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: The addresses for the frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

When the main frequency source is set to "0: Digital setting", the main frequency set by parameters (b5-01 or b6-01) is in the unit of Hz. When the main frequency source is set to other options, the frequency is set in percentage. The base value (100%) is determined by the per-unit base value of frequency (A2-04).

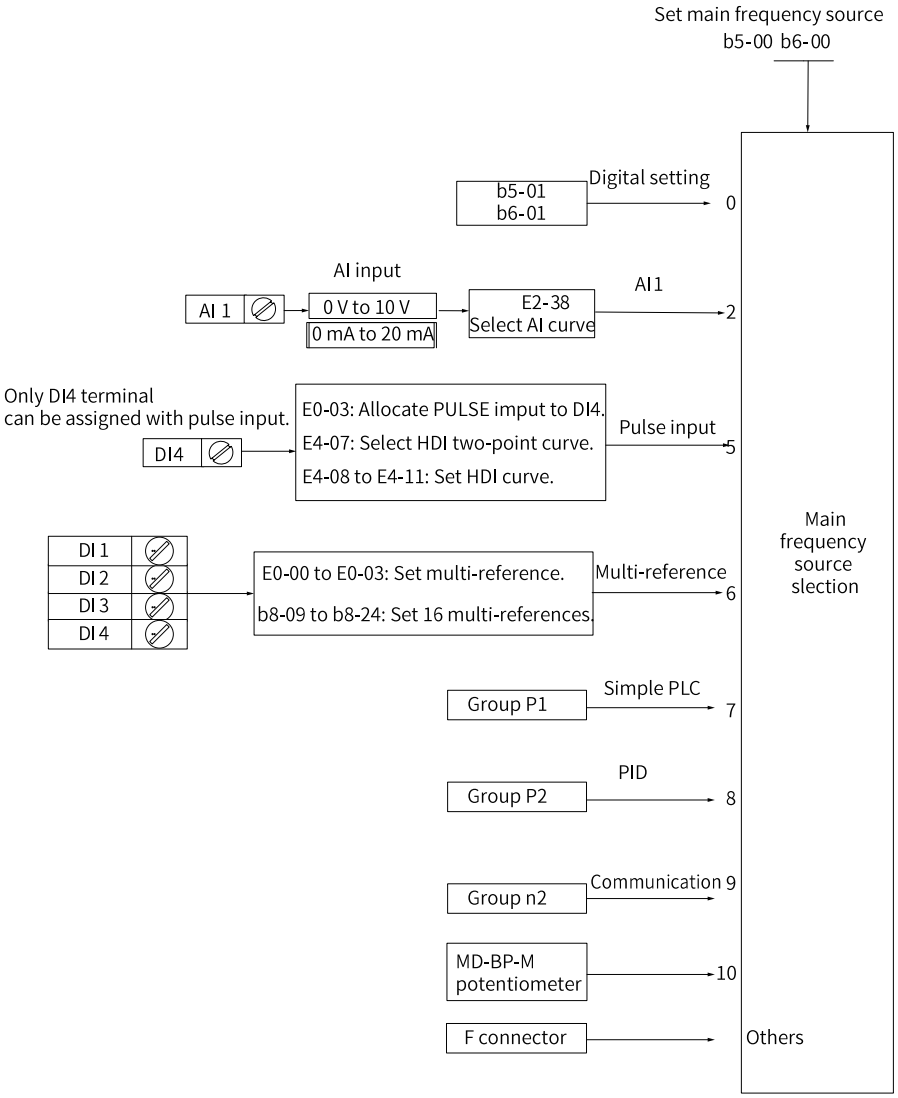


Figure 3-18 Main frequency source selection

3.2.2.2 Setting Main Frequency Through Parameter

Description

When b5-00 (Main frequency source) is set to 0, the value in Hz of b5-01 is the main frequency setting of the AC drive.

Related Parameters

Item	Name	Default	Value Range	Descriptions
b5 - 01 (F0-30)	Digital setting of main frequency	50.00 Hz	0.00 Hz to A2-17	Used to set the target frequency. Active when the main frequency source is parameters. b5-01 and F0-30 are the same parameter. After F0-30 is modified, b5-01 is automatically synchronized.

3.2.2.3 Setting Main Frequency Through Operating Panel

Description

The AC drive supports external operating panels such as MD-BP-M and the operating panel provided with the AC drive. For details, see *" Commissioning Tools" on page 26*. You can set the main frequency of the AC drive by pressing the key on the operating panel. The following figure shows the operating panel.



Figure 3-19 Operating panel

Steps

You can set the frequency by modifying the parameters or modifying the frequency by pressing the UP/DOWN key on the operating panel.

- Modify the parameters on the operating panel to set the frequency

  1. After power-on, press  to enter the parameter setting interface. Press  ,  ,  to locate b0-03 (set channel selection) and set it to 0 (set channel 1). Then press  to confirm the settings.
  2. Locate b5-00 (main frequency source) and set it to 0 (Set by the parameter (b5-01).
  3. Locate b5-01 (Digital setting of main frequency) and set it to 20.00. That is, the output frequency of set channel 1 to 20.00 Hz. The operating panel blinks 20.00.

- Press UP/DOWN key to set the frequency
  On the operating panel, set the main frequency source to parameters and set the frequency value to 20.00 Hz. The following steps are as follows:

Quickly set the frequency references when the AC drive is at rest through the  ,  keys, or terminals UP and DOWN. For example, use the operating panel to correct the frequency of 20.00 Hz to 19.99 Hz or 20.01 Hz. The procedures are as below:

1. For intuitive display, make the operating panel LED display the frequency 
2. Click the key  once. The operating panel blinks  .
3. Then click the key  twice. The operating panel blinks  .

If you want the frequency reference corrected by the UP/DOWN key to be restored after power-on again, set the value of P0-89 (UPDOWN retention selection upon power failure) to 1 (Retentive).

The frequency reference can also be corrected quickly when the AC drive is running through the  ,  keys, or terminals UP and DOWN. For example, during the frequency accelerating from 0.00 Hz to 20.00 Hz, when the frequency accelerates to 10.00 Hz, correct the current frequency by using the  and  keys. The steps are as follows:

1. Set P0-87 (UPDOWN reference during running) to 0 (running frequency) through the operating panel.
2. For intuitive display, the operating panel displays the running frequency.
3. When the operating frequency reaches 10.00 Hz, click  once and the operating panel displays the operating frequency as 10.01 Hz. And the frequency does not continue to accelerate according to the original acceleration time. Then press the  key once, the operating panel LED displays the running frequency at 10.02 Hz.

You can set whether the frequency reference corrected by UPDOWN during running is retained at stop through P0-88 (UPDOWN retention selection upon stop). If you want the frequency reference to be retained at power failure, set P0-88 (UPDOWN retention selection upon stop) to 1 (Retentive) and P0-89 (UPDOWN retention selection upon power failure) to 1 (Retentive).

Related Parameters

Param.	Name	Default	Value Range	Descriptions
b5‑01 (F0-30)	Digital setting of main frequency	50.00 Hz	0.00 Hz to A2-17	Used to set the target frequency. Active when the main frequency source is parameters.
P0-87	UPDOWN reference during running	0	0: Running frequency 1: Frequency reference	Defines the frequency reference adjusted by UPDOWN key during running. Value description 0: Running frequency - The target frequency increases or decreases from the running frequency adjusted by UPDOWN keys. 1: Set frequency - The target frequency increases or decreases from the set frequency adjusted by UPDOWN keys.

Param.	Name	Default	Value Range	Descriptions
P0-88	UPDOWN retention selection upon stop	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UPDOWN is retentive when the AC drive stops. Value description 0: Non-retentive. Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared when the AC drive stops. 1: Retentive. Parameters b5-01 and b6-01 are set through the operating panel and then adjust the frequency by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is retained when the AC drive stops.
P0-89	UPDOWN retention selection upon power failure	0	0: Non-retentive 1: Retentive	Defines whether the frequency corrected by UPDOWN is retentive upon power failure. Value description 0: Non-retentive. Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is cleared upon power failure. 1: Retentive. Parameters b5-01 and b6-01 (digital setting of main frequency) are set through the operating panel and then adjusted by the ▲ or ▼ keys or terminal UP or DOWN signals. The frequency adjustment is retained upon power failures.

Note

The parameter F0-30 in the table is the mapping of parameter b5-01. The settings of the two parameters are equivalent.

3.2.2.4 Setting Main Frequency Through AI

Description

The AC drive is equipped with a voltage-type analog input terminal AI. When b5-00 (Main frequency source) = 2 (AI1) is set, the AI terminal is selected as the source of the frequency reference. The AI input is converted to the input ratio through the AI curve. 100.0% of the input ratio corresponds to rated motor frequency (C4-06). Each AI terminal can select five different AI curves. The AI curve defines the relationship between the analog input voltage (or current) and the corresponding set values. For details on setting AI curves, see *"3.7.6 Analog Input Terminal (AI)" on page 270*. This section takes AI curve 1 as an example.

Steps

The basic steps for setting the main frequency through AI are as follows:

1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%":
   Set E2-40 (minimum input of AI curve 1) to 0.00 V.

   Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%.

   Set E2-42 (maximum input of AI curve 1) to 10.00 V.

   Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0%.

2. Set AI filter time through E2-10 (AI1 filter time).
3. Set b5-00 (Main frequency source) = 2 (AI1) to select AI as the frequency source.
   After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.

Related Parameters

Table 3–4

Param.	Name	Default	Value Range	Descriptions
E2-10	AI1 filter time	0.10s	0.00s to 10.00s	This parameter indicates the software filter time of AI1. Additional information: 1. The filter acts directly on AI hardware sampling. 2. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 3. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42	This parameter defines the minimum input point of x axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). Additional information: 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y axis represents the per-unit percentage of the rated motor frequency. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.

Param.	Name	Default	Value Range	Descriptions
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.
E2-43	Percentage corresponding to maximum input of AI curve 1	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.

3.2.2.5 Setting Main Frequency Through Pulse

Description

Set b5-00 (Main frequency source) to 5 (HDI) to select the input pulse as the main frequency. When the frequency source is HDI pulse input, the pulse reference can only be input from multi-function terminal DI4. Specifications of pulse reference signal: 15 V to 30 V (voltage) and 0 kHz to 20 kHz (frequency)

You can set the relationship between the percentage and the pulse frequency input from DI4, such as defined by two-point curve and four-point curve. Set the two-point curve through E4-08 to E4-11, and set the four-point curve through E4-12 to E4-19. For details on setting HDI curves, see *"3.7.5 High-Speed Digital Input (HDI)" on page 261*. This section takes the HDI two-point curve as an example. When pulse input is used as the frequency source, the pulse input 100% corresponds to the value of C4-06 (Rated motor frequency).

Instances

The basic steps for setting main frequency through HDI pulses are as follows:

1. Set E0-03 to 30 to assign DI4 with the "Pulse frequency input" function.
2. Select HDI pulse as the source of the main frequency reference of set channel 1 by setting b0-03 to 0 and b5-00 to 5. In this mode, the HDI pulse reference must be obtained from multi-functional input terminal DI4.
3. To set the relationship between the HDI frequency input and the two-point curve to "4 kHz to 20 kHz corresponds to 20% to 100%":
   Set E4-08 to 4.00 kHz.

   Set E4-09 to 20.0%.

   Set E4-10 to 20.00 kHz.

   Set E4-11 to 100.0%.

After setting the preceding steps, when the HDI input is 10 kHz, the main frequency is 50% of the rated motor frequency, and when the HDI input frequency is changed, the running frequency is processed according to the HDI curve.

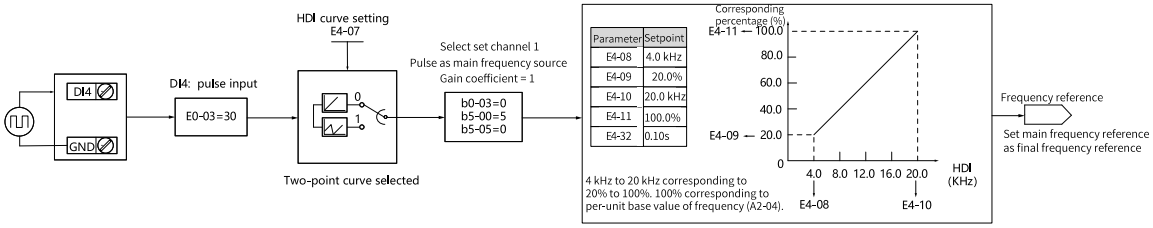


Figure 3-20 Parameters used to set the main frequency through pulse input

Related Parameters

Item	Name	Default	Value Range	Descriptions
E4-08	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency.
E4-09	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input.
E4-10	Maximum input of two-point HDI curve	20.00 kHz	E2-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency.
E4-11	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input.

Note

When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-10 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.

3.2.2.6 Setting Main Frequency Through Multi-reference

Description

Set b5-00 (Main frequency source) to 6 (multi-reference) to select the multi-reference output as the main frequency. 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.

The AC drive supports up to 16 frequency references in multi-reference operation mode, which can be set through combinations of input signals from the four DI terminals, or through b8-03 (Multi-reference

selection bit 0) to b8-06 (Multi-reference selection bit 3). 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.r	Name	Default	Value Range	Descriptions
b8-03	Multi-reference selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 0. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit1, bit2, and bit3. Value description 0: The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 12 (Multi-reference terminal 1), the value of b8-03 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b8-04	Multi-reference bit 1	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 1. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit2, and bit3. Value description 0: The value of multi-reference bit1 is 0. 1: The value of multi-reference bit1 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 13 (Multi-reference terminal 2), the value of b8-04 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

Param.r	Name	Default	Value Range	Descriptions
b8-05	Multi-reference bit 2	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 2. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit3. Value description 0: The value of multi-reference bit2 is 0. 1: The value of multi-reference bit2 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 14 (Multi-reference terminal 3), the value of b8-05 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b8-06	Multi-reference bit 3	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 3. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit2. Value description 0: The value of multi-reference bit3 is 0. 1: The value of multi-reference bit3 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 15 (Multi-reference terminal 4), the value of b8-06 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

Param.r	Name	Default	Value Range	Descriptions
b8‑08 (F0-38)	Multi-reference 0 setting mode	0	0 to 6	It defines the source of multi-reference 0. Value description 0: Set by the parameter (b8-09) - The value of multi-reference 0 is set by b8-09. 1: AI1 The multi-reference 0 is input by current or voltage signal through the AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: Reserved 3: MD-BP-M potentiometer The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse The multi-reference 0 is set through the pulse frequency of the DI4. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID PID output is selected as the source of multi-reference 0. 6: Digital setting of the main frequency (b5-01/b6-01) Multi-reference 0 is set by the digital setting of the main frequency (b5-01/b6-01). The multi-reference 0 is calculated based on the set frequency. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Param.r	Name	Default	Value Range	Descriptions
b8‑09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	Sets the value of multi-reference 0. The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Additional information: 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states, corresponding to 16 frequency setpoints. 2: This parameter defines the frequency reference for each multi-reference when the frequency reference source is set to multi-reference. Parameters b8-09 to b8-24 correspond to a total of 16 frequency references for frequency 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency (C4-06). 3. When the multi-reference is used as the frequency source, the set frequency is limited by C4-10 (Maximum motor frequency) and d1-03 (Digital setting of positive upper frequency). To set the multi-reference value to exceed 100%, modify these two limit parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. 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 of the rated value.
b8‑10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8‑11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8‑12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8‑13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8‑14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8‑15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8‑16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8‑17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8‑18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8‑19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8‑20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8‑21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8‑22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8‑23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8‑24	Multi-reference 15	0.00%	b8-43 to b8-42	

Note

- The parameters F0-38 to F0-42 in the table is the mapping of parameters b8-08 to b8-12. The settings of the two parameters are equivalent.
- A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected.After the DI terminal is assigned with function 12 (Multi-reference terminal 1) to 15 (Multi-reference terminal 4), the value of b8-03 to b8-06 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

To use multi-reference as the main frequency 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 3–5 Multi-reference input terminal

Parameter	Parameter Name	Setpoint	Description
E0-00 (F0-10)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F0-11)	DI2 function	13	Multi-reference terminal 2

Parameter	Parameter Name	Setpoint	Description
E0-02 (F0-12)	DI3 function selection	14	Multi-reference terminal 3
E0-03 (F0-13)	DI4 function selection	15	Multi-reference terminal 4

Instances

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. The target running frequency is calculated automatically by b8-11 (multi-reference 2) x A2-04 (per-unit base value of frequency). The following figure shows the frequency setting.

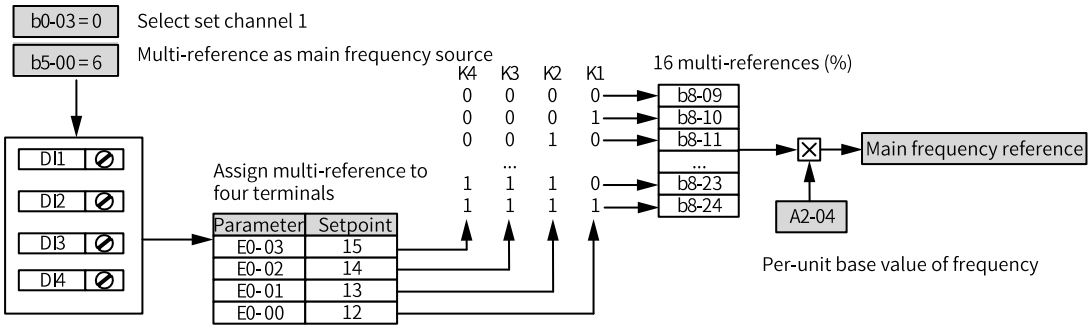


Figure 3-21 Multi-reference setting

The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. For details, see the following table.

Table 3–6 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
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.

3.2.2.7 Setting Main Frequency Through Simple PLC

Description

Set b5-00 (Main frequency source) to 7 (simple PLC) to select the PLC as the main frequency source. In some industrial applications, the AC motor only needs to support the functions of start/stop, time- and segment-based speed regulation, and automatic forward and reverse run. In this case, using the simple PLC can provide the preceding control functions and a PLC is not required. The simple PLC can directly set the running speed, direction, and running time of each stage. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor cycles in timed duration and in the forward and reverse directions at different speeds according to the operation process.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P1-00	Simple PLC module	0	0: Disable 1: Enable	This parameter is used to enable or disable the simple PLC module. Value description 0: Disable. If the simple PLC module is disabled, the output 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 simple PLC step, are all cleared. 1: Enable. The simple PLC module is enabled, but whether the PLC module is calculated and output is normal depends on P1-01.
P1-01	Simple PLC calculation enablement source	1126	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the simple PLC calculation enablement source. Value description 0: Simple PLC calculation function is disabled. 1: Simple PLC calculation function is enabled. 3 to 7: DI1 to DI5 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI5 terminals. Others: Connector B Whether simple PLC calculation is enabled depends on the status of the selected connector B. Additional information: 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.

Parameter	Name	Default	Value Range	Descriptions
P1-02	Simple PLC running 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 for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. Value description 0: Multi-reference 0 value is output after single-cycle running of the simple PLC module. 1: The final values are output after single-cycle running of the simple PLC module. 2: The simple PLC starts running again from the first stage after completing a cycle. 3: After simple PLC runs for a cycle, the output per-unit value obtained in the simple PLC step is 0. Additional information: 1. If this parameter is set to 0, 1, and 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 position: Retention selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Sets the simple PLC function. Value description Ones position: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC is retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time.

Parameter	Name	Default	Value Range	Descriptions
P1-04	Simple PLC status reset	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Simple PLC status reset Value description 0: The simple PLC status reset is disabled, and the simple PLC operates according to the setting. 1: The simple PLC status reset is enabled. The simple PLC module is restored to the initial state: Simple PLC running phase is 0, and the simple PLC output is the setpoint of the multi-reference 0 of P1-09. 3: Whether the simple PLC status reset is enabled depends on the input state of DI1 terminal. 4: Whether the simple PLC status reset is enabled depends on the input state of DI2 terminal. 5: Whether the simple PLC status reset is enabled depends on the input state of DI3 terminal. 6: Whether the simple PLC status reset is enabled depends on the input state of DI4 terminal. 7: Whether the simple PLC status reset is enabled depends on the input state of DI5 terminal. Others: Connector B Whether the simple PLC status reset is enabled depends on the status of the selected connector B. Additional information: After the DI terminal is assigned with function 23 (Simple PLC status reset), the value of P1-04 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
P1-08	Time unit of simple PLC	0	0: s (second) 1: h (hour)	Sets the time unit of simple PLC operation. Value description 0: Set the unit of simple PLC running time to second. 1: Set the unit of simple PLC running time to hour.

Parameter	Name	Default	Value Range	Descriptions
P1-09	Running time of multi-reference 0 set by simple PLC	0	0 to 6553.5s(h)	Sets the running time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. Additional information: It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.
P1-10	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0	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)	Sets the acceleration/deceleration time of multi-reference 0 set by simple PLC. Value description 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC.
P1-11	Running time of multi-reference 1 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-12	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-13	Running time of multi-reference 2 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-14	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-15	Running time of multi-reference 3 set by simple PLC	0	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-16	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Running time of multi-reference 4 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-18	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-19	Running time of multi-reference 5 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-20	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-21	Running time of multi-reference 6 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-22	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Running time of multi-reference 7 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-24	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-25	Running time of multi-reference 8 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-26	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-27	Running time of multi-reference 9 set by simple PLC	0	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-28	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Running time of multi-reference 10 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-30	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-31	Running time of multi-reference 11 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-32	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-33	Running time of multi-reference 12 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-34	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Running time of multi-reference 13 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-36	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-37	Running time of multi-reference 14 set by simple PLC	0	Same as P1-09	Same as P1-09
P1-38	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-39	Running time of multi-reference 15 set by simple PLC	0	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-40	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
b8‑08 (F0-38)	Multi-reference 0 setting mode	0	0: Set by the parameter (b8-09) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01 Others: F connector	It defines the source of multi-reference 0. Value description 0: Set by the parameter (b8-09) - The value of multi-reference 0 is set by b8-09. 1: AI1 The multi-reference 0 is input by current or voltage signal through the AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: Reserved 3: MD-BP-M potentiometer The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse The multi-reference 0 is set through the pulse frequency of the DI4. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID PID output is selected as the source of multi-reference 0. 6: Digital setting of the main frequency (b5-01/b6-01) Multi-reference 0 is set by the digital setting of the main frequency (b5-01/b6-01). The multi-reference 0 is calculated based on the set frequency. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Parameter	Name	Default	Value Range	Descriptions
b8 - 09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	Sets the value of multi-reference 0. The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Additional information: 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states, corresponding to 16 frequency setpoints. 2: This parameter defines the frequency reference for each multi-reference when the frequency reference source is set to multi-reference. Parameters b8-09 to b8-24 correspond to a total of 16 frequency references for frequency 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency (C4-06). 3. When the multi-reference is used as the frequency source, the set frequency is limited by C4-10 (Maximum motor frequency) and d1-03 (Digital setting of positive upper frequency). To set the multi-reference value to exceed 100%, modify these two limit parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. 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 of the rated value. 5. The 16 multi-reference operating frequency of the simple PLC is set by multi-reference value 0 to multi-reference value 15.
b8 - 10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8 - 11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8 - 12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8 - 13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8 - 14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8 - 15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8 - 16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8 - 17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8 - 18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8 - 19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8 - 20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8 - 21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8 - 22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8 - 23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8 - 24	Multi-reference 15	0.00%	b8-43 to b8-42	

Instances

The steps for setting simple PLC as the main frequency source are as follows. For details, see *"5.9 Simple PLC Function" on page 416*.

1. Set b0-03 to 0 and b5-00 to 7 to select simple PLC as the main frequency reference source of set channel 1.
2. Set the parameters b8-09 (multi-reference 0) to b8-24 (multi-reference 15). The 16 multi-reference values correspond to the frequency set in the 16 stages of the simple PLC. Set the parameters P1-09 to P1-40 to define the running time and acceleration/deceleration time of each speed.
3. Set P1-02 to select the simple PLC operation mode.

4. Set the ones position of the value of P1-03 to configure whether the current STEP and the current STEP running time of the simple PLC are retentive upon power-off. Set the tens position of the value of P1-03 to set the simple PLC module status when the calculation is disabled and the calculation is enabled again.
5. Sets the P1-01 (simple PLC calculation enablement 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 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.
   - 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 segment i when the calculation is stopped.
   - If you want the simple PLC to start calculating the running time only when the motor is running, you can configure the source as L1-26 (motor running flag). In addition, if you want to stop the motor after a single running, set b0-04 (internal process stop source) to L4-71 (Simple PLC single stop command).
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 b8-09). 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.

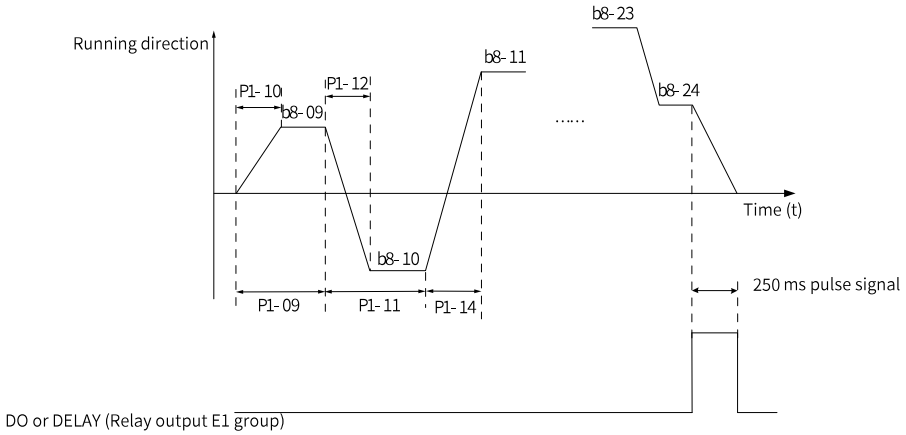


Figure 3-22 Use of simple PLC as the main frequency source

3.2.2.8 Setting Main Frequency Through PID

Description

Set b5-00 (Main frequency source) to 8 (PID) to select the PID output as the main frequency. PID control is a common method of process control. By performing proportional, integral, and derivative operations on the difference between the feedback signal and the target signal of the controlled variable, and adjusting the output frequency of the AC drive, a closed-loop system is formed to stabilize the controlled variable at the target level. The PID-controlled output is used as the running 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. When the PID output is selected as the running 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 differential parameters. The PID control parameters are defined as follows:

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A greater Kp value means faster deviation reduction but causes oscillation, especially in the case of long hysteresis. A smaller Kp value means lower probability of oscillation but leads to slow adjustment.
- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. Shorter differential time indicates greater adjustment intensity.
- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. When adjusting PID parameters, the differential time Td is not modified to prevent oscillation.

For details on PID functions, see *"5.10 PID Process Control" on page 422*.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P2-00	PID enable	0	0: Enable 1: Enable Others: B connector	Sets whether PID is enabled 0: Disable PID operation is not performed and the output is cleared. 1: Enable PID operation is performed based on parameters. Others: B connector Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Positive 1: Negative Others: B connector	Sets the PID action direction. 0: Positive. When the feedback value is lower than the PID reference, the output frequency of the AC drive increases. 1: Negative. When the feedback value is lower than the PID reference, the output frequency of the AC drive decreases. Others: B connector. Select the parameter in the bit connector to control PID direction (0: positive; 1: negative).

Param.	Name	Default	Value Range	Descriptions
P2-02	PID reference source	0	0: PID digital setting 1: AI1 3: Potentiometer MD-BP-M 4: HDI pulse 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	This parameter specifies the PID reference source. Value description 0: PID digital setting The PID target reference is the value of P2-03 (PID digital setting). 1: AI1 The PID target reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer The PID reference source is set by the MD-BP-M potentiometer. 4: HDI pulse The PID target reference is the per-unit value of the HDI curve corresponding to the DI4 pulse frequency input. 5: Multi-reference The PID target reference is the per-unit value after multi-reference calculation. 6: Simple PLC The PID target reference is the per-unit value after simple PLC calculation. 8: Communication The PID reference is set by remote communication (1000H). Others: F connector The parameter in float connector is used as the PID target reference value. Additional information: When P2-00 is set to 5 (multi-reference), b8-08 (multi-reference 0 setting mode) cannot be set to 5 (PID reference).
P2-03	PID digital setting	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter shall be set.
P2-04	PID feedback source	0	0: AI1 3: Potentiometer MD-BP-M 4: HDI pulse 5: Communication reference Others: F connector	It is used to select the PID feedback channel. Value description 0: AI1 The PID feedback reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer The PID reference source is set by the MD-BP-M potentiometer. 4: HDI pulse The PID Feedback reference is the per-unit value of the HDI curve corresponding to the HDI pulse frequency input. 5: Communication The PID reference is set by remote communication (1000H). Others: F connector The parameter in float connector is used as the PID feedback reference value.

Param.	Name	Default	Value Range	Descriptions
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. Additional information: The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.
P2-15	PID parameter 1 integral time Ti1	2.0	0.01s to 10.00s	Indicates the integral time Ti of the first group of parameters in PID control. Additional information: It decides the integral regulating intensity. The shorter the integral time, the greater the adjustment intensity will be.
P2-16	PID parameter 1 derivative time Td1	0	0.000s to 10.000s	Defines the derivative time Td of the first group of parameters in PID control. Additional information: It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. Additional information: See P2-14.
P2-18	PID parameter 2 integral time Ti2	2.0	0.01s to 10.00s	Indicates the integral time Ti of the second group of parameters in PID control. Additional information: See P2-15.
P2-19	PID parameter 2 derivative time Td2	0	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. Additional information: See P2-16.

Param.	Name	Default	Value Range	Descriptions
P2-26	Source of maximum PID output	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to 100%. 2: AI1 The maximum PID output value is limited to the value of the AI1curve in the per-unit system. 5: HDI pulse The maximum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference The maximum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC The maximum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID The maximum PID output value is limited to the per-unit value of the current PID output. 9: Communication The maximum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M The maximum PID output value is set by the MD-BP-M potentiometer. Other: F connector The maximum PID output value is limited to the value of the selected floating-point connector.

Param.	Name	Default	Value Range	Descriptions
P2-27	Source of minimum PID output	0	0: -100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to -100%. 2: AI1 The minimum PID output value is limited to the value of the AI1 curve in the per-unit system. 5: HDI pulse The minimum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference The minimum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC The minimum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID The minimum PID output value is limited to the per-unit value of the current PID output. 9: Communication The minimum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M The minimum PID output value is set by the MD-BP-M potentiometer. Other: F connector The minimum PID output value is limited to the value of the selected floating-point connector.

Instances

The steps for setting PID as the main frequency source are as follows:

1. Set b0-03 to 0 and b5-00 to 8 to select PID as the main frequency reference source of set channel 1.
2. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the maximum value of PID feedback.

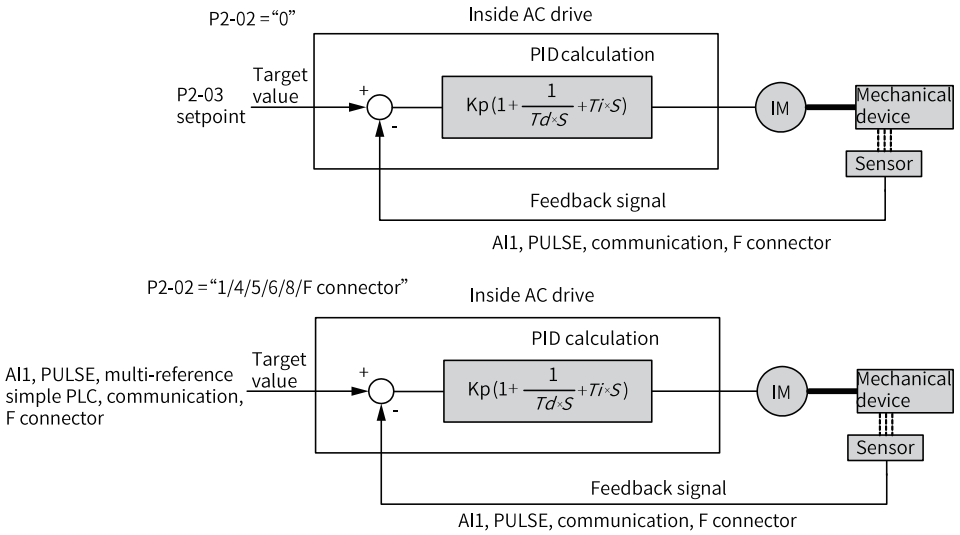


Figure 3-23 Principle of process PID control

3. Set P2-04 to select the PID feedback source.
4. Set P2-01 to select the PID action direction.
5. Set P2-26 and P2-27 to set the maximum PID output value and minimum output value respectively. The output of PID adjustment is between the maximum and minimum values.
6. Set P2-00 to 1 to enable PID.

Then the main frequency of the AC drive is set by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback value. The main frequency of the AC drive also changes to the PID output. For PID adjustment methods, see *"5.10 PID Process Control" on page 422*.

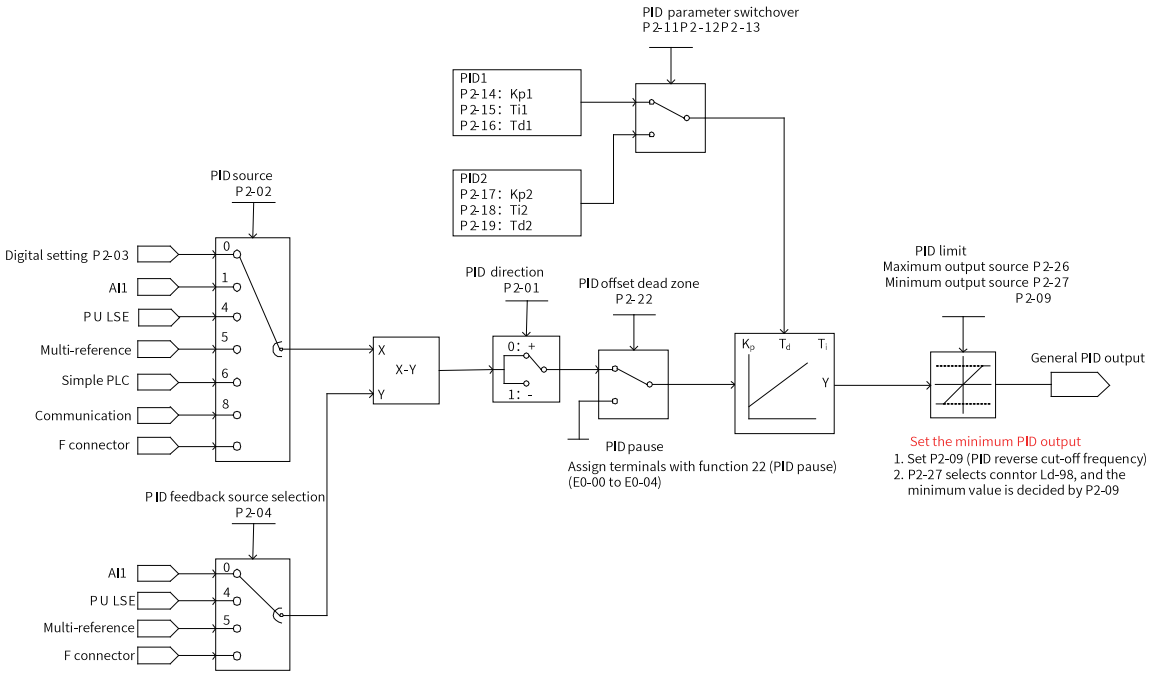


Figure 3-24 Parameter settings for process PID control

Upper and lower limits of PID output

You can set the maximum and minimum values of the PID output by setting P2-26 and P2-27. For example, when the main frequency source is PID and A2-04 is 50 Hz, set P2-09 to 2 Hz, set P2-27 to Ld-98, and P2-26 to 0 to achieve PID output range of 100.0% to -4.0%. Accordingly, the frequency reference range of the selected channel is 100% to -4%.

3.2.2.9 Setting the Main Frequency Through Communication

Description

Set b5-00 (Main frequency source) to 9 to select the communication setpoint as the main frequency. The AC drive supports two communication protocols, all of which are onboard modules, as shown in the following table.

Supported Protocol	Communication Hardware	Models
Modbus	RS485 communication interface of MD600 series AC drive	MD600S
	CN1 (RJ45) interface of MD600 series AC drive	MD600S, MD600A
CANopen/CANlink	CN1 (RJ45) interface of MD600 series AC drive	MD600A

Related Parameters

When the AC drive model is MD600S, that is, A3-06 (AC drive hardware type) = 4, Modbus communication is available. Set related communication parameters in group n2. For details about the Modbus communication protocol, see *" Modbus Communication" on page 470*.

Parameter Code	Name	Default	Value Range	Descriptions
n2 - 00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n2 - 01	Modbus data format	0	0: No check (8-N- 2) 1: Even parity check (8-E- 1) 2: Odd parity check (8-O- 12) 3: No check (8-N-1)	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Additional information: Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.

Parameter Code	Name	Default	Value Range	Descriptions
n2 - 02	Modbus local address	1	1 to 247	Sets the Modbus local address. Additional information: The local address must be unique in the range of 1 to 247, which is the basis for point-point communication between the AC drive and the host controller.
n2 - 03	Modbus response delay	2	0 ms to 20 ms (valid for Modbus)	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller. Additional information: If the response delay is shorter than the system processing time, the system processing time prevails. This means that the system processes data and then sends the data to the host controller. If the response delay is longer than the system processing time, the system processes data and waits for the response delay time. After the time elapses, the system sends the data to the host controller.
n2 - 04	Modbus communication timeout time	0	0.0 (Invalid) 0.1s to 60.0s	Sets Modbus timeout time. Additional information: When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. When it is set to a non-zero value, if the interval between the current communication and the next communication exceeds the Modbus communication timeout time (n2-04), the system reports a communication fault.

When the AC drive model is MD600A, that is, A3-06 (AC drive hardware type) = 0, Modbus communication is available. Set related communication parameters in group n3. For details about the CAN communication protocol, see *" CANlink Communication" on page 494* and *" CANopen Communication" on page 506*.

Parameter	Name	Default	Value Range	Descriptions
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n3-01	CAN communication enable	1	0: Enable 1: Disable	Set whether CAN communication is enabled.
n3-02	CAN station number	1	1 to 247	Sets the CAN communication station number.
n3-10	CAN communication protocol selection	2	1: CANopen 2: CANlink	This parameter is used to select a CAN communication protocol.
n3-14	CANopen mode	0	0: Default mode 1: Expert mode	Used to set CANopen user control mode.
n3-15	CANopen inhibit time	0	0μs to 65535μs	This parameter sets the inhibit time in CANopen expert mode in the unit of 100 μs.
n3-16	CANopen event time	0	0 ms to 65535 ms	Used to set the event time of CANopen expert mode in ms.

Communication address

Set the input source parameters such as b5-00 (Main frequency source) = 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the communication address specified by the AC drive according to the communication protocol, you can set the main frequency of the AC drive. The following table lists the communication addresses supported by the AC drive.

Communication address		Description of the communication address
Communication setpoint 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H speed setting]. The converted floating point value can also be set as communication of the commonly-used float point connector. • When n0-14 is set to 0, the written value as an unsigned 16-bit number, represents frequency in Hz, with the decimal place determined by A0-70. For instance, if you write the decimal value 1000 and set A0-70 (Frequency decimal place) to 2, this means the frequency is set to 10.00 Hz. For instance, if you write the decimal value 40000 and set A0-70 (Frequency decimal place) to 1, this means the frequency is set to 4000.0 Hz. • When n0-14 is set to 1, the written value as a signed 16-bit number, represents frequency in Hz, with the decimal place determined by A0-70. For instance, if you write the decimal value -1000 and set A0-70 (Frequency decimal place) to 2, this means the frequency is set to -10.00 Hz. For instance, if you write the decimal value 20000 and set A0-70 (Frequency decimal place) to 1, this means the frequency is set to 2000.0 Hz. • When n0-14 is set to 2, the written value, as a signed 16-bit number, represents speed in Hz, with no decimal place. When the decimal value 1500 is written and the number of pole pairs is 2, the frequency reference is 30.00 Hz. When the decimal value –3000 is written and the number of pole pairs is 2, the frequency reference is –60.00 Hz. • When n0-14 is set to 3, the unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against 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 unit is percentage and the value is a signed 16-bit number containing two decimal places. The written value is referenced against the maximum frequency. For example, when the decimal value -10000 is written and the rated frequency is 150.00 Hz, the frequency reference is -150.00 Hz.

The data format of the special address 7310H is set by n0-14 [7310H speed setting], as shown in the following table. When the value of n0-14 is 0, 1, or 2, the written value of 7310H can be used as the frequency source. When the value of n0-14 is 3 or 4, the written value of 7310H can be used as input sources such as torque reference source, V/f separation voltage source, and PID reference source.

Parameter	Name	Default	Value Range
n0-14	7310H speed setting	1	0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

For example, when n0-14 = 1 and A0-70 = 2 , write 2500 to 7310H to set the main frequency to 25.00 Hz. Write -2500 to 7310H to set the main frequency to -25.00 Hz.

Instances

To set Communication as the main frequency source of channel 1:

1. Set b0-03 to 0 and b5-00 to 9 to select communication as the main frequency reference source of set channel 1.
2. Set n0-13 and select the 1000H speed setting configuration.
3. Use the host controller to send a write command to the AC drive.

The following takes the Modbus protocol as an example to describe how to set the main frequency through communication. For example, to set the frequency reference to 100.0% (10000) through communication, send the write command 01 06 10 00 27 10 97 36.

The following table describes the definition of each byte.

Byte	Description
01H (configurable)	Drive address
06H	Write command
1000H	Frequency reference address
2710H (10000 in decimal)	Target frequency
9736H	CRC check

Similarly, to set the frequency reference to –100% (–10000) through communication, send the write command 01 06 10 00 D8 F0 D7 4E. In the command, D8F0 is the low-order four bits of the hexadecimal number converted from -10000.

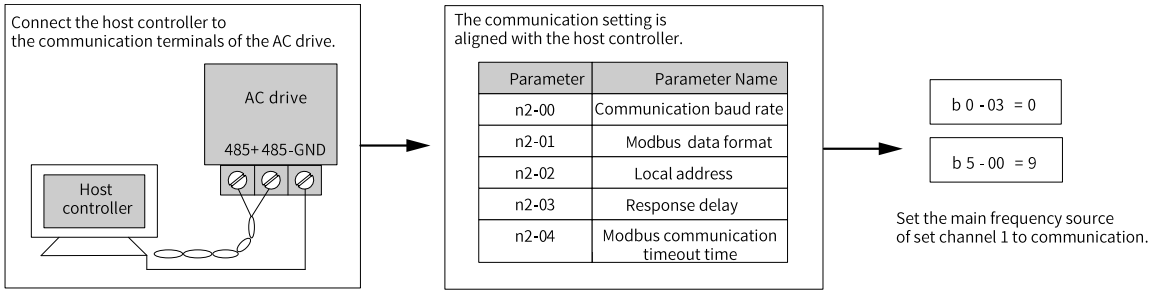


Figure 3-25 Parameter settings for using communication as the main frequency reference source

When n0-13 is set to 1 (1000H speed setting), the frequency range set through communication is -10000 to +10000 (decimal), corresponding to -100.00% to +100.00%. -100.00% corresponds to the negative per-unit base value of frequency (A2-04), and +100.00% corresponds to the per-unit base value of frequency (A2-04). Assume that A2-04 (per-unit base value of frequency) is set to 50 Hz. If the frequency reference in the write command is 2710H, which is equivalent to 10000 in the decimal format, the actual written frequency reference is 50 Hz (50 x 100.00%).

Table 3–7 Relationship between master commands and slave responses

Command from the Master		Response from the Slave	
ADDR	01H	ADDR	01H
CMD	06H	CMD	06H
High-order bit of the parameter address	10H	High-order bit of the parameter address	10H
Low-order bit of the parameter address	00H	Low-order bit of the parameter address	00H

Command from the Master		Response from the Slave	
High-order bit of the data content	27H	High-order bit of the data content	27H
Low-order bit of the data content	10H	Low-order bit of the data content	10H
CRC high-order bit	97H	CRC high-order bit	97H
CRC low-order bit	36H	CRC low-order bit	36H

3.2.3 Selecting the Auxiliary Frequency Source

There are multiple auxiliary frequency reference sources including digital setting, AI1, pulse input, multi-reference, simple PLC, PID, communication setting, potentiometer MD-BP-M,and F connector. You can set through b5-02 and b6-02.

Parameter	Name	Value Range	Default	Description
b5-02 (b6-02)	Auxiliary frequency source	0: 0 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	Sets the auxiliary frequency source. Value description 0: 0. The auxiliary frequency is set to 0. 2: AI1. The auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The auxiliary frequency is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the auxiliary frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies 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. 10: Potentiometer MD-BP-M. The auxiliary frequency is set through the potentiometer MD-BP-M. Others: F connector. A parameter No. is set for a float connector, and the value of the connector is read as the auxiliary frequency reference. This mode is used for expansion of common sources. Note: The addresses for the auxiliary frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14.

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 the frequency per unit value of A2-04.

When the auxiliary frequency is used as a reference source, it is set in the same way as the main frequency reference. For the setting of the auxiliary frequency, see the main frequency setting. The output main and auxiliary frequency is set after the main and auxiliary operation relationship.

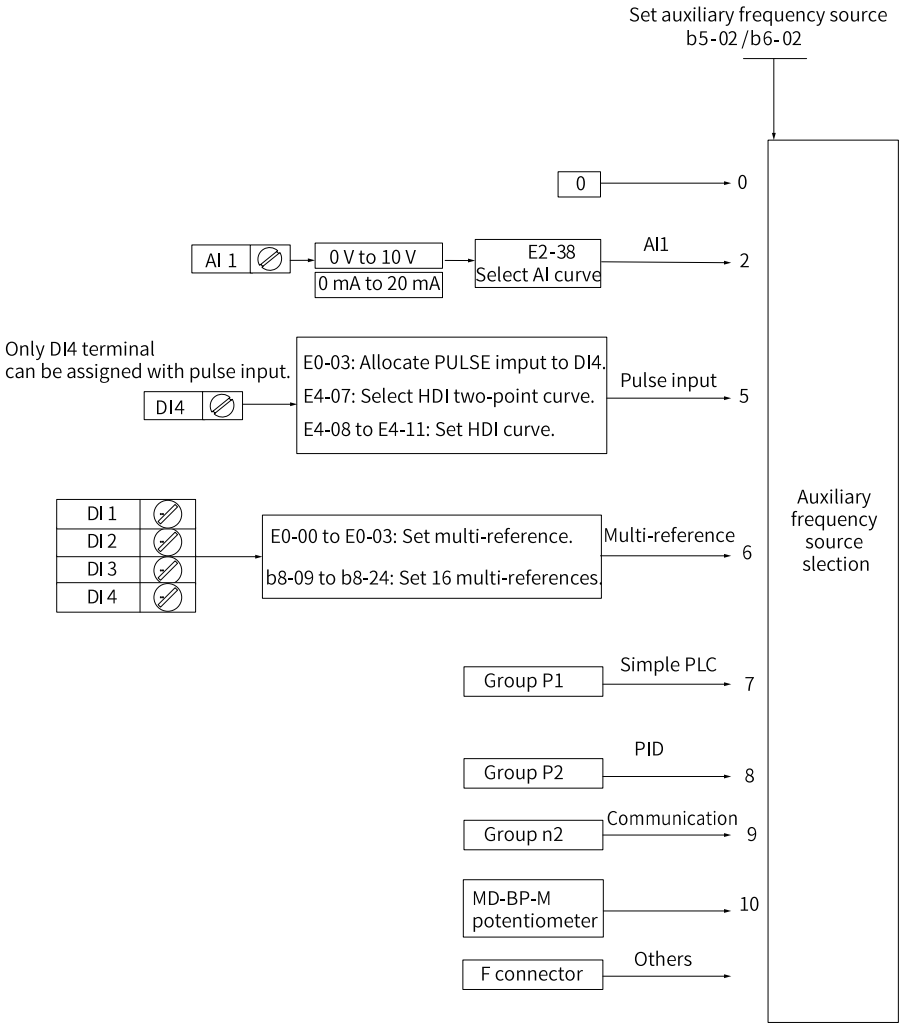


Figure 3-26 Auxiliary frequency reference source selection

3.2.4 Selecting Source of Main Frequency and Auxiliary Frequency Superposition

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. Multiply the calculation result by A2-04 to obtain the frequency reference.

There are five main and auxiliary operation relationships:

- 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 maximum result by comparing the absolute values of the main and auxiliary frequencies and is the original value (without the absolute value symbol).
- 3 [Min(|Main|, |Auxiliary|)]: The target frequency is the minimum result by comparing the absolute values of the main and auxiliary frequencies and is the original value (without the absolute value symbol).
- 4: Main frequency x auxiliary frequency: The operation result is the main frequency multiplied by the auxiliary frequency.

For example, assume that 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 operation) = 1 Main frequency - auxiliary frequency), the frequency reference value is (100%-30%) x 50.00 = 35.00 Hz.

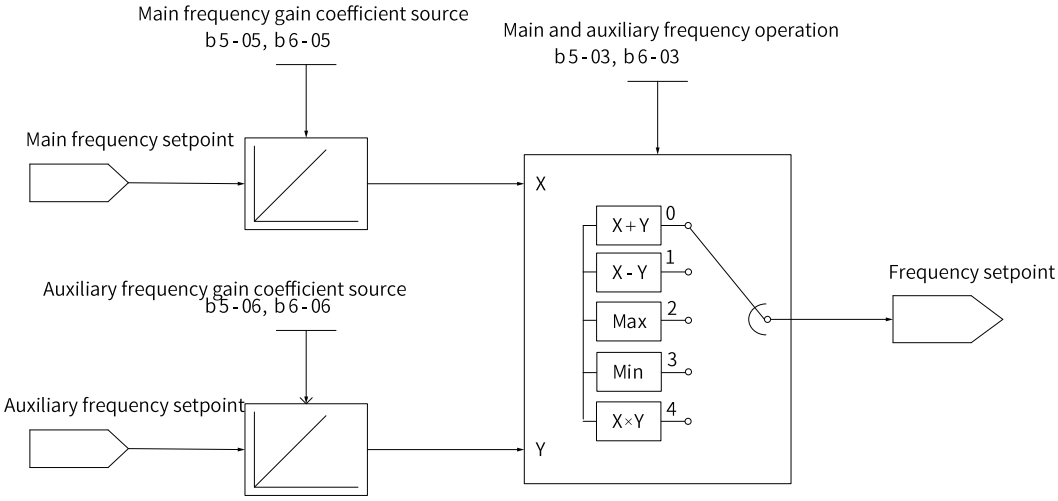


Figure 3-27 Main and auxiliary frequency source selection

Param.	Parameter Name	Default	Value Range	Descriptions
b5-03	Main and auxiliary frequency operation	0	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max (|Main|, |Auxiliary|) 3: Min(|Main|, |Auxiliary|) 4: Main frequency x auxiliary frequency	Defines the operation relationship between the main frequency and the auxiliary frequency. The main frequency and auxiliary frequency are calculated in percentage. Multiply the calculation result by A2-04 to obtain the frequency reference. Value description 0: Main frequency + auxiliary frequency. The operation result is the main frequency X plus the auxiliary frequency Y. 1: Main frequency - auxiliary frequency. The operation result is the main frequency X minus the auxiliary frequency Y. 2: Max (|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is larger. 3: Min(|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is smaller. 4: Main frequency x auxiliary frequency. The operation result is the main frequency X multiplied by the auxiliary frequency Y.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-05	Main frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set the main frequency gain coefficient source. Value description 0: 100%. The gain coefficient of main frequency reference is set to 100%. 2: AI1. The gain coefficient of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of main frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain coefficient of main frequency reference, different combinations of DI terminal states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain coefficient of main frequency reference. 9: Communication. The gain coefficient of main frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid main frequency reference is the current set frequency multiplied by the main frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid main frequency reference is 50 x 50% = 25 Hz.

Param.	Parameter Name	Default	Value Range	Descriptions
b5-06	Auxiliary frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set auxiliary frequency gain coefficient source. Value description 0: 100%. The gain factor of auxiliary frequency reference is set to 100%. 2: AI1. The gain factor of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of auxiliary frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain factor of auxiliary frequency reference, different combinations of DI terminal states correspond to different gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain factor of auxiliary frequency reference. 9: Communication. The gain factor of auxiliary frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid auxiliary frequency reference is the current set frequency multiplied by the auxiliary frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid auxiliary frequency reference is 50 x 50% = 25 Hz.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-03	Main and auxiliary frequency operation	0	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max (|Main|, |Auxiliary|) 3: Min(|Main|, |Auxiliary|) 4: Main frequency x auxiliary frequency	Defines the operation relationship between the main frequency and the auxiliary frequency. The main frequency and auxiliary frequency are calculated in percentage. Multiply the calculation result by A2-04 to obtain the frequency reference. Value description 0: Main frequency + auxiliary frequency. The operation result is the main frequency X plus the auxiliary frequency Y. 1: Main – Auxiliary. The operation result is the main frequency X minus the auxiliary frequency Y. 2: Max (|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is larger. 3: Min(|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is smaller. 4: Main frequency x auxiliary frequency. The operation result is the main frequency X multiplied by the auxiliary frequency Y.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-05	Main frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set the main frequency gain coefficient source. Value description 0: 100%. The gain coefficient of main frequency reference is set to 100%. 2: AI1. The gain coefficient of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of main frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain coefficient of main frequency reference, different combinations of DI terminal states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain coefficient of main frequency reference. 9: Communication. The gain coefficient of main frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid main frequency reference is the current set frequency multiplied by the main frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid main frequency reference is 50 x 50% = 25 Hz.

Param.	Parameter Name	Default	Value Range	Descriptions
b6-06	Auxiliary frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set auxiliary frequency gain coefficient source. Value description 0: 100%. The gain factor of auxiliary frequency reference is set to 100%. 2: AI1. The gain factor of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of auxiliary frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain factor of auxiliary frequency reference, different combinations of DI terminal states correspond to different gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain factor of auxiliary frequency reference. 9: Communication. The gain factor of auxiliary frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid auxiliary frequency reference is the current set frequency multiplied by the auxiliary frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid auxiliary frequency reference is 50 x 50% = 25 Hz.

3.2.5 Jog Frequency and Additional Frequency

Description

In addition to the main frequency and auxiliary frequency described above, each set channel has two jog frequencies. Jog frequency 1 is valid only when jog command 1 is active, and jog frequency 2 is valid only when jog command 2 is active.

Additional frequencies are also available. Additional frequency: Set b5-04 and b6–04 to set the additional frequency of two set channels, which is used for speed adjustment without acceleration/ deceleration time. The additional frequency takes effect only during normal operation. The effective value is superimposed directly to the output of the ramp function generator.

The following figure shows the relationship between the main frequency, auxiliary frequency, jog frequency, and additional frequency.

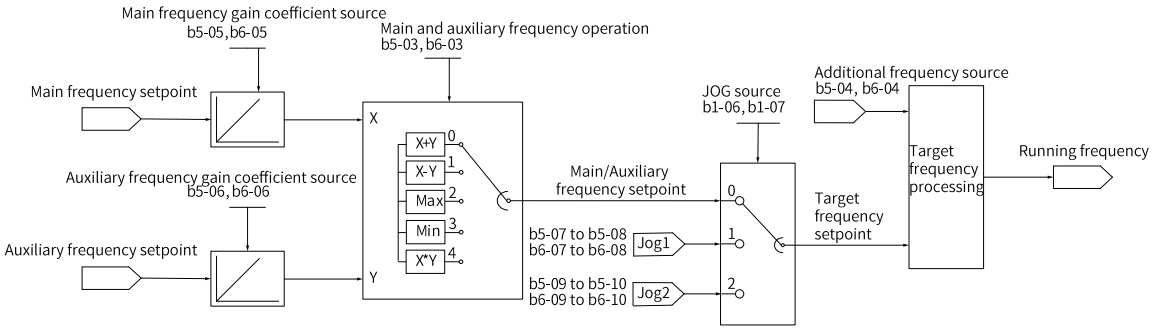


Figure 3-28 Frequency reference

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
b5‑04 (F0-33)	Additional frequency source	0	0: Disabled 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set the additional frequency source of set channel 1. Value description 0: 0 The additional frequency is set to 0. 2: AI1 The additional frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The additional frequency is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference When multi-reference is used as the additional frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies 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 input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The additional frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the additional frequency. This mode is used for expansion of common sources. Note: The addresses for the additional frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14. The additional frequency is superimposed directly on the set frequency.

Parameter	Name	Default	Value Range	Descriptions
b5‑07 (F0-56)	Jogging frequency 1 source	0	0: Set by the parameter (b5-08) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 1 frequency source Value description 0: Set by the parameter (b5-08) The jog frequency 1 source is “jog frequency 1 reference”, set by the parameter (b5-08). 2: AI1 The jog frequency 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The jog frequency 1 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog frequency 1 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 reference values. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the jog frequency 1 source. 9: Communication Communication is selected as the jog frequency 1 source. 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. 10: Potentiometer MD-BP-M The jog frequency 1 is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b5‑08 (F0-57)	Digital setting of jog frequency 1	2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 1 It takes effect when b5-07 is set to 0.

Parameter	Name	Default	Value Range	Descriptions
b5‑09 (F0-58)	Jogging frequency 2 source	0	0: Set by the parameter (F0-59) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 2 frequency source Value description 0: Digital setting The jog frequency 2 source is “jog frequency 2 reference”, set by F0-59 2: AI1 The jog frequency 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The jog frequency 2 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the jog frequency 2 source. 9: Communication Communication is selected as the jog frequency 2 source. In this mode, the jog frequency 2 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The jog frequency 2 is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 2. This mode is used for expansion of common sources.
b5‑10 (F0-59)	Digital setting of jog frequency 2	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 2 It takes effect when b5-09 is set to 0.

Parameter	Name	Default	Value Range	Descriptions
b6-04	Additional frequency source	0	0: Disabled 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets additional frequency source. Value description 0: 0 The additional frequency is set to 0. 2: AI1 The additional frequency is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The additional frequency is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference When multi-reference is used as the additional frequency source, combinations of different DI states correspond to different frequencies. The four multi-reference terminals can provide 16 states, corresponding to 16 frequencies. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the frequency. The simple PLC module is used to set the running time and acceleration/deceleration time of each frequency. Up to 16 frequencies 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 input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The additional frequency is set through the potentiometer MD-BP-M. Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as the additional frequency. This mode is used for expansion of common sources. Note: The addresses for the additional frequency set by communication are 0x1000 (dedicated for Modbus) and 0x7310 (CAN and Modbus). When the frequency is written through communication by using address 0x1000, the setting option is set by n0-13. When the frequency is written through communication by using address 0x7310, the setting option is set by n0-14. The additional frequency is superimposed directly on the set frequency.

Parameter	Name	Default	Value Range	Descriptions
b6-07	Jogging frequency 1 source	0	0: Set by the parameter (b6-08) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 1 frequency source Value description 0: Set by the parameter (b6-08) The jog frequency 1 source is “jog frequency 1 reference”, set by the parameter (b5-08). 2: AI1 The jog frequency 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The jog frequency 1 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference When multi-reference is used as the jog frequency 1 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 reference values. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the jog frequency 1 source. 9: Communication Communication is selected as the jog frequency 1 source. 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. 10: Potentiometer MD-BP-M The source of jog frequency 1 is the voltage of the potentiometer MD-BP-M Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b6-08	Digital setting of jog frequency 1	2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 1 It takes effect when b5-07 is set to 0.

Parameter	Name	Default	Value Range	Descriptions
b6-09	Jogging frequency 2 source	0	0: Set by the parameter (b6-10) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 2 frequency source Value description 0: Set by the parameter (b6-10) The jog frequency 2 source is “jog frequency 2 reference”, set by the parameter (b5-10). 2: AI1 The jog frequency 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse The jog frequency 2 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID PID is selected as the jog frequency 2 source. 9: Communication Communication is selected as the jog frequency 2 source. In this mode, the jog frequency 2 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M The source of jog frequency 2 is the voltage of the potentiometer MD-BP-M Others: F connector A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b6-10	Digital setting of jog frequency 2	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jog frequency 2 It takes effect when b6-09 is set to 0.

Note

The motor parameters in group F0 in the table are the mapping of motor parameters in group b5. The settings of the two groups are equivalent.

3.2.6 Frequency Reference Limits

Description

Frequency upper limit: Defines the maximum running frequency of the motor. Frequency lower limit: Defines the minimum running frequency of the motor. Maximum frequency: Defines the maximum output frequency. Minimum frequency: Defines 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 automatically kept equal to the rated motor frequency.

The frequency reference limits includes the forward frequency upper limit, the forward frequency lower limit, the reverse frequency upper limit, and the reverse frequency lower limit.

The active forward frequency upper limit is limited by the combination of three parameters: C4-10 (Maximum motor frequency), d1-03 (Digital setting of the forward frequency upper limit), and d1-05 (Source of forward frequency upper limit). The minimum value of the three parameters is used as the forward frequency upper limit of the set frequency. For the forward frequency lower limit, the two limit parameters are C4-11 (Minimum motor frequency) and d1-07 (Digital setting of forward frequency lower limit). The maximum values of the two parameters are the final effective limit of the forward frequency lower limit of the set frequency. The reverse frequency limits are similar.

The set frequency is also limited by the RFG forward/reverse speed limit after being fed into the RFG. The RFG forward speed upper limit is limited only by the minimum value of C4-10 (Maximum motor frequency) and d1-03 (Digital setting of the forward frequency upper limit). The RFG reverse speed upper limit is limited by the maximum value of C4-10 (Maximum motor frequency) and d1-04 (Digital setting of reverse frequency upper limit).

Note

By default, d1-03 and d1-05 are 800%. To set the forward frequency upper limit, modify C4-10 (Maximum motor frequency). Similarly, to set the upper limit of the reverse frequency, modify C4-10 (Maximum motor frequency).

Related Parameters

Table 3–8 Parameters related to the frequency reference limit

Parameter	Name	Default	Value Range	Descriptions
C4-06 (F1-06)	Rated motor frequency	50.00 Hz	0.01 Hz to 599.00 Hz	It is used to set the rated motor frequency in the unit of Hz.
C4-10 (F1-10)	Maximum motor frequency	50.00 Hz	C4-06 to 599.00 Hz	It is used to set the allowed maximum frequency of the motor in the unit of Hz.
C4-11 (F1-11)	Minimum motor frequency	0	0.00 Hz to C4-10	It is used to set the allowed minimum frequency of the motor in the unit of Hz.
d1‐03 (F2-22)	Digital setting of the forward frequency upper limit	800%	d107 to 800.0%	This parameter limits the forward maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Additional information: The forward frequency upper limit is the minimum value of d1-03 and d1-05.

Parameter	Name	Default	Value Range	Descriptions
d1‑04 (F2-23)	Digital setting of reverse frequency upper limit 1	-800%	800.0% to d108	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Additional information: The reverse frequency upper limit is the minimum value of d1-04 and d1-06.

Parameter	Name	Default	Value Range	Descriptions
d1‑05 (F2-24)	Source of forward frequency upper limit 2	0	0: 800% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter limits the forward maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Value description 0: 800%. Set the forward frequency upper limit to 800%. 2: AI1. The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The forward frequency upper limit is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the forward 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 limit values. 7: Simple PLC. Simple PLC is a multi-reference operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the forward 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 forward frequency upper limit is set through PID. 9: Communication. The forward frequency upper limit is set through communication. The forward frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The forward frequency upper limit is the input value of the MD-BP-M potentiometer. Other: F connector. The forward frequency upper limit depends on the value of the selected F connector. Additional information: The forward frequency upper limit is the minimum value of F2-22 and F2-24.

Parameter	Name	Default	Value Range	Descriptions
d1‑06 (F2-25)	Source of reverse frequency upper limit 2	1	0: -800% 1: Opposite to the forward frequency upper limit 2 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter limits the reverse maximum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency. Value description 0: -800%. Set the reverse frequency upper limit to -800%. 1: Opposite to the forward frequency upper limit. Opposite to the forward frequency upper limit (d1-03). 2: AI1. The reverse frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The reverse frequency upper limit is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the reverse 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 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 reverse frequency upper limit is set through PID. 9: Communication. The reverse frequency upper limit is set through communication. The reverse frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The reverse frequency upper limit is the input value of the MD-BP-M potentiometer. Other: F connector. The reverse frequency upper limit depends on the value of the selected F connector. Additional information: The reverse frequency upper limit is the minimum value of F2-23 and F2-25.

Parameter	Name	Default	Value Range	Descriptions
d1‑07 (F2-26)	Digital setting of forward frequency lower limit 1	0	0% to d103	This parameter limits the forward minimum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency.
d1‑08 (F2-27)	Digital setting of reverse frequency lower limit 1	0	d104 to 0%	This parameter limits the reverse minimum operation frequency. It is a per-unit value based on the rated motor frequency, that is, 100% indicates the rated motor frequency.

Note

The parameter group F in the table is the mapping of parameters group C and d. The settings of the two groups are equivalent.

3.2.7 Define Running Mode in Case of a Frequency Below Minimum Limit

Description

The minimum frequency of the motor defines the minimum output frequency.

If the frequency reference of the AC drive is lower than the value of C4-11 (minimum frequency of the motor), you need to set P0-11 to further specify the corresponding action of the AC 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 the minimum frequency of the motor
  If the frequency reference is below the minimum frequency of the motor, the AC drive will run at this minimum frequency.
- 1: Stop
  If the frequency reference is below the minimum frequency of the motor, the AC drive stops.
- 2: Run at zero speed
  If the frequency reference is less than the minimum frequency of the motor, the AC drive runs at zero speed.
- 3: Coast to stop
  If the frequency reference is less than the minimum frequency of the motor, the AC drive coasts to stop.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-11	Operation mode when the frequency reference is less than the minimum motor frequency	0	0: Run at the minimum frequency of the motor 1: Stop 2: Run at zero speed 3: Coast to stop	Defines the running mode when the frequency reference is less than the minimum motor frequency 0: Run at the minimum frequency of the motor If the frequency reference is less than the minimum frequency of the motor, the AC drive runs at a frequency greater than or equal to the minimum frequency of the motor. In this case, the final operation frequency is limited by both the frequency lower limit and the minimum frequency. 1: Stop If the frequency reference is below the minimum frequency of the motor, the AC drive decelerates to stop. 2: Run at zero speed If the frequency reference is less than the minimum frequency of the motor, the AC drive runs at zero speed. 3: Coast to stop If the frequency reference is less than the minimum frequency of the motor, the AC drive coasts to stop

3.2.8 Frequency Reference Source Selection

The frequency reference for each set channel is defined by the main frequency and auxiliary frequency. Main frequency reference x main frequency reference gain coefficient = valid main frequency reference. Auxiliary frequency reference x auxiliary frequency reference gain coefficient = valid auxiliary frequency reference. After the operation of the valid main frequency reference and valid auxiliary frequency reference, the value serves as the input of the ramp function generator. After the acceleration/ deceleration time, the actual frequency reference is generated.

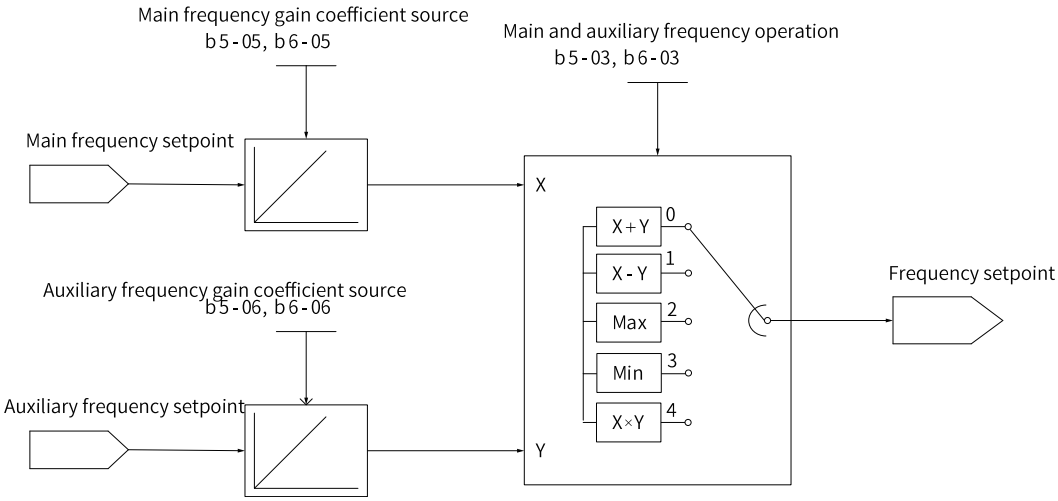


Figure 3-29 Main and auxiliary frequency source selection

Param.	Name	Default	Value Range	Descriptions
b5-03	Main and auxiliary frequency operation	0	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max (|Main|, |Auxiliary|) 3: Min(|Main|, |Auxiliary|) 4: Main frequency x auxiliary frequency	Defines the operation relationship between the main frequency and the auxiliary frequency. The main frequency and auxiliary frequency are calculated in percentage. Multiply the calculation result by A2-04 to obtain the frequency reference. Value description 0: Main frequency + auxiliary frequency. The operation result is the main frequency X plus the auxiliary frequency Y. 1: Main frequency - auxiliary frequency. The operation result is the main frequency X minus the auxiliary frequency Y. 2: Max (|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is larger. 3: Min(|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is smaller. 4: Main frequency x auxiliary frequency. The operation result is the main frequency X multiplied by the auxiliary frequency Y.

Param.	Name	Default	Value Range	Descriptions
b5-05	Main frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set the main frequency gain coefficient source. Value description 0: 100%. The gain coefficient of main frequency reference is set to 100%. 2: AI1. The gain coefficient of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of main frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain coefficient of main frequency reference, different combinations of DI terminal states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain coefficient of main frequency reference. 9: Communication. The gain coefficient of main frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid main frequency reference is the current set frequency multiplied by the main frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid main frequency reference is 50 x 50% = 25 Hz.

Param.	Name	Default	Value Range	Descriptions
b5-06	Auxiliary frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set auxiliary frequency gain coefficient source. Value description 0: 100%. The gain factor of auxiliary frequency reference is set to 100%. 2: AI1. The gain factor of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of auxiliary frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain factor of auxiliary frequency reference, different combinations of DI terminal states correspond to different gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain factor of auxiliary frequency reference. 9: Communication. The gain factor of auxiliary frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid auxiliary frequency reference is the current set frequency multiplied by the auxiliary frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid auxiliary frequency reference is 50 x 50% = 25 Hz.

Param.	Name	Default	Value Range	Descriptions
b6-03	Main and auxiliary frequency operation	0	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max (|Main|, |Auxiliary|) 3: Min(|Main|, |Auxiliary|) 4: Main frequency x auxiliary frequency	Defines the operation relationship between the main frequency and the auxiliary frequency. The main frequency and auxiliary frequency are calculated in percentage. Multiply the calculation result by A2-04 to obtain the frequency reference. Value description 0: Main frequency + auxiliary frequency. The operation result is the main frequency X plus the auxiliary frequency Y. 1: Main frequency - auxiliary frequency. The operation result is the main frequency X minus the auxiliary frequency Y. 2: Max (|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is larger. 3: Min(|Main|, |Auxiliary|). The operation result is the absolute value of the main frequency X or the auxiliary frequency Y, whichever is smaller. 4: Main frequency x auxiliary frequency. The operation result is the main frequency X multiplied by the auxiliary frequency Y.

Param.	Name	Default	Value Range	Descriptions
b6-05	Main frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set the main frequency gain coefficient source. Value description 0: 100%. The gain coefficient of main frequency reference is set to 100%. 2: AI1. The gain coefficient of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of main frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain coefficient of main frequency reference, different combinations of DI terminal states correspond to different frequencies. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain coefficient of main frequency reference. 9: Communication. The gain coefficient of main frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid main frequency reference is the current set frequency multiplied by the main frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid main frequency reference is 50 x 50% = 25 Hz.

Param.	Name	Default	Value Range	Descriptions
b6-06	Auxiliary frequency gain coeffi-cient source	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Set auxiliary frequency gain coefficient source. Value description 0: 100%. The gain factor of auxiliary frequency reference is set to 100%. 2: AI1. The gain factor of auxiliary frequency reference is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The gain coefficient of auxiliary frequency reference is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source for the gain factor of auxiliary frequency reference, different combinations of DI terminal states correspond to different gain factors. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source for the gain factor of auxiliary frequency reference. 9: Communication. The gain factor of auxiliary frequency reference is set through communication. In this mode, the gain coefficient is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The the gain coefficient is set through the potentiometer MD-BP-M. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the gain coefficient. This mode is used for expansion of common sources. Note: The valid auxiliary frequency reference is the current set frequency multiplied by the auxiliary frequency reference gain coefficient. For example, if the frequency is set to 50 Hz and b5-06 is set to communication, and the gain coefficient is set to 50%, the valid auxiliary frequency reference is 50 x 50% = 25 Hz.

Sometimes, a frequency regulation reference that is enabled directly without acceleration/deceleration time is required for the process. The system provides a supplementary frequency reference, which is enabled only during running. It is added to the RFG output frequency when it is being enabled.

3.3 Torque Reference

This section describes the torque reference source of the AC drive and the setting method of different torque reference sources. Similar to setting the frequency reference, the AC drive has two channels for setting the torque reference, which can change the motor running state. Parameter group b5 corresponds to set channel 1, and group b6 corresponds to set channel 2.

Set the current active set channel through b0-03 as the following figure. When set channel 1 is selected, group b5 is activated. In this case, the torque reference is set by group b5. When set channel 2 is selected, group b6 is activated. In this case, the torque reference is set by group b6 parameters.

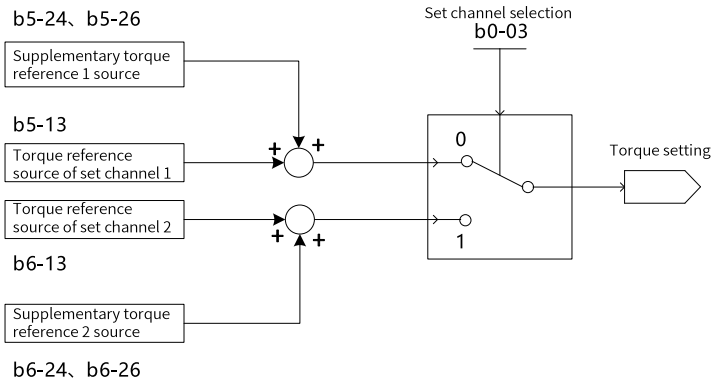


Figure 3-30 Torque reference source

In addition, there is the supplementary torque, which takes effect only during normal operation. The effective value is superimposed directly to the output of torque. For details, see *"3.3.9 Setting Supplementary Torque" on page 203*.

3.3.1 Selecting Source for Torque Reference

Set channel 1 is active in default mode. b5-13 (Torque reference source) allows you to select the torque setting method, such as digital setting, AI, multi-reference, and communication, which is similar to frequency reference source.

Table 3–9 Related Parameters

Parameter	Description	Default	Value Range	Descriptions
b5‑13 (b6-13)	Torque reference source	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	This parameter sets the torque reference source. Value description 0: Digital setting. The torque reference source is the "digital setting of torque reference". 2: AI1. The torque reference is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The torque reference is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different torque references. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. The torque reference is set through PID. 9: Communication. The torque reference source is 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. 10: Potentiometer MD-BP-M. The torque reference is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the torque reference. This mode is used for expansion of common sources.

The torque reference is in percentage format. Its base value (100%) is determined based on the per-unit base value of frequency (A2-06).

3.3.2 Setting Torque Reference Through Parameter

Set b5-13 (Torque reference source) to 0 to select the value of b5-14 as the torque source.

Table 3–10 Related Parameters

Item	Name	Default	Value Range
b5-14	Torque reference digital setting	0	-800.0% to 800.0%

If b5-14 is set to 50.0%, the torque setting is 50.0%.

3.3.3 Setting Torque Through AI

Description

The MD600 control board is equipped with a voltage-type analog input terminal (AI). When b5-13 (Torque reference source) is set to 2 (AI1), the AI terminal is selected as the source of the frequency source. The AI input is converted to the input ratio through the AI curve. 100.0% of the input ratio corresponds to rated motor frequency (C4-06). Each AI terminal can select five different AI curves. The AI curve defines the relationship between the analog input voltage (or current) and the corresponding set values. For details on setting AI curves, see *"3.7.6 Analog Input Terminal (AI)" on page 270*. This section takes AI curve 1 as an example.

Steps

The basic steps for setting torque through AI are as follows:

- Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%":
  Set E2-40 (minimum input of AI curve 1) to 0.00 V.

  Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%.

  Set E2-42 (maximum input of AI curve 1) to 10.00 V.

  Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0%.
- Set AI filter time through E2-10 (AI1 filter time).
- Set b5-13 (Torque reference source) = 2 (AI1) to select AI as the torque source.

After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the torque setting is 50%. When AI1 input voltage is changed, thetorque setting changes according to the AI1 curve.

Related Parameters

Item	Name	Default	Value Range	Descriptions
E2-10	AI1 filter time	0.10s	0.00s to 10.00s	This parameter indicates the software filter time of AI1. Additional information: 1. The filter acts directly on AI hardware sampling. 2. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 3. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42	This parameter defines the minimum input point of x axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). Remarks 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y axis represents the per-unit percentage of the rated motor frequency. 2. Five AI curves are provided. Curves 1 to 3 are two-point curves. The two points are the minimum input point and maximum input point, and the relevant parameters are E2-40 to E2-51. Curves 4 and 5 are four-point curves. The four points are the minimum input point, maximum input point, and two inflection points, and the relevant parameters are E2-52 to E2-67.
E2-41	Percentage corresponding to minimum input of AI curve 1	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Remarks See E2-40.
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). Remarks See E2-40.
E2-43	Percentage corresponding to maximum input of AI curve 1	100.0%	-800.0% to 800.0%	This parameter defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). Remarks See E2-40.

3.3.4 Setting Torque Reference Through Pulse

Description

Set b5-13 (Torque reference source) to 5 to select the HDI input as the torque reference. When the torque source is HDI pulse input, the pulse reference can only be input from multi-function terminal DI4. Specifications of pulse reference signal: 15 V to 30 V (voltage) and 0 kHz to 20 kHz (frequency)

You can set the relationship between the percentage and the pulse frequency input from DI4, such as defined by two-point curve and four-point curve. Set the two-point curve through E4-08 to E4-11, and set the four-point curve through E4-12 to E4-19. For details on setting HDI curves, see *"3.7.5 High-Speed Digital Input (HDI)" on page 261*. This section takes the HDI two-point curve as an example. When the pulse input is used as the torque reference, the pulse input 100% corresponds to the torque setpoint.

Steps

The basic steps for setting torque through HDI pulses are as follows:

1. Set E0-03 to 30 to assign DI4 with the "Pulse frequency input" function.
2. Select HDI pulse as the source of the main frequency reference of set channel 1 by setting b0-03 to 0 and b5-13 to 5. In this mode, the HDI pulse reference must be obtained from multi-functional input terminal DI4.
3. To set the relationship between the HDI frequency input and the two-point curve to "4 kHz to 20 kHz corresponds to 20% to 100%":
   Set E4-08 to 4.00 kHz.

   Set E4-09 to 20.0%.

   Set E4-10 to 20.00 kHz.

   Set E4-11 to 100.0%.

After setting the preceding steps, when the HDI input is 10 kHz, the torque is set to 50%, and when the HDI input frequency is changed, the running frequency is processed according to the HDI curve and the torque is changed.

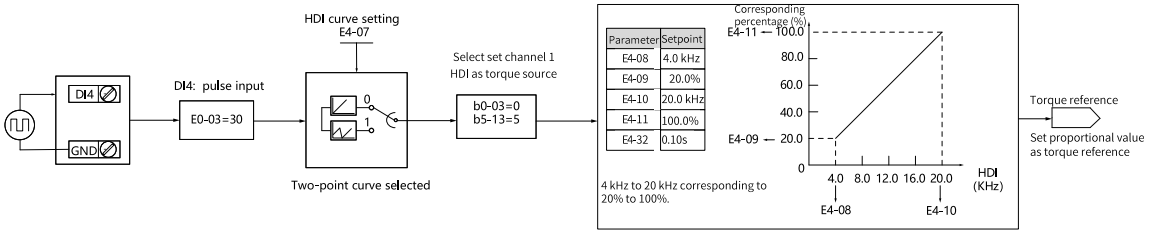


Figure 3-31 Parameter setting when torque reference is set through pulse input

Related parameter

Param.	Name	Default	Value Range	Descriptions
E4-08	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies of the DI4, and the y axis represents the percentages of the rated motor frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-08 corresponds to the x axis of the minimum pulse input, that is, the minimum input frequency of the pulse.
E4-09	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies of the DI4, and the y axis represents the percentages of the rated motor frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-09 corresponds to the y axis of minimum pulse input, that is, the set value corresponding to the minimum pulse input.

Param.	Name	Default	Value Range	Descriptions
E4-10	Maximum input of two-point HDI curve	20.00 kHz	E4-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies of the DI4, and the y axis represents the percentages of the rated motor frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-10 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.
E4-11	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. Additional information: When the high-speed pulse function of the DI4 is used as the source of the main frequency, it is necessary to define a curve that maps pulse frequencies to frequency references. The frequency references are percentages of the rated motor frequency (C4-06). The x axis of the curve represents the pulse frequencies of the DI4, and the y axis represents the percentages of the rated motor frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-11 corresponds to the y axis of maximum pulse input, that is, the set value corresponding to the maximum pulse input.

3.3.5 Setting Torque Through Multi-Reference

Description

Set b5-13 (Torque reference source) to 6 (multi-reference) to select the multi-reference output as the torque reference.

Up to 16 multi-references can be set, which can be selected through b8-03 (Multi-reference selection bit 0) to b8-06 (Multi-reference selection bit 3) or the 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 Range	Descriptions
b8-03	Multi-reference selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 0. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit1, bit0, bit2, and bit3. Value description 0: The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 12 (Multi-reference terminal 1), the value of b8-03 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b8-04	Multi-reference bit 1	0		Sets the source of multi-reference selection bit 1. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit2, and bit3. The value description and the additional information are the same as b8-03.
b8-05	Multi-reference bit 2	0		Sets the source of multi-reference selection bit 2. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit3. The value description and the additional information are the same as b8-03.
b8-06	Multi-reference bit 3	0		Sets the source of multi-reference selection bit 3. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit1, and bit2. The value description and the additional information are the same as b8-03.

Param.	Name	Default	Value Range	Descriptions
b8‑08 (F0-38)	Multi-reference 0 setting mode	0	0: Set by the parameter (b8-09) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01 Others: F connector	It defines the source of multi-reference 0. Value description 0: Set by the parameter (b8-09) - The value of multi-reference 0 is set by b8-09. 1: AI1. The multi-reference 0 is input by current or voltage signal through the AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: Reserved 3: MD-BP-M potentiometer. The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse. The multi-reference 0 is set through the pulse frequency of the DI4. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID. PID output is selected as the source of multi-reference 0. 6: Digital setting of the main frequency (b5-01/b6-01). Multi-reference 0 is set by the digital setting of the main frequency (b5-01/b6-01). The multi-reference 0 is calculated based on the set frequency. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Param.	Name	Default	Value Range	Descriptions
b8‑09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	Sets the value of multi-reference 0. The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Additional information: 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states, corresponding to 16 frequency setpoints. 2: This parameter defines the frequency reference for each multi-reference when the frequency reference source is set to multi-reference. Parameters b8-09 to b8-24 correspond to a total of 16 frequency references for frequency 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency (C4-06). 3. When the multi-reference is used as the frequency source, the set frequency is limited by C4-10 (Maximum motor frequency) and d1-03 (Digital setting of positive upper frequency). To set the multi-reference value to exceed 100%, modify these two limit parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. 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 of the rated value.
b8‑10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8‑11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8‑12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8‑13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8‑14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8‑15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8‑16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8‑17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8‑18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8‑19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8‑20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8‑21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8‑22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8‑23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8‑24	Multi-reference 15	0.00%	b8-43 to b8-42	

Note

The parameters F0-39 to F0-42 in the table is the mapping of parameters b8-09 to b8-12. The settings of the two parameters are equivalent.

To use multi-reference as the torque reference source, assign functions 12 to 15 to the DI terminals or set b803 (multi-reference selection bit0) to b806 (multi-reference selection bit3).

Table 3–11 Multi-reference input terminal

Parameter	Parameter Name	Value Range	Function Description
E0-00 (F0-10)	DI1 function selection	12	Multi-reference terminal 1
E0-01 (F0-11)	DI2 function	13	Multi-reference terminal 2

Parameter	Parameter Name	Value Range	Function Description
E0-02 (F0-12)	DI3 function selection	14	Multi-reference terminal 3
E0-03 (F0-13)	DI4 function selection	15	Multi-reference terminal 4

Note

The parameters F0-10 to F0-13 are the mapping of parameters E0-00 to E0-03. The settings of the two parameters are equivalent.

Example:

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.

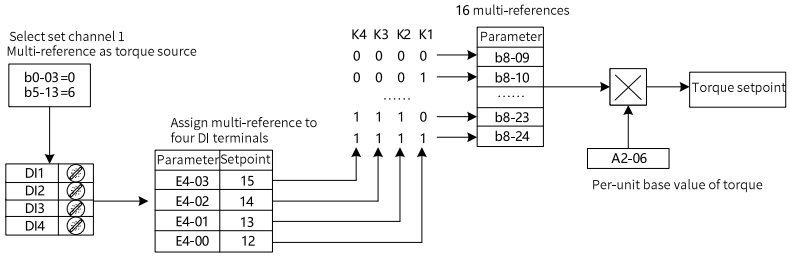


Figure 3-32 Setting torque through multi-reference

The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. as listed in the following table.

Table 3–12 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
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.

3.3.6 Setting Torque Through Simple PLC

Description

Set b5-13 (Torque reference source) to 7 (simple PLC) to select the simple PLC output as the torque reference. In some industrial applications, the AC motor only needs to support the functions of start/stop, time- and segment-based speed regulation, and automatic forward and reverse run. In this case, using the simple PLC can provide the preceding control functions and a PLC is not required. The simple PLC can directly set the running speed, direction, and running time of each stage. It can be used in industrial equipment such as mixture mixing and industrial washing machines. For example, in industrial washing machines, the motor cycles in timed duration and in the forward and reverse directions at different speeds according to the operation process.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P1-00	Simple PLC module	0	0: Enable 1: Disable	This parameter is used to enable or disable the simple PLC module. Value description 0: Disable If the simple PLC module is disabled, the output 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 simple PLC step, are all cleared. 1: Enable The simple PLC module is enabled, but whether the PLC module is calculated and output is normal depends on P1-01.
P1-01	Simple PLC calculation enablement source	1126	0: Disabled 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the simple PLC calculation enablement source. Value description 0: Simple PLC calculation function is disabled. 1: Simple PLC calculation function is enabled. 3: DI1 - Whether simple PLC calculation is enabled depends on the input state of DI1 terminal. 4: DI2 - Whether simple PLC calculation is enabled depends on the input state of DI2 terminal. 5: DI3 - Whether simple PLC calculation is enabled depends on the input state of DI3 terminal. 6: DI4 - Whether simple PLC calculation is enabled depends on the input state of DI4 terminal. 7: DI5 - Whether simple PLC calculation is enabled depends on the input state of DI5 terminal. Others: Connector B Whether simple PLC calculation is enabled depends on the status of the selected connector B. Additional information: 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.

Parameter	Name	Default	Value Range	Descriptions
P1-02	Simple PLC running 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 for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. Value description 0: Multi-reference 0 value is output after single-cycle running of the simple PLC module. 1: The final values are output after single-cycle running of the simple PLC module. 2: The simple PLC starts running again from the first stage after completing a cycle. 3: After simple PLC runs for a cycle, the output per-unit value obtained in the simple PLC step is 0. Additional information: 1. If this parameter is set to 0, 1, and 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 selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Sets the simple PLC function. Value description Ones: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC is retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time.

Parameter	Name	Default	Value Range	Descriptions
P1-04	Simple PLC status reset	0	0: Disabled 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Simple PLC status reset Value description 0: The simple PLC status reset is disabled, and the simple PLC operates according to the setting. 1: The simple PLC status reset is enabled. The simple PLC module is restored to the initial state: Simple PLC running phase is 0, and the simple PLC output is the setpoint of the multi-reference 0 of P1-09. 3 to 7: Whether the simple PLC status reset is enabled depends on the input state of DI1 to DI5 terminals. Others: Connector B. Whether the simple PLC status reset is enabled depends on the status of the selected connector B. Additional information: After the DI terminal is assigned with function 23 (Simple PLC status reset), the value of P1-04 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
P1-08	Time unit of simple PLC	0	0: s (second) 1: h (hour)	Sets the time unit of simple PLC operation. Value description 0: Set the unit of simple PLC running time to second. 1: Set the unit of simple PLC running time to hour.
P1-09	Running time of multi-reference 0 set by simple PLC	0s (h)	0s (h) to 6553.5s (h)	Sets the running time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. Additional information: It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.

Parameter	Name	Default	Value Range	Descriptions
P1-10	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0	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)	Sets the acceleration/deceleration time of multi-reference 0 set by simple PLC. Value description 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC.
P1-11	Running time of multi-reference 1 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-12	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-13	Running time of multi-reference 2 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-14	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-15	Running time of multi-reference 3 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-16	Accelera-tion/ Deceleration time of multi-reference 3 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-17	Running time of multi-reference 4 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-18	Accelera-tion/ Deceleration time of multi-reference 4 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-19	Running time of multi-reference 5 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-20	Accelera-tion/ Deceleration time of multi-reference 5 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-21	Running time of multi-reference 6 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-22	Accelera-tion/ Deceleration time of multi-reference 6 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-23	Running time of multi-reference 7 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-24	Accelera-tion/ Deceleration time of multi-reference 7 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-25	Running time of multi-reference 8 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-26	Accelera-tion/ Deceleration time of multi-reference 8 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-27	Running time of multi-reference 9 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-28	Accelera-tion/ Deceleration time of multi-reference 9 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-29	Running time of multi-reference 10 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-30	Accelera-tion/ Deceleration time of multi-reference 10 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-31	Running time of multi-reference 11 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-32	Accelera-tion/ Deceleration time of multi-reference 11 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-33	Running time of multi-reference 12 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-34	Accelera-tion/ Deceleration time of multi-reference 12 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-35	Running time of multi-reference 13 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-36	Accelera-tion/ Deceleration time of multi-reference 13 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-37	Running time of multi-reference 14 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09
P1-38	Accelera-tion/ Deceleration time of multi-reference 14 set by simple PLC	0	Same as P1-10	Same as P1-10
P1-39	Running time of multi-reference 15 set by simple PLC	0s (h)	Same as P1-09	Same as P1-09

Parameter	Name	Default	Value Range	Descriptions
P1-40	Accelera-tion/ Deceleration time of multi-reference 15 set by simple PLC	0	Same as P1-10	Same as P1-10
b8‑08 (F0-38)	Multi-reference 0 setting mode	0	0: Set by the parameter (b8-09) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01 Others: F connector	It defines the source of multi-reference 0. Value description 0: Set by the parameter (b8-09) - The value of multi-reference 0 is set by b8-09. 1: AI1. The multi-reference 0 is input by current or voltage signal through the AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: Reserved 3: MD-BP-M potentiometer. The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse. The multi-reference 0 is set through the pulse frequency of the DI4. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID. PID output is selected as the source of multi-reference 0. 6: Digital setting of the main frequency (b5-01/b6-01). Multi-reference 0 is set by the digital setting of the main frequency (b5-01/b6-01). The multi-reference 0 is calculated based on the set frequency. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Parameter	Name	Default	Value Range	Descriptions
b8 - 09 (F0-39)	Multi-reference 0	0.00%	b8-43 to b8-42	Sets the value of multi-reference 0. The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Additional information: 1: The unit of the multi-reference is %. The AC drive provides four multi-reference terminals (b8-03 to b8-06), which provide 16 states, corresponding to 16 frequency setpoints. 2: This parameter defines the frequency reference for each multi-reference when the frequency reference source is set to multi-reference. Parameters b8-09 to b8-24 correspond to a total of 16 frequency references for frequency 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency (C4-06). 3. When the multi-reference is used as the frequency source, the set frequency is limited by C4-10 (Maximum motor frequency) and d1-03 (Digital setting of positive upper frequency). To set the multi-reference value to exceed 100%, modify these two limit parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. 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 of the rated value. 5. The 16 multi-reference operating frequency of the simple PLC is set by multi-reference value 0 to multi-reference value 15.
b8 - 10 (F0-40)	Multi-reference 1	0.00%	b8-43 to b8-42	
b8 - 11 (F0-41)	Multi-reference 2	0.00%	b8-43 to b8-42	
b8 - 12 (F0-42)	Multi-reference 3	0.00%	b8-43 to b8-42	
b8 - 13	Multi-reference 4	0.00%	b8-43 to b8-42	
b8 - 14	Multi-reference 5	0.00%	b8-43 to b8-42	
b8 - 15	Multi-reference 6	0.00%	b8-43 to b8-42	
b8 - 16	Multi-reference 7	0.00%	b8-43 to b8-42	
b8 - 17	Multi-reference 8	0.00%	b8-43 to b8-42	
b8 - 18	Multi-reference 9	0.00%	b8-43 to b8-42	
b8 - 19	Multi-reference 10	0.00%	b8-43 to b8-42	
b8 - 20	Multi-reference 11	0.00%	b8-43 to b8-42	
b8 - 21	Multi-reference 12	0.00%	b8-43 to b8-42	
b8 - 22	Multi-reference 13	0.00%	b8-43 to b8-42	
b8 - 23	Multi-reference 14	0.00%	b8-43 to b8-42	
b8 - 24	Multi-reference 15	0.00%	b8-43 to b8-42	

Instances

The steps for setting simple PLC as the torque source are as follows. For details, see *"5.9 Simple PLC Function" on page 416*.

1. Set the parameters b8-09 (multi-reference 0) to b8-24 (multi-reference 15). The 16 multi-reference values correspond to the torque set in the 16 stages of the simple PLC. Set the parameters P1-09 to P1-40 to define the running time and acceleration/deceleration time of each torque.
2. Set the parameters b8-09 (multi-reference 0) to b8-24 (multi-reference 15). The 16 multi-reference values correspond to the torque set in the 16 stages of the simple PLC. Set the parameters P1-09 to P1-40 to define the running time and acceleration/deceleration time of each torque.
3. Set P1-02 to select the simple PLC operation mode.
4. Set the ones position of the value of P1-03 to configure whether the current STEP and the current STEP running time of the simple PLC are retentive upon power-off. Set the tens position of the value of P1-03 to set the simple PLC module status when the calculation is disabled and the calculation is enabled again.

5. Sets the P1-01 (simple PLC calculation enablement 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 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.
- 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 segment i when the calculation is stopped.
- If you want the simple PLC to start calculating the running time only when the motor is running, you can configure the source as L1-26 (motor running flag). In addition, if you want to stop the motor after a single running, set b004 (internal process stop source) to L4-71 (Simple PLC single stop command).

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 torque is set to the torque set by STEP0, that is, multi-reference 0 (defined by b8-09). After the current STEP is performed by the simple PLC, switch to the next STEP, and the torque setpoint is also switched to the torque set by the PLC.

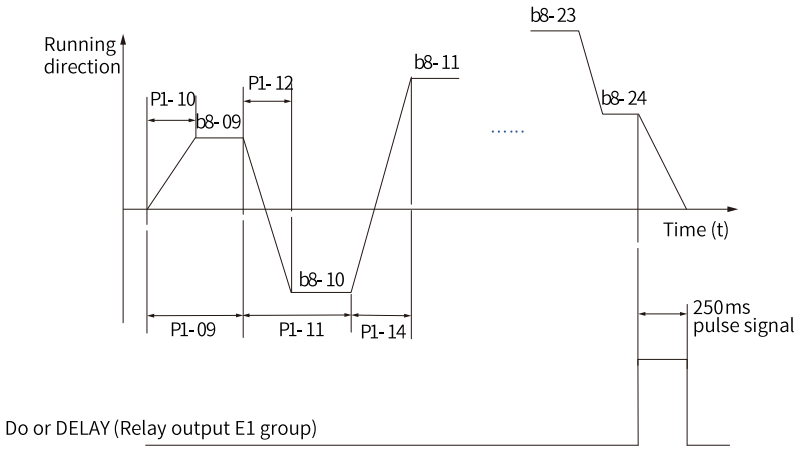


Figure 3-33 Setting torque through simple PLC

3.3.7 Setting Torque Through PID

Description

Set b5-13 (Torque reference source) to 8 (PID) to select the PID output as the torque reference. PID control is a common method of process control. By performing proportional, integral, and derivative operations on the difference between the feedback signal and the target signal of the controlled variable, and adjusting the output frequency of the AC drive, a closed-loop system is formed to stabilize the controlled variable at the target level. The PID-controlled output is used as the running 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. When the PID output is selected as the running frequency, the PID output 100% corresponds to A2-06 (Per-unit base value of torque).

PID control adjusts the PID output by modifying the proportional, integral, and differential parameters. The PID control parameters are defined as follows:

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A greater Kp value means faster deviation reduction but causes oscillation, especially in the case of long hysteresis. A smaller Kp value means lower probability of oscillation but leads to slow adjustment.
- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the adjustment intensity.
- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. When adjusting PID parameters, the differential time Td is not modified to prevent oscillation. For details on PID functions, see *"5.10 PID Process Control" on page 422*.

Related Parameters

Par am.r	Name	Default	Value Range	Descriptions
P2-00	Process PID	0	0: Enable 1: Enable Others: B connector	Sets whether PID is enabled 0: Disable. PID operation is not performed and the output is cleared. 1: Enable. PID operation is performed based on parameters. Others: B connector Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Forward 1: Reverse Others: B connector	Sets the PID action direction. 0: Positive. When the feedback value is lower than the PID reference, the output frequency of the AC drive increases. 1: Negative. When the feedback value is lower than the PID reference, the output frequency of the AC drive decreases. Others: 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.r	Name	Default	Value Range	Descriptions
P2-02	PID reference source	0	0: PID digital setting 1: AI1 3: Potentiometer MD-BP-M 4: HDI pulse 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	This parameter specifies the PID reference source. Value description 0: PID digital setting. The PID target reference is the value of P2-03 (PID digital setting). 1: AI1. The PID target reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer. The PID reference source is set by the MD-BP-M potentiometer. 4: HDI pulse. The PID target reference is the per-unit value of the HDI curve corresponding to the DI4 pulse frequency input. 5: Multi-reference. The PID target reference is the per-unit value after multi-reference calculation. 6: Simple PLC. The PID target reference is the per-unit value after simple PLC calculation. 8: Communication. The PID reference is set by remote communication (1000H). Others: F connector. The parameter in float connector is used as the PID target reference value. Additional information: When P2-00 is set to 5 (multi-reference), b8-08 (multi-reference 0 setting mode) cannot be set to 5 (PID reference).
P2-03	PID reference	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter shall be set.
P2-04	PID feedback source	0	0: AI1 3: Potentiometer MD-BP-M 4: HDI setting 5: Communication Others: F connector	It is used to select the PID feedback channel. Value description 0: AI1. The PID feedback reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer. The PID reference source is set by the MD-BP-M potentiometer. 4: Pulse reference (DI7). The PID feedback reference is the per-unit value of the HDI curve corresponding to the HDI pulse frequency input. 5: Communication. The PID reference is set by remote communication (1000H).
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. Additional information: The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.

Param.r	Name	Default	Value Range	Descriptions
P2-15	PID parameter 1 integral time Ti1	2.0s	0.01s to 10.00s	Indicates the integral time Ti of the first group of parameters in PID control. Additional information: It decides the integral regulating intensity. The shorter the integral time, the greater the adjustment intensity will be.
P2-16	PID parameter 1 derivative time Td1	0s	0.000s to 10.000s	Defines the derivative time Td of the first group of parameters in PID control. Additional information: It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. Additional information: See P2-14.
P2-18	PID parameter 2 integral time Ti2	2.0s	0.01s to 10.00s	Indicates the integral time Ti of the second group of parameters in PID control. Additional information: See P2-15.
P2-19	PID parameter 2 derivative time Td2	0s	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. Additional information: See P2-16.

Param.r	Name	Default	Value Range	Descriptions
P2-26	Source of maximum output	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to 100%. 2: AI1. The maximum PID output value is limited to the value of the AI1curve in the per-unit system. 5: HDI pulse. The maximum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference. The maximum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC. The maximum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID. The maximum PID output value is limited to the per-unit value of the current PID output. 9: Communication. The maximum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M. The maximum PID output value is set by the MD-BP-M potentiometer. Other: F connector. The maximum PID output value is limited to the value of the selected floating-point connector.
P2-27	Source of minimum output	0	0: -100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to -100%. 2: AI1. The minimum PID output value is limited to the value of the AI1 curve in the per-unit system. 5: HDI pulse. The minimum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference. The minimum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC. The minimum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID. The minimum PID output value is limited to the per-unit value of the current PID output. 9: Communication. The minimum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M. The minimum PID output value is set by the MD-BP-M potentiometer. Other: F connector. The minimum PID output value is limited to the value of the selected floating-point connector.

Instances

The steps for setting PID as the torque source are as follows:

1. Set b0-03 to 0 and b5--13 to 8 to select PID as the torque reference source of set channel 1.
2. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the maximum value of PID feedback.

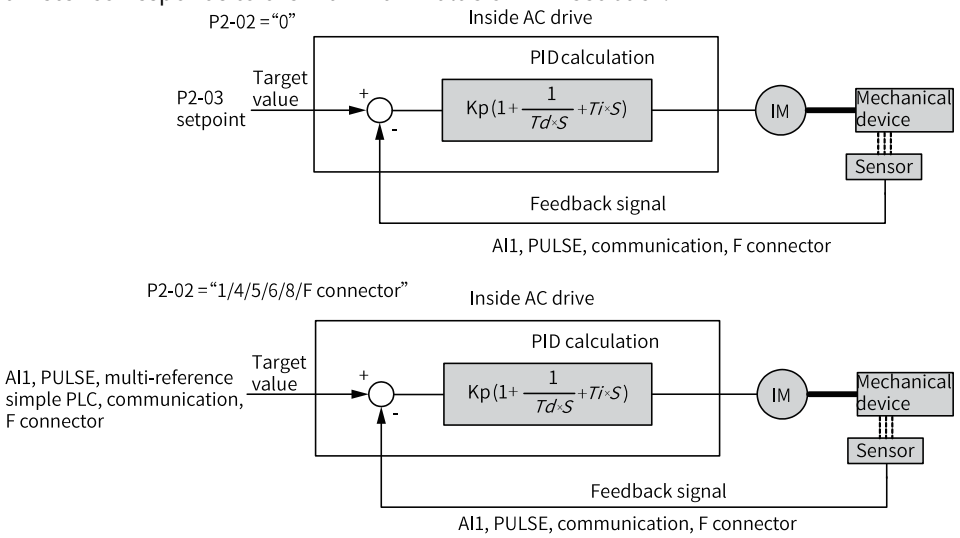


Figure 3-34 Principle of general PID control

3. Set P2-04 to select the PID feedback source.
4. Set P2-01 to select the PID action direction.
5. Set P2-26 and P2-27 to set the maximum PID output value and minimum output value respectively. The output of PID adjustment is between the maximum and minimum values.
6. Set P2-00 to 1 to enable PID.

Then the torque of the AC drive is set by the PID output value. The PID automatically adjusts the PID output value based on the PID feedback value. The torque of the AC drive also changes to the PID output. For PID adjustment methods, see *"5.10 PID Process Control" on page 422*.

3.3.8 Setting Torque Reference Through Communication

Description

Set b5-13 (Torque reference source) to 9 to select the communication setpoint as the torque. The AC drive supports two communication protocols, all of which are onboard modules, as shown in the following table.

Models	Supported Protocol	Communication Hardware
MD600S	Modbus	RS485 communication interface of MD520 series AC drive
MD600A	CANopen/CANlink	CN1 interface of MD520 series AC drive

Related Parameters

When the AC drive model is MD600S, that is, A3-06 (AC drive hardware type) = 4, Modbus communication is available. Set related communication parameters in group n2. For details about the Modbus communication protocol, see *"7.4.1 Overview" on page 470*.

Parameter Code	Name	Default	Value Range	Descriptions
n2 - 00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	This parameter defines the speed of data transmitted between the host controller and the AC drive. The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n2 - 01	Modbus data format	0	0: No check (8-N- 2) 1: Even parity check (8-E- 1) 2: Odd parity check (8-O- 12) 3: No check (8-N-1)	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n2 - 02	Modbus local address	1	1 to 247	Sets the Modbus local address. Additional information: The local address must be unique in the range of 1 to 247, which is the basis for point-point communication between the AC drive and the host controller.

Parameter Code	Name	Default	Value Range	Descriptions
n2‑03	Modbus response delay	2	0 ms to 20 ms (valid for Modbus)	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller. Additional information: If the response delay is shorter than the system processing time, the system processing time prevails. This means that the system processes data and then sends the data to the host controller. If the response delay is longer than the system processing time, the system processes data and waits for the response delay time. After the time elapses, the system sends the data to the host controller.
n2‑04	Modbus communication timeout time	0	0.0 (invalid) 0.1s to 60.0s	Sets Modbus timeout time. Additional information: When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. When it is set to a non-zero value, if the interval between the current communication and the next communication exceeds the Modbus communication timeout time (n2-04), the system reports a communication fault.

When the AC drive model is MD600A, that is, A3-06 (AC drive hardware type) = 0, Modbus communication is available. Set related communication parameters in group n3.

Parameter	Name	Default	Value Range	Descriptions
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n3-01	CAN communication enable	1	0: Enable 1: Disable	Sets whether CAN communication is enabled.
n3-02	CAN station number	1	1 to 247	Sets the CAN communication station number.
n3-10	CAN communication protocol selection	2	1: CANopen 2: CANlink	This parameter is used to select a CAN communication protocol.
n3-14	CANopen mode	0	0: Default mode 1: Expert mode	Used to set CANopen user control mode.

Parameter	Name	Default	Value Range	Descriptions
n3-15	CANopen inhibit time	0	0μs to 65535μs	This parameter sets the inhibit time in CANopen expert mode in the unit of 100 μs.
n3-16	CANopen event time	0	0 ms to 65535 ms	Used to set the event time of CANopen expert mode in ms.

When CANopen communication is performed, set n3-10 = 1 and set other CAN communication parameters. For details about CANopen communication protocol, see *"7.6.1 Overview" on page 506*.

When CANlink communication is performed, set n3-10 = 2 and set other CAN communication parameters. For details about CANlink communication protocol, see *"7.5.1 Overview" on page 494*.

Communication address

Set b5-13 (Torque reference source) to 9 to select the communication setpoint as the torque source.

When the torque 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 *" List of Communication Protocols" on page 457*.

The 7310H is one of the communication addresses supported by the AC drive. It is defined as follows:

Communication address		Description of the communication address
Communication speed setting value 2	7310H	The target torque can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H speed setting]. 0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

Set n0-14 [7310H speed setting] = 3. In this case, write 1000 to 7310H to set the torque to 20%.

3.3.9 Setting Supplementary Torque

Description

The supplementary torque (additional torque) takes effect only during normal operation. The effective value is superimposed directly to the output of torque. The supplementary torque can be set for both set channels, and two supplementary torque can be set for each channel. The relationship between the supplementary torque and torque reference is shown in the following figure.

Related Parameters

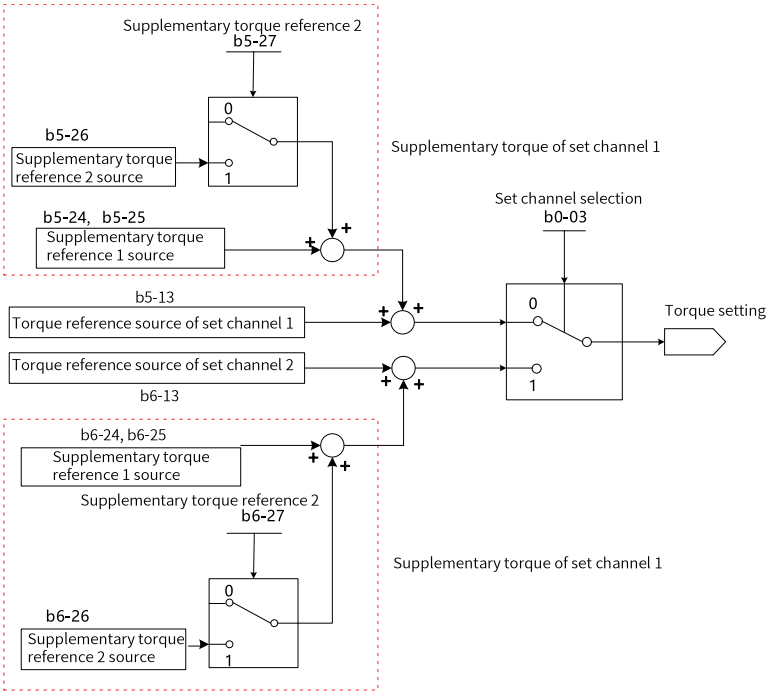


Figure 3-35 Torque reference and supplementary torque

Related Parameters

Param.	Name	Default	Value Range	Descriptions
b5-24	Supplementary torque reference 1 source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets the source of supplementary torque reference 1 Value description 0: Digital setting. The source of supplementary torque reference 1 is the "digital setting of supplementary torque reference 1". 2: AI1. The supplementary torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The supplementary torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source of supplementary 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of supplementary torque reference 1. 9: Communication. The source of supplementary torque reference 1 is 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. 10: MD-BP-M potentiometer. The source of supplementary torque reference 1 is the input voltage of the MD-BP-M potentiometer. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 1. This mode is used for expansion of common sources.
b5-25	Digital setting of supplementary torque reference 1	0	-400.0% to 400.0%	Defines the digital value of supplementary torque reference 1. The value is effective when the source of supplementary torque reference 1 is set to 0.

Param.	Name	Default	Value Range	Descriptions
b5-26	Supplementary torque reference 2 source	0	0: 0 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets the source of supplementary torque reference 2 Value description 0: 0. The source of supplementary torque reference 2 is set to "0". 2: AI1. The supplementary torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The supplementary torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source of supplementary 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of supplementary torque reference 2. 9: Communication. The source of supplementary torque reference 2 is 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. 10: MD-BP-M potentiometer. The source of supplementary torque reference 2 is the input voltage of the MD-BP-M potentiometer. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 2. This mode is used for expansion of common sources.

Param.	Name	Default	Value Range	Descriptions
b5-27	Supplementary torque reference 2	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets whether supplementary torque reference 2 is enabled. When the value is 0, supplementary torque 2 is disabled. When the value is 1, supplementary torque 2 is enabled. Value description 0: Supplementary torque reference 2 is disabled. 1: Supplementary torque reference 2 is enabled. 3 to 7: DI1 to DI5 - Whether supplementary torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b6-24	Supplementary torque reference 1 source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets the source of supplementary torque reference 1 Value description 0: Digital setting The source of supplementary torque reference 1 is the "digital setting of supplementary torque reference 1". 2: AI1. The supplementary torque reference 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The supplementary torque reference 1 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source of supplementary 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of supplementary torque reference 1. 9: Communication. The source of supplementary torque reference 1 is 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. 10: MD-BP-M potentiometer. The source of supplementary torque reference 1 is the input voltage of the MD-BP-M potentiometer. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 1. This mode is used for expansion of common sources.
b6-25	Digital setting of supplementary torque reference 1	0	-400.0% to 400.0%	Sets the digital setting of supplementary torque reference 1.

Param.	Name	Default	Value Range	Descriptions
b6-26	Supplementary torque reference 2 source	0	0: 0 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets the source of supplementary torque reference 2 Value description 0: 0. The source of supplementary torque reference 2 is set to "0". 2: AI1. The supplementary torque reference 2 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference. The supplementary torque reference 2 is set by using the pulse frequency input through the DI terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the source of supplementary 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of supplementary torque reference 2. 9: Communication. The source of supplementary torque reference 2 is 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. 10: MD-BP-M potentiometer. The source of supplementary torque reference 2 is the input voltage of the MD-BP-M potentiometer. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the supplementary torque reference 2. This mode is used for expansion of common sources.

Param.	Name	Default	Value Range	Descriptions
b6-27	Supplementary torque reference 2	0	0: Enable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets whether supplementary torque reference 2 is enabled. When the value is 0, supplementary torque 2 is disabled. When the value is 1, supplementary torque 2 is enabled. Value description 0: Supplementary torque reference 2 is disabled. 1: Supplementary torque reference 2 is enabled. 3 to 7: DI1 to DI5 - Whether supplementary torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

3.3.10 Setting Torque Limit

Description

The torque upper limit refers to the maximum torque setting that the motor torque cannot surpass. The torque upper limit refers to the minimum torque. The motor torque setting cannot be lower than the limit.

The torque upper limit is the smaller value of d1-09 (Digital setting of torque upper limit 1) and d1-11 (Source of torque upper limit 2). The torque lower limit is the larger value of d1-10 (Digital setting of torque lower limit 1) and d1-12 (Source of torque lower limit 2).

Param.	Name	Default	Value Range	Descriptions
d1‑09 (F2-30)	Digital setting of torque upper limit 1	180.0%	0.0° to 800.0%	This parameter limits the positive maximum output torque. It is a per-unit value based on the rated motor torque. Additional information: The effective forward torque limit is the smaller value between d1-09 and d1-11.
d1-10 (F2-31)	Digital setting of torque lower limit 1	-180.0%	-800.0% to 0.0%	This parameter limits the negative maximum output torque. It is a per-unit value based on the rated motor torque. Additional information: The effective reverse torque limit is the smaller value between d1-10 and d1-12.

Param.	Name	Default	Value Range	Descriptions
d1-11 (F2-32)	Source of torque upper limit 2	0	0: 800% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the forward torque limit source. It is the per unit value based on the rated motor torque. Value description 0: 800%. Set the forward torque limit to 800%. 2: AI1. The forward torque limit is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The forward torque limit is set through the pulse frequency of the DI4. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 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 reverse torque limits. 7: Simple PLC. Simple PLC is a multi-reference operation command that can control the operation time and acceleration and deceleration time. The forward torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID. The forward torque limit is set through PID. 9: Communication. The forward torque limit is set through communication. The forward frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The forward torque limit is set through the MD-BP-M potentiometer. Others: F connector. The reverse frequency upper limit is set through the F connector. Remarks The effective forward torque limit is the smaller value between d1-09 and d1-11.

Param.	Name	Default	Value Range	Descriptions
d1-12 (F2-33)	Source of torque lower limit 2	1	0: -800% 1: Opposite to the source of torque upper limit 2 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the reverse torque limit source. It is the per unit value based on the rated motor torque. 0: -800%. Set the reverse torque limit to -800%. 1: Opposite to torque upper limit 2. Set the reverse torque limit to the opposite value of torque upper limit 2 (d1-11). 2: AI1. The reverse torque limit is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The reverse torque limit is set through the pulse frequency of the DI4. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the reverse torque limit, combinations of different DI states correspond to different reverse torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reverse torque limits. 7: Simple PLC. Simple PLC is a multi-reference operation command that can control the operation time and acceleration and deceleration time. The reverse torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID. The reverse torque limit is set through PID. 9: Communication. The reverse torque limit is set through communication. 10: MD-BP-M potentiometer. The reverse torque limit is set the MD-BP-M potentiometer. Others: F connector. The reverse frequency upper limit is set through the F connector. Remarks The effective reverse torque limit is the smaller value between d1-10 and d1-12.

Note

The motor parameters in group F2 in the table are the mapping of motor parameters in group d1. The settings of the two groups are equivalent.

3.4 Start/Stop Mode

3.4.1 AC Drive Startup Mode

The drive supports two start modes: direct start and flying start. Set d0-02 to select a start mode of the AC drive.

3.4.1.1 Flying Start

Scenario

If a motor in rotation is started in direct start mode, an overcurrent fault may be caused due to inrush current upon startup. When d0-02 (Startup mode) is set to 1, the AC drive uses the flying start mode. In this mode, the drive first determines the motor rotation speed and direction, and then starts at the detected frequency of the motor. This mode is applicable to applications where the drive is used to drive large-inertia machinery loads.

To restart the motor when it is running, select the flying start mode.

Flying start is applicable to all control modes.

Working Principle

If a motor in rotation is started in direct start mode, an overcurrent or overload fault may be caused due to inrush current upon startup. The flying start function is applicable to applications where the motor in rotation is started in V/f and SVC control mode. In this case, the AC drive can automatically track the motor speed and direction to start the rotating motor smoothly without impact.

The following figure shows the motor speed flying start diagram. After startup, the motor synchronous frequency tracks the motor speed, after which the motor enters the normal operation mode.

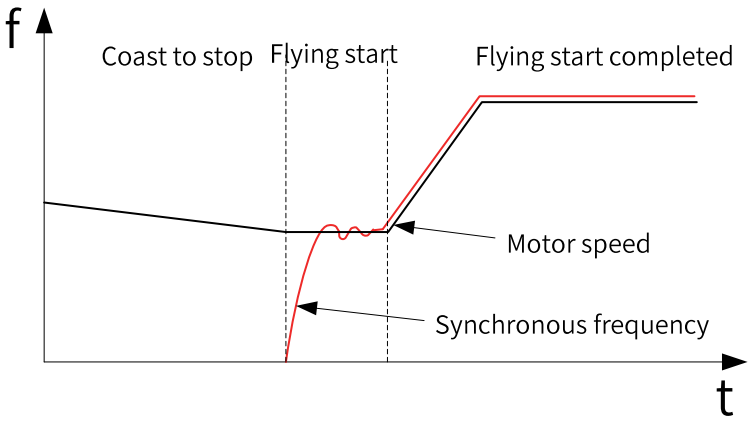


Figure 3-36 Diagram of the flying start process

Note

It is recommended that the AC drive be equipped with a motor for parameter auto-tuning when magnetic field oriented flying start is selected.

Related Parameters

Parameters related to flying start are as follows.

Parameter	Name	Default	Value Range	Descriptions
d0-02 (F2-15)	Startup mode	0	0: Direct start 1: Flying start	This parameter is used to set the start 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 is started during rotation. For other scenarios, select direct start.
d0-03 (F2-16)	Flying start mode	4	0: From frequency at stop 1: From the mains frequency 2: From the maximum frequency 4: Magnetic field oriented flying start	It is used to set the flying start mode when the AC drive starts. Value description 0: From stop frequency. The current speed is searched from the last stop frequency. If external force drives the motor to a speed higher than the speed at stop, this mode is not applicable. 1: From the mains frequency. The current speed is searched from the mains frequency of 50 Hz. This mode is applicable to scenarios where the motor is restarted after stop for a long time. 2: From the maximum frequency. The current speed is searched from F1-10 (Maximum motor frequency). It is generally used for generating loads. 4: Magnetic field oriented flying start. The current speed is searched using magnetic field oriented flying start. The search speed is faster than the first three modes, but motor parameters need to be tuned. Used for flying start in SVC mode.

Note

The motor parameters in group F2 in the table are the mapping of motor parameters in group d0. The settings of the two groups are equivalent.

Precautions

- In the V/f control mode of the asynchronous motor, four flying start modes can be selected. In the SVC control mode, only magnetic field oriented flying start is available.
- In the V/f control mode of the asynchronous motor, setting parameter d0-03 (flying start mode) to 0, 1, or 2 may result in a longer flying start time. But in this case, the requirements on the motor parameter are low.
- For synchronous motor flying start, there is no need to adjust the flying start mode (d0-03).

- After flying start is enabled (d2-02 = 1), the self-check before startup is automatically bypassed, because the rotating motor may lead to false self-check faults.

Instances

The motor coasts to stop after an operation. The large inertia of the motor system causes long coast-to-stop time, during which the motor needs to be restarted. In this case, set d0-02 (Start mode) to 1 (Flying start), and d0-03 (Flying start mode) to 4 (Magnetic field oriented flying start). Then start. The motor speed is tracked and the motor starts smoothly again from the current speed.

Flying start is required in applications such as the fan, water pump, air conditioner, and air compressor. The coast-to-stop time of a motor with high power or high inertia is long after a motor fault. If the motor runs after the fault is reset, enable the flying start function to start again.

3.4.1.2 Direct Start of Asynchronous Motor (Pre-excitation Start)

Scenario

After receiving the start command, the motor speed is set to the RFG output, and accelerates according to the acceleration time. This startup mode is applicable to most load applications.

Working Principle

In V/f control mode, set the parameter d0-02 (Start mode) to 0 (Direct start). After receiving the start command, the motor speed is set to the RFG output.

In the SVC mode of asynchronous motor, set d0-02 (Start mode) = 0 (Direct start) and set pre-excitation parameters. The motor needs to enter the pre-excitation state before generating the rotor magnetic field to better control the output torque of the motor. You can select time or current-based excitation.

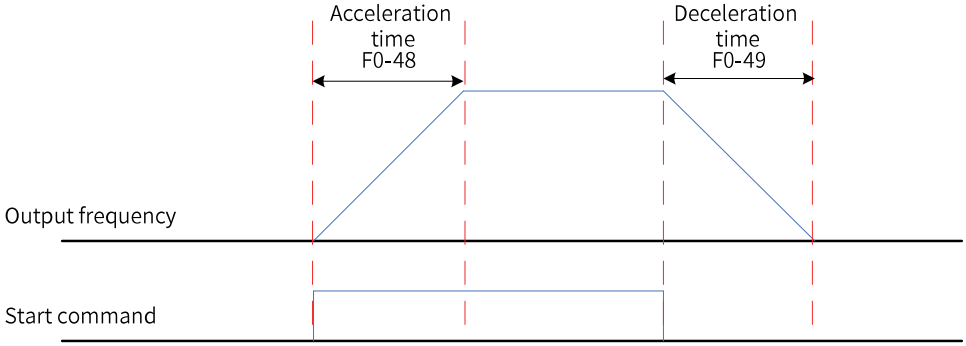


Figure 3-37 Direct start

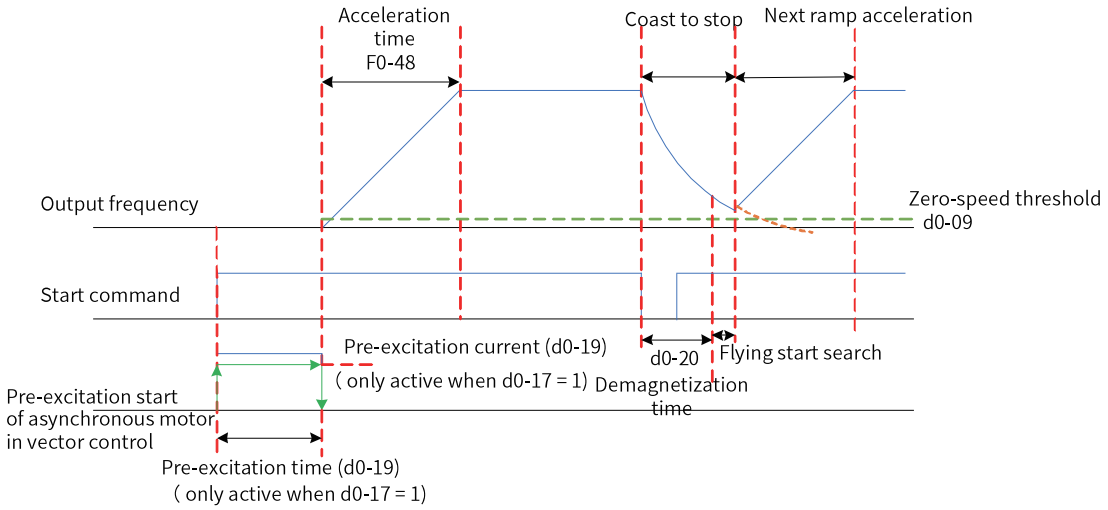


Figure 3-38 Pre-excitation and demagnetization time of the asynchronous motor

Related Parameters

Item	Name	Default	Value Range	Descriptions
d0-02 (F2-15)	Start mode	0	0: Direct start 1: Flying start	It is used to set the start mode of the AC drive. Value description 0: Direct start This mode applies to scenarios where the motor starts from a standstill state. 1: Flying start This mode applies to start the motor during rotation.
d0-17	Pre-excitation mode	1	0: Pre-excitation based on time 1: Pre-excitation based on the current reference 2: Pre-excitation based on the maximum current	This parameter selects a pre-excitation mode for an asynchronous motor in the vector control mode. Value description 0: Pre-excitation based on time. After the excitation time before start reaches the time set by d0-18, the drive enters the normal running state. The excitation current reference is calculated by the system automatically. 1: Pre-excitation based on the current reference. Excite according to the current set by d0-19 before start. After the magnetic flux reaches the target value, the drive enters the normal running state. 2: Pre-excitation based on the maximum current. Before start, the system calculates the maximum current based on the rated drive current and the rated motor current. Excitation according to the maximum current can realize fast excitation and start.
d0-18	Pre-excitation time	1000 ms	1 ms to 30000 ms	This parameter sets the pre-excitation time for the asynchronous motor in the vector control mode. Additional information: This parameter is valid when d0-17 is set to 0.

Item	Name	Default	Value Range	Descriptions
d0-19	Pre-excitation current	100%	1% to 200%	This parameter sets the pre-excitation current for the asynchronous motor in the vector control mode. Additional information: 1: Rated motor current as the base value in percentage. 2: Active when d0-17 = 1 (Pre-excitation based on the current reference)
d0-20	Demag-netization time	0.50s	1% to 200%	This parameter sets the demagnetization time for the asynchronous motor. Additional information: If you want to restart the motor after the motor coasts to stop, wait for the time set by d0-20. Then the motor can be restarted. If the time set of d0-20 is too short, abnormalities such as flying start failure may occur. The demagnetization time is activated only when the asynchronous motor coasts to stop.

Precautions

- Pre-excitation start is applicable only to the asynchronous motors in SVC control mode.
- This mode is the quick pre-excitation start mode.
- The excitation time is set by d0-18 only when the pre-excitation mode is set to based on time (d0-17 = 0). The excitation current is dynamically calculated according to the excitation time, and the pre-excitation is completed after the excitation time reaches.
- The excitation current is set by d0-19 only when the pre-excitation mode is set to based on current (d0-17 = 1). In this case, pre-excitation time changes.

Instances

Applicable scenarios for pre-excitation based on time: For applications with multiple asynchronous motors and motors are expected to be started simultaneously, pre-excitation based on time can be used to start and complete pre-excitation of multiple asynchronous motors at the same time.

3.4.1.3 Synchronous Motor Direct Startup (Magnetic Pole Position Auto-Tuning)

Scenario

Before initiating a direct start, it's essential for the synchronous motor to identify the current rotor's magnetic pole position to ensure the motor starts in the correct direction.

Working Principle

Direct starting 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 start-up issues such as reverse start-up, oscillation, or out-of-step caused by excessive deviation between the initial wave phase angle and the actual position of the motor's rotor.

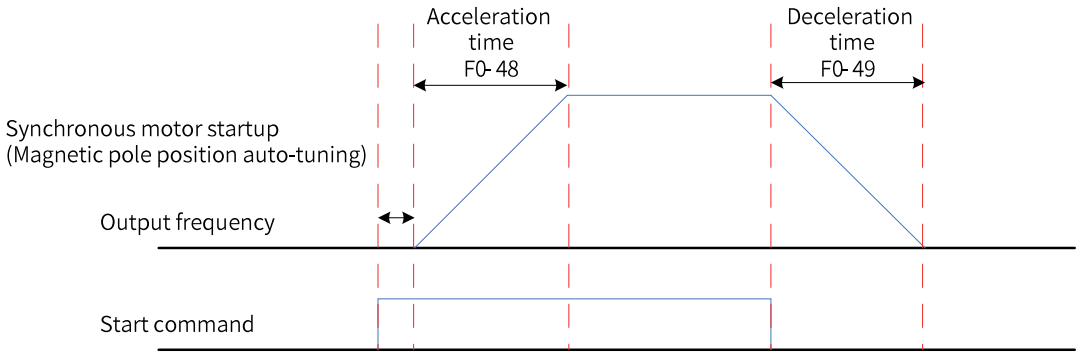


Figure 3-39 Magnetic pole position auto-tuning process

Related Parameters

The following parameters are involved in the magnetic pole position auto-tuning function:

Parameter	Name	Default	Value Range	Descriptions
d0-70	Initial position detection of synchronous motor before start	0	0: Detected every time upon operation 1: No detection 2: Detected upon initial operation after power-on	This parameter sets the detection mode of the initial position of the synchronous motor before start. Value description 0: Detected every time upon operation 1: No detection 2: Detected upon initial operation after power-on
d0-71	Initial position detection method of synchronous motor before start	2	0: Pulse 1: High frequency injection 2: Adaptive mode 3: Pre-positioning	This parameter sets the initial position detection method of the synchronous motor before start. Value description 0: Pulse. The magnetic pole position is tuned by the default method before start. 1: High-frequency injection. The magnetic pole position is tuned by high-frequency injection before start. 2: Adaptive mode. Whether to enable high-frequency injection depends on the motor inductance. 3: Pre-positioning. Make the motor stop at a fixed angle before start and then start the motor.
d0-75	Initial position detection current of synchronous motor	80%	50% to 180%	This parameter specifies the target current for magnetic pole position auto-tuning of the synchronous motor. A lower current setting means lower noise during detection. However, setting the current too low may cause inaccuracies in position detection.
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, reasonable setting of this compensation angle can avoid reverse rotation upon startup.

Precautions

- For direct starts of synchronous motors, it is strongly recommended to keep the magnetic pole position auto-tuning feature enabled. Otherwise, reverse start-up, acceleration/deceleration oscillation, or step loss may occur.
- When d0-70 is set to 2 (Detected upon initial operation after power-on), if the motor speed at coast-to-stop is higher than the zero speed threshold, the position is considered lost and the position will be re-tuned during the next direct start.
- The pulse method is typically used for non-salient pole motors, while high-frequency injection is suitable for salient pole motors. The pre-positioning is applicable to applications where the motor rotates slightly before starting.
- It is normal for synchronous motors to exhibit an obvious noise during pulse auto-tuning. A "sizzling" noise occurs before starting in high-frequency injection mode. In noise-sensitive environments, carefully select the magnetic pole position auto-tuning mode based on the motor's characteristics to minimize noise.
- By default, magnetic pole position auto-tuning is performed every time for the synchronous motor starts up in SVC control mode.
- The time for pulse auto-tuning is about 15 ms.
- The time for high-frequency injection auto-tuning is about 120 ms.
- The pre-positioning time is about 2s.

3.4.2 AC Drive Stop Mode

Scenario

Stop modes specify the actions upon corresponding stop commands, including decelerate to stop, coast to stop, stop at maximum capability,and quick stop. In some special applications, the DC braking at stop is also required.

Working Principle

The AC drive has three start/stop commands: ON_OFF1 (start/stop), OFF2 (coast to stop), and OFF3 (quick stop).

ON_OFF1 (Start/Stop): Invalid when the value is 0, valid when the value is 1. The AC drive starts and stops controlled by OFF2 in combination with ON_OFF1 and OFF3. When the OFF2 and OFF3 commands are invalid and no fault exists, the ON_OFF1 command is triggered during the rising edge from 0 to 1. When the stop command is triggered by the falling edge from 1 to 0, the AC drive stops in the mode set by d004 (OFF1 stop mode).

OFF2 (Coast to stop): Inactive when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF3. When ON_OFF1 is active and the OFF3 command is inactive and no fault occurs, the OFF2 command triggers during the falling edge from 1 to 0. The AC drive stops in the mode set by d005 (OFF2 stop mode).

OFF3 (Quick stop): Invalid when the value is 1, valid when the value is 0. The AC drive starts and stops controlled by ON_OFF1 in combination with ON_OFF1 and OFF2. When ON_OFF1 is active and the OFF2 command is inactive and no fault occurs, the OFF3 command triggers during the falling edge

from 1 to 0. The AC drive stops in the mode set by d006 (OFF3 stop mode). Jog 1 (JOG1): Invalid when the value is 0, valid when the value is 1. When it is valid, the AC drive runs at the frequency set by jog 1.

Table 3–13

Operation Mode	Command	Value Range	Result
Start	Normal Start	ON_OFF1: 0 to 1 OFF2: 1 OFF3: 1	The AC drive starts normally.
Stop	OFF1 stop command	ON_OFF1: 1 to 0 OFF2: 1 OFF3: 1	The AC drive stops according to the OFF1 setting. The OFF1 stop mode includes decelerate to stop, coast to stop, and stop with maximum capability.
	OFF2 stop command	ON_OFF1: 1 OFF2: 1 to 0 OFF3: 1	The AC drive stops according to the mode set by OFF2 (Coast to stop).
	OFF3 stop command	ON_OFF1: 1 OFF2: 1 OFF3: 1 to 0	The AC drive stops according to the OFF1 setting. The OFF1 stop mode includes quick stop and stop with maximum capability.

As shown in the preceding table, the stop modes of OFF1 to OFF3 can be set for different commands. The different stop modes are defined as follows:

1. Coast to stop
   d0-05 (OFF2 stop mode) is fixed to coast-to-stop. When a motor coasts to stop, the IGBT output is directly blocked and the motor rotates freely due to inertia and stops due to friction. For large-inertia devices, this process takes quite a long time. Most faults and OFF2 stop mode can trigger the coast-to-stop mode.

2. Decelerate to stop
   d0-04 (OFF1 stop mode) generally selects deceleration to stop. Once the deceleration to stop command is input, the AC drive decreases the output frequency to 0 and then stops based on the RFG deceleration time. The AC drive has two deceleration-to-stop modes: OFF1 decelerate to stop and OFF3 quick stop. Once the OFF1 stop command (decelerate to stop) is input, the AC drive decreases the output frequency to 0 based on the RFG deceleration time. Once the OFF3 stop command (quick stop) is input, the AC drive decreases the output frequency to 0 based on the deceleration time for quick stop (b7-34).

3. Stop at maximum capability
   After the stop at maximum capability mode is activated, the speed reference of the motor is forced to be 0. The motor decelerates to 0 based on the maximum output capability. During deceleration, the motor torque or current may reach the limit.

4. Quick stop

d0-06 (OFF3 stop mode) is set to quick stop in general case. The quick stop mode is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34/b7-35/b7-36.

Note

If the motor reaches the torque and current limit during deceleration, the corresponding deceleration time will be longer.

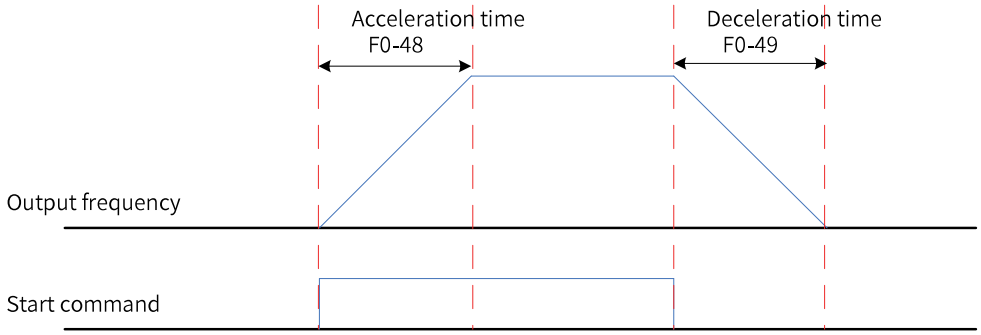


Figure 3-40 Decelerate to stop

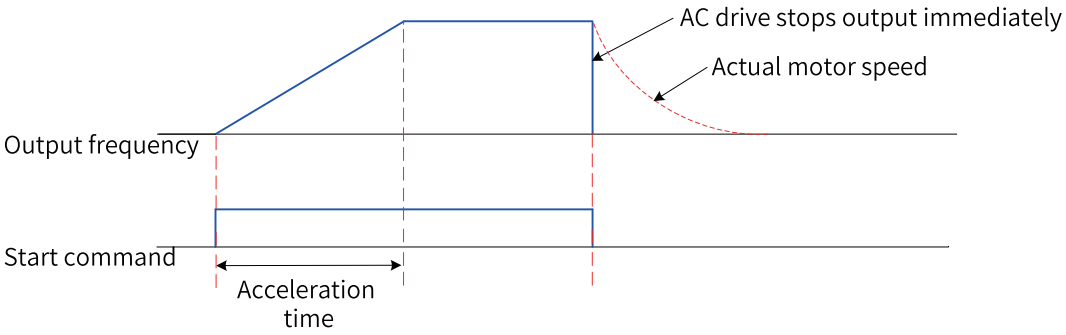


Figure 3-41 Coast to stop

Related Parameters

The following parameters are involved in selecting the stop mode:

Param.	Name	Default	Value Range	Descriptions
d0-04 (F2-17)	OFF1 stop mode	0	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	It is used to set the OFF1 stop mode. Value description 0: Decelerate to stop The stop mode is determined by the valid ramp settings. 1: Coast to stop The AC drive stops output to shut down. At this time, the power supply of the motor is cut off and the driving system is in the free braking state. 2: Stop at 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) stop mode	0	0: Coast to stop	This parameter displays the OFF2 stop mode. The default value is coast to stop. It is equivalent to the function of coast to stop assigned to a terminal and is used for operation interruption.
d0-06	OFF3 (quick stop) stop mode	0	0: Quick stop 1: Stop at maximum capability	This parameter defines the OFF3 (quick stop) stop mode. Value description 0: Quick stop It is equivalent to the function of emergency stop assigned to a terminal. The deceleration time is determined by b7-34/b7-35/b7-36. 1: Stop at 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.

Param.	Name	Default	Value Range	Descriptions
d0-07	Stop mode during running	1	0: OFF1 stop mode 1: OFF2 (coast to stop) stop mode 2: OFF3 (quick stop) stop mode	This parameter specifies the stop mode after the run enable signal is inactive. It is equivalent to the running-pause or running-enable function of the terminal. Value description 0: OFF1 stop mode The stop mode is determined by d0-04. 1: OFF2 (coast to stop) stop mode. The stop mode is coast-to-stop. 2: OFF3 (quick stop) stop mode The stop mode is determined by d0-06.
d0-08	Stop mode for torque control	1	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	Sets the stop mode in torque control. Value description 0: Coast to stop forcibly, and the drag system is in the free braking state. 1: Switch to speed mode and stop according to the stop mode active in the current speed mode. 2: 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, the motor stops. In this mode, the motor speed shall decrease to zero. Otherwise, the motor may not stop.

3.4.3 DC Braking

Scenario

The setting of DC braking time at startup before start applies to applications where the motor may rotate at start.

When the asynchronous motor (V/f) is started, the DC braking function can help increase the startup torque.

In some special applications, the DC braking at stop is also required to ensure that the rotor stops securely after stop.

Working Principle

The DC braking function supplies a DC current to the motor's stator winding, generating a braking force that brings the motor to a halt.

3.4.3.1 DC Braking at Startup

Function diagram

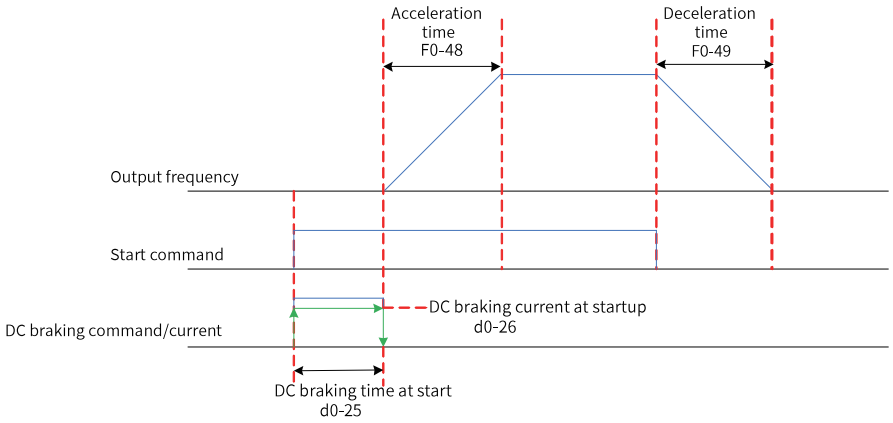


Figure 3-42 Enable DC braking

Related Parameters

The following parameters are involved in enabling the DC braking at startup.

Param.r	Name	Default	Value Range	Descriptions
d0-25	DC braking time at startup	0s	0.0s to 100.0s	This parameter sets the start DC braking time. Additional information: This parameter is valid in the direct startup mode (d0-02 set to 0). Setting this parameter to 0 disables the function. When this parameter is set to a non-zero value, the drive consistently outputs the DC current (d0-26) to generate braking force before starting the motor. When the duration set in d0-25 elapses, normal operation starts.
d0-26	DC braking current at startup	50%	0% to 100%	This parameter sets the DC braking current upon start. The larger the DC braking current, the stronger the braking force. Additional information: This parameter uses the rated motor current as the base value in percentage.
d0-31	Kp adjustment of DC braking current loop	1.0	0.1 to 2.0	This parameter sets the current loop Kp adjustment factor during DC braking.
d0-32	DC injection braking current loop Ti adjustment	1.0	0.1 to 2.0	This parameter sets the current loop Ti adjustment factor during DC braking.

Precautions

- Note that the current and operating time of DC braking must be smaller than the overload limit of the motor and AC drive.

- Long-term braking can ensure that the asynchronous motor is at the zero speed but may cause much motor heating.
- Do not use DC braking on traction loads. Traction loads can cause the motor to rotate, resulting in personal injury or death.
- Do not use the DC braking function to replace the brake function of the mechanical device.

3.4.3.2 DC Braking at Stop

Function diagram

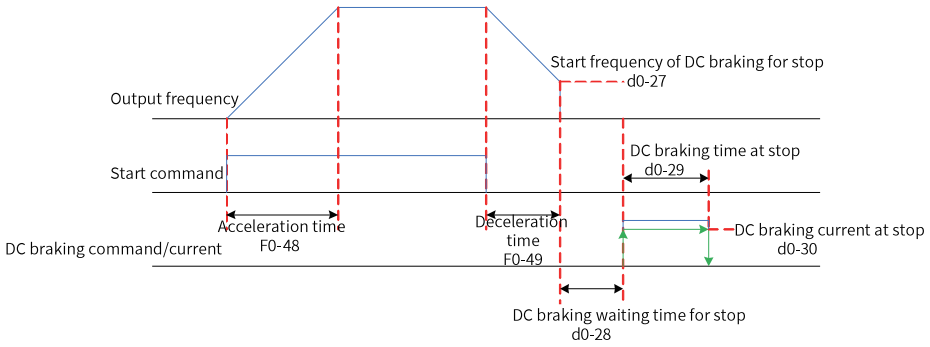


Figure 3-43 DC braking at stop

Related Parameters

The following parameters are involved in selecting the stop mode:

Param.	Name	Default	Value Range	Descriptions
d0-27	Starting frequency for DC braking at stop	0 Hz	0.0 Hz to 600.0 Hz	This parameter sets the start frequency of DC braking for stop. Additional information: 1. During deceleration to stop, when the operation frequency falls below the value of d0-27, the drive blocks the output and sustains this state for the duration specified in d0-28. Then, the drive outputs the DC braking current specified in d0-30 for the duration specified in d0-29 and enters the shutdown state. 2. This frequency must not be set too high; otherwise, overcurrent may occur on the drive.
d0-28	DC braking waiting time for stop	0.0s	0.0s to 100.0s	This parameter sets the waiting time of DC braking for stop. Additional information: During deceleration to stop, when the operation frequency falls to the value of d0-27, the drive blocks the output and sustains this state for the duration specified in d0-28. Then, the drive outputs the DC injection braking current specified in d0-30 for the duration specified in d0-29, and then enters the shutdown state. The time is to wait for the asynchronous motor to demagnetize. If the time is too short, overcurrent may easily occur.

Param.	Name	Default	Value Range	Descriptions
d0-29	DC braking time at stop	0.0s	0.0s to 100.0s	This parameter sets the DC braking time for stop. Additional information: During deceleration to stop, when the operation frequency falls to the value of d0-27, the drive blocks the output and sustains this state for the duration specified in d0-28. Then, the drive outputs the DC injection braking current specified in d0-30 for the duration specified in d0-29, and then enters the shutdown state.
d0-30	DC braking current at stop	50%	0% to 300%	This parameter sets the DC braking current for stop. Additional information: During deceleration to stop, when the operation frequency falls to the value of d0-27, the drive blocks the output and sustains this state for the duration specified in d0-28. Then, the drive outputs the DC injection braking current specified in d0-30 for the duration specified in d0-29, and then enters the shutdown state. This current percentage is based on the rated motor current. A larger value means stronger braking force.
d0-31	Kp adjustment of DC braking current loop	1.0	0.1 to 2.0	This parameter sets the current loop Kp adjustment factor during DC braking.
d0-32	DC injection braking current loop Ti adjustment	1.0	0.1 to 2.0	This parameter sets the current loop Ti adjustment factor during DC braking.

Precautions

- The starting frequency for DC braking at stop must not be set too high; otherwise, overcurrent may occur on the AC drive.
- If the DC braking waiting time is too short during asynchronous motor operation, overcurrent may occur.
- Note that the current and operating time of DC braking must be smaller than the overload limit of the motor and AC drive.

3.4.4 Jog

Description

In some applications, the AC drive needs to run at a low speed temporarily to facilitate equipment testing. In this case, jogging applies. The following figure shows the relationship between the output frequency and acceleration/deceleration time during jogging.

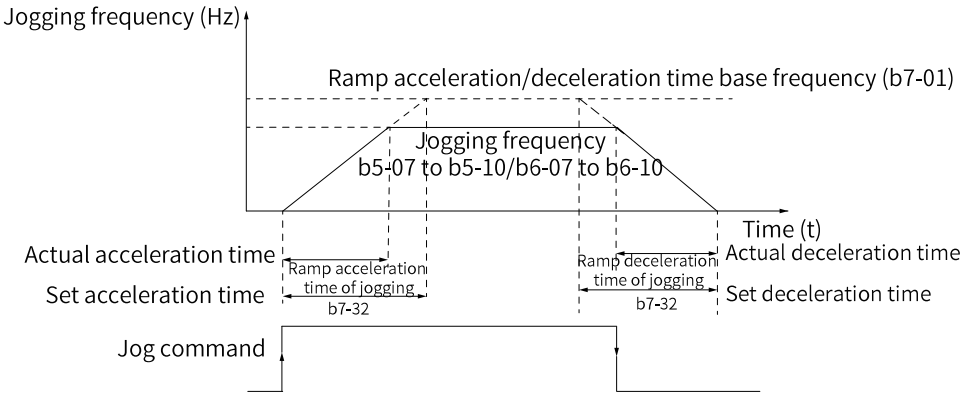


Figure 3-44 Jogging

Related parameter

Param.	Name	Default	Value Range	Descriptions
b7‑01 (F0-46)	Ramp acceleration/ deceleration time base frequency	1	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Sets ramp acceleration/deceleration time base frequency. Value description 0: Sets the rated frequency as the acceleration/ deceleration time base. 1: Sets the maximum frequency as the acceleration/ deceleration time base. 2: Sets 100 Hz as the acceleration/deceleration time base. 3: Sets the set frequency as the acceleration/ deceleration time base. Additional information: Acceleration time indicates time required by the AC drive to accelerate from 0 Hz to the ramp acceleration/deceleration time base frequency. Deceleration time indicates time required by the AC drive to decelerate from the ramp acceleration/ deceleration time base frequency to 0 Hz.
b7‑31 (F0-62)	Jogging ramp source	0	0: Ramp time of normal running 1: Ramp time of jogging	Sets the jogging ramp source. Value description 0: Normal operation ramp time. The jog ramp time is the same as the normal operation ramp time. 1: Jog ramp time. The jog ramp time is set separately (b7-32 and b7-33).
b7‑32 (F0-63)	Ramp acceleration time of jogging	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to rise from 0 to F0-46 (base frequency for acceleration/deceleration) in jog mode. It determines the frequency rise rate in jog mode. Additional information: Acceleration time setting requirements: The acceleration current must be limited below the overcurrent capacity of the AC drive, so as not to cause the AC drive to trip due to overcurrent stall.

Param.	Name	Default	Value Range	Descriptions
b7‑33 (F0-64)	Ramp deceleration time of jogging	20.00s	0.00s to 650.00s	This parameter defines the time required for the output frequency to fall from F0-46 (base frequency for acceleration/deceleration) to 0 in jog mode. It determines the frequency fall rate in jog mode. Additional information: Deceleration time setting requirements: Avoid too large smoothing circuit voltage, so as not to cause the AC drive to trip due to overvoltage stall.
b5‑07 (F0-56)	Jogging frequency 1 source	0	0: Set by the parameter (b5-08) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 1 frequency source Value description 0: Set by the parameter (b5-08). The jog frequency 1 source is “jog frequency 1 reference”, set by the parameter (b5-08). 2: AI1. The jog frequency 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The jog frequency 1 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the jog frequency 1 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the jog frequency 1 source. 9: Communication. Communication is selected as the jog frequency 1 source. 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. 10: Potentiometer MD-BP-M. The source of jog frequency 1 is the voltage of the potentiometer MD-BP-M Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b5‑08 (F0-57)	Jog 1 frequency	2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jogging frequency 1 It takes effect when b5-07 is set to 0.

Param.	Name	Default	Value Range	Descriptions
b5‑09 (F0-58)	Jogging frequency 2 source	0	0: Set by the parameter (b5-10) 2: AI1 5: PULSE pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets Jog 2 frequency source Value description 0: Set by the parameter (b5-10) The jog frequency 2 source is “jog frequency 2 reference”, set by the parameter (b5-10). 2: AI1. The jog frequency 1 is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The jog frequency 2 is set by using the pulse frequency input through the DI4 terminal. It is calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the jog frequency 2 source. 9: Communication. Communication is selected as the jog frequency 2 source. In this mode, the jog frequency 2 is input through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: Potentiometer MD-BP-M. The source of jog frequency 2 is the voltage of the potentiometer MD-BP-M Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as jog frequency 1. This mode is used for expansion of common sources.
b5‑10 (F0-59)	Jog 2 frequency	-2.00 Hz	-50.00 Hz to 50.00 Hz	Digital setting of jogging frequency 2 It takes effect when b5-09 is set to 0.
b1-06/ b3-06	User-defined JOG1 (jogging) source	0	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets user-defined JOG1 (jogging) source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 7: DI1 to DI5 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.

Param.	Name	Default	Value Range	Descriptions
b1-07/ b3-07	User-defined JOG2 (jogging) source	0	0: Disabled 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets user-defined JOG2 (jogging) source. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Value description 0: Invalid - Indicates that jog is invalid. 3 to 9: DI1 to DI7 - Whether the jogging is enabled depends on the terminal state of the DI. Other: B connector - Whether the jogging is enabled depends on other B connectors. You can select other B connectors through the pop-up window.
b1-09	Jog/ON_OFF1 priority mode selection	0	0: No priority 1: Jog preferred 2: OFF1 preferred	Used to select the priority level of jog and normal operation commands. Value description 0: No priority. The AC drive responds only to the operation command that arrives first. 1: Priority for JOG. The jog command can interrupt normal operation. 2: Priority for ON_OFF1 (start/stop). Normal operation commands can interrupt jogging.

Instances

The following section introduces how to set parameters related to jogging when the DI terminal is used as the jogging command source.

Procedure	Forward Jogging	Reverse Jogging
1	b0-02 = 0, select control channel 1. b1-00 = 1, main command source of control channel 1 is set to terminal.	
2	E0-01 = 4. Assign DI2 with jog 1.	E0-00 = 5. Assign DI1 with jog 2.
		d1-02 = 1, which means the negative speed is allowed.
3	b0-03 = 0, select set channel 1.	
4	Set b5-07 to 0 and b5-08 to 2.00 Hz, and set b7-31 and b7-33 properly.	Set b5-09 to 0 and b5-10 to -2.00 Hz, and set b7-31 and b7-33 properly.
	In the stop status, when the DI2 gives the enable command, the AC drive starts to jog in the forward direction. When the DI2 gives the disable command, the AC drive decelerates to stop.	In the stop status, when the DI1 gives the enable command, the AC drive starts to jog in the reverse direction. When the DI1 gives the disable command, the AC drive decelerates to stop.

3.5 Acceleration/Deceleration Time

3.5.1 Acceleration/Deceleration Time Setting

Description

The acceleration time indicates the time required for the AC drive to accelerate from 0 Hz to b7 (Ramp acceleration/deceleration time base frequency). The deceleration time indicates the time required for the AC drive to decelerate from b7 (Ramp acceleration/deceleration time base frequency) to 0 Hz. Set acceleration/deceleration time as the following steps.

1. Set b7-01 (ramp acceleration/deceleration time base frequency) to 1 (maximum frequency) and set the maximum motor frequency (C4-10) to 50 Hz.
2. Set the acceleration time (b7-04) to 10s. In this case, the accelerated speed during acceleration is 5 Hz/s (50 Hz/10s). Set the deceleration time (b7-05) to 25s. In this case, the accelerated speed during deceleration is 2 Hz/s (50 Hz/25s).
3. Set the running frequency to 25 Hz and start the AC drive. The drive will accelerate to 25 Hz at the speed of 5 Hz/s and then run at the frequency of 25 Hz. The actual acceleration time is 5s.
4. Stop the AC drive. The drive will decelerate to zero frequency at the speed of 2 Hz/s and then stop. The actual deceleration time is 12.5s.

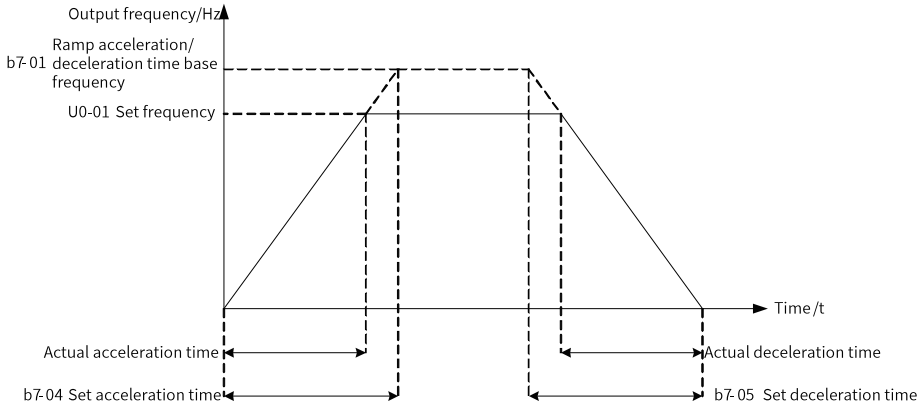


Figure 3-45 Acceleration/deceleration time base frequency

The following table describes parameters related to acceleration/deceleration time.

Param.	Name	Default	Value Range	Descriptions
b7‑01 (F0-46)	Ramp acceleration/ deceleration time base frequency	0	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Frequency reference	Sets ramp acceleration/deceleration time base frequency. Value description 0: Sets the rated frequency as the acceleration/ deceleration time base. 1: Sets the maximum frequency as the acceleration/ deceleration time base. 2: Sets 100 Hz as the acceleration/deceleration time base. 3: Sets the set frequency as the acceleration/ deceleration time base. Additional information: Acceleration time indicates time required by the AC drive to accelerate from 0 Hz to the ramp acceleration/deceleration time base frequency. Deceleration time indicates time required by the AC drive to decelerate from the ramp acceleration/ deceleration time base frequency to 0 Hz.
b7‑04 (F0-48)	Ramp 1 acceleration time	20.0s	0.0s to 6500.0s	It is used to set the first group of acceleration time. By default, the first group of acceleration/deceleration time is selected. Additional information: It indicates the time required for the output frequency to increase from 0 to the ramp acceleration/ deceleration time base frequency (b7-01). The time is used to set the accelerated speed during acceleration. The AC drive provides four groups of acceleration/ deceleration time, which can be selected by using the parameter b7-02 or b7-03 or DI. This parameter specifies the first acceleration time. Acceleration time setting requirements: The acceleration current must be limited below the overcurrent capacity of the AC drive, so as not to cause the AC drive to trip due to overcurrent stall.
b7‑05 (F0-49)	Ramp 1 deceleration time	20.0s	0.0s to 6500.0s	Sets ramp 1 deceleration time. Additional information: It indicates the time required for the output frequency to decrease from the ramp acceleration/deceleration time base frequency (b7-01) to 0. The time is used to set the accelerated speed during deceleration. The AC drive provides four groups of acceleration/ deceleration time, which can be selected by using the parameter b7-02 or b7-03 or DI. This parameter specifies the first deceleration time.

The AC drive provides four groups of acceleration/deceleration time. You can select the effective acceleration/deceleration time by b7-02 (Ramp selection bit0) and b7-03 (Ramp selection bit1).

Param.	Name	Default	Value Range	Descriptions
b7-02	Ramp selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets ramp selection bit 0. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Ramp (RFG) selection bit 0. The AC drive supports time settings for four acceleration/deceleration schemes, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: Indicates that the value of ramp selection bit 0 is 0. 1: Indicates that the value of ramp selection bit 1 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: This parameter is invalid when b7-28 is set to 1 and b7-29 or b7-30 is set to a non-zero value. After the DI terminal is assigned with function 16 (Acceleration/deceleration time selection terminal 1), the value of b7-02 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b7-03	Ramp selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets ramp selection bit 1. When the bit signal is 0, the command is disabled. When the bit signal is 1, the command is enabled. Ramp (RFG) selection bit 0. The AC drive supports time settings for four acceleration/deceleration schemes, which can be switched by combining the states of ramp (RFG) selection bits 0 and 1 in four ways. Value description 0: Indicates that the value of ramp selection bit 1 is 0. 1: Indicates that the value of ramp selection bit 1 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: This parameter is invalid when b7-28 is set to 1 and b7-29 or b7-30 is set to a non-zero value. After the DI terminal is assigned with function 17 (Acceleration/deceleration time selection terminal 2), the value of b7-03 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

You can also switch by using the DI assigned with functions 16 and 17 (terminal function 16: Acceleration/deceleration time selection terminal 1 and 17: Acceleration/deceleration selection terminal 2). The acceleration/deceleration time is defined by the following parameters:

- Group 1: b7-04 (ramp 1 acceleration time) and b7-05 (ramp 1 deceleration time), time unit: 0.1 s.
- Group 2: b7-10 (ramp 2 acceleration time) and b7-11 (ramp 2 deceleration time), time unit: 0.1 s.
- Group 3: b7-16 (ramp 3 acceleration time) and b7-17 (ramp 3 deceleration time), time unit: 0.01 s.
- Group 4: b7-22 (ramp 4 acceleration time) and b7-23 (ramp 4 deceleration time), time unit: 0.01 s.

Instances

The following example uses DI1 and DI2 as the input switchover terminals to describe how to set the acceleration/deceleration time.

- Set E0-00 and E0-01 to select DI1 and DI2 for switchover.

Param.	Name	Value Range	Description
E0-00	DI1 function selection	16	Acceleration/deceleration time selection terminal 1
E0-01	DI2 function selection	17	Acceleration/deceleration time selection terminal 2

- Set the corresponding acceleration/deceleration time through parameters.

DI1 State	DI2 State	Acceleration/Deceleration Time
OFF	OFF	Acceleration/Deceleration time 1: b7-04, b7-05
ON	OFF	Acceleration/Deceleration time 2: b7-10, b7-11
OFF	ON	Acceleration/Deceleration time 3: b7-16, b7-17
ON	ON	Acceleration/Deceleration time 4: b7-22, b7-23

- Set b7-00 (ramp acceleration/deceleration mode) to select the frequency change mode during the start and stop process of the AC drive.
  - 0: Linear acceleration/deceleration. The output frequency increases or decreases linearly.
  - 1: S-curve acceleration/deceleration When the target frequency changes dynamically in real time, the output frequency increases or decreases based on the S-curve. This mode is applicable to scenarios requiring supreme riding comfort and real-time response.
- Set the time proportion of S-curve start segment and time proportion of S-curve end segment as the following table.

Param.	Description	Default	Value Range	Descriptions
b7‑06 (F0-50)	Ramp 1 acceleration start arc	0.00s	0.00s to 650.00s	Defines the motion time of the ramp 1 acceleration start segment arc. Additional information: This parameter defines the arc time of the output frequency acceleration start segment. It determines the acceleration rate of the given acceleration start segment arc. It is the start arc of the first acceleration scheme. Too large setting of this parameter may lead to prolonged acceleration/deceleration time. Too small setting of this parameter may lead to torque oscillation. This function is active only in the S curve acceleration/ deceleration mode when b7-00 is 1. For example, if this parameter is set to 2s and the actual acceleration time to the set frequency is 10s, the first 2s is in arc motion phase and the last 8s is in linear motion phase. In addition, the AC drive still moves according to the set linear acceleration/deceleration time in the linear motion phase.
b7‑07 (F0-51)	Ramp 1 acceleration end arc	0.00s	0.00s to 650.00s	Defines the motion time of the ramp 1 acceleration end segment arc. Additional information: This parameter defines the arc time of the output frequency acceleration end segment. It determines the acceleration rate of the given acceleration end segment arc. It is the end arc of the first acceleration scheme. Too large setting of this parameter may lead to prolonged acceleration/deceleration time. Too small setting of this parameter may lead to torque oscillation. This function is active only in the S curve acceleration/ deceleration mode when b7-00 is 1. For example, if this parameter is set to 2s and the actual acceleration time to the set frequency is 10s, the first 8s is in the linear motion phase and the last 2s is in linear motion phase. In addition, the AC drive still moves according to the set linear acceleration/deceleration time in the linear motion phase.

Param.	Description	Default	Value Range	Descriptions
b7‑08 (F0-52)	Ramp 1 deceleration start arc	0.00s	0.00s to 650.00s	Defines the motion time of the ramp 1 acceleration/ deceleration time start segment arc. Additional information: This parameter defines the arc time of the output frequency deceleration start segment. It determines the acceleration rate of the given deceleration start segment arc. It is the start arc of the first deceleration scheme. Too large setting of this parameter may lead to prolonged acceleration/deceleration time. Too small setting of this parameter may lead to torque oscillation. This function is active only in the S curve acceleration/ deceleration mode when b7-00 is 1. For example, if this parameter is set to 2s and the actual deceleration time to the set frequency is 10s, the first 2s is in arc motion phase and the last 8s is in linear motion phase. In addition, the AC drive still moves according to the set linear acceleration/deceleration time in the linear motion phase.
b7‑09 (F0-53)	Ramp 1 deceleration end arc	0.00s	0.00s to 650.00s	Defines the motion time of the ramp 1 acceleration/ deceleration time end segment arc. Additional information: This parameter defines the arc time of the output frequency deceleration end segment. It determines the acceleration rate of the given deceleration end segment arc. It is the end arc of the first deceleration scheme. Too large setting of this parameter may lead to prolonged acceleration/deceleration time. Too small setting of this parameter may lead to torque oscillation. This function is active only in the S curve acceleration/ deceleration mode when b7-00 is 1. For example, if this parameter is set to 2s and the actual deceleration time to the set frequency is 10s, the first 8s is in the linear motion phase and the last 2s is in linear motion phase. In addition, the AC drive still moves according to the set linear acceleration/deceleration time in the linear motion phase.

Note

The motor parameters in group F0 in the table are the mapping of motor parameters in group b7. The settings of the two groups are equivalent.

- Select the arc type. In case of abrupt acceleration or deceleration, the output frequency of the ramp function generator is not smooth and the acceleration rate of the output frequency is discontinuous, which may cause motor torque oscillation and damage to mechanical gears.
  b7-43 is set to 0 (No continuous smoothing): Switched to the new target direction immediately when the acceleration/deceleration trend changes

  b7-43 is set to 1 (Continuous smoothing): Executing the end arc of the current acceleration/ deceleration segment before switching to the set direction when the acceleration/deceleration trend changes

3.5.2 Acceleration/Deceleration Time Switchover Frequency

Description

This function enables selection of different acceleration/deceleration time based on the running frequency during running of the AC drive. The following figure shows the schematic diagram of acceleration/deceleration time switchover. During acceleration, if the running frequency is lower than b7-29, acceleration time 2 is selected; if it is higher than b7-29, acceleration time 1 is selected. During deceleration, if the running frequency is higher than b7-30, deceleration time 1 is selected; if it is lower than b7-30, deceleration time 2 is selected.

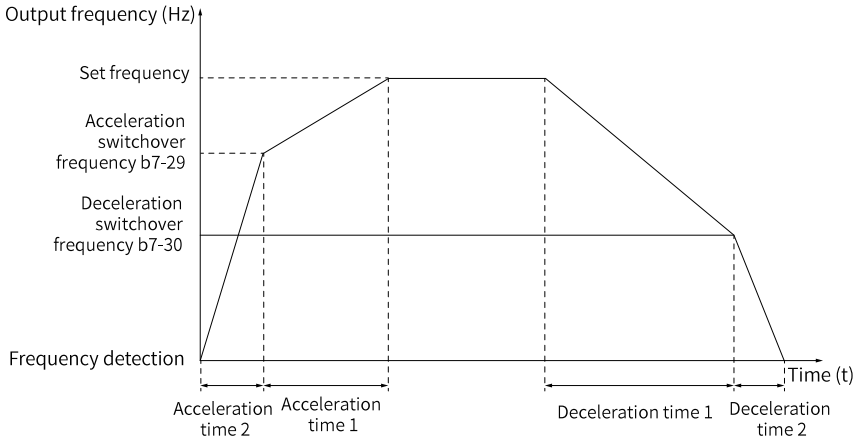


Figure 3-46 Frequency for acceleration/deceleration time switchover

This function is valid only when the DI is not assigned with function 16 (acceleration/deceleration time selection terminal 1) or 17 (acceleration/deceleration time selection terminal 2).

Related parameter

Param.	Name	Default	Value Range	Descriptions
b7-28	Ramp 1/2 frequency switchover	0	0: Enable 1: Enable	Defines whether ramp 1/2 frequency switchover is enabled. When this function is enabled, ramp selection bit 1/bit 0 (b7-02/03) are invalidated. Value description 0: Disable 1: Enable Additional information: This parameter is generally used in combination with b7-29 and b7-30 to use different acceleration/deceleration time (acceleration rate) during acceleration/deceleration.
b7-29	Ramp 1/2 acceleration switchover frequency	0.0 Hz	0.0 Hz to A2-18	Sets ramp 1/2 acceleration switchover frequency. During the acceleration stage, if the output frequency is greater than or equal to this set point, the current effective ramp is ramp 1 acceleration. Otherwise, the current effective ramp is ramp 2 acceleration
b7-30	Ramp 1/2 deceleration switchover frequency	0.0 Hz	0.0 Hz to A2-18	Sets ramp 1/2 deceleration switchover frequency. During the deceleration stage, if the output frequency is greater than or equal to this set point, the current effective ramp is ramp 1 deceleration. Otherwise, the current effective ramp is ramp 2 deceleration.

3.6 Modify Motor Direction

3.6.1 Motor Running Direction Limit

Description

The motor running direction can be limited by setting parameters d1-01 (positive speed) and d1-02 (negative speed).

- When d1-01 is set to 0 (Inhibited), the motor runs at zero frequency when a forward run command is input to the AC drive.
- When d1-02 is set to 0 (Inhibited), the motor runs at zero frequency when a reverse run command is input to the AC drive.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d1‑01 (F2-20)	Positive speed	1	0: Inhibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	This parameter specifies whether the AC drive allows forward operation. Value description 0: Forward operation is inhibited. 1: Forward operation is allowed. 3 to 7: DI1 to DI5 - Whether the forward operation is allowed depends on the terminal state of the DI. Other: B connector - Whether the forward operation is allowed depends on other B connectors. Additional information: After the DI terminal is assigned with function 78 (Forward running enable), the value of d1-01 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
d1‑02 (F2-21)	Negative speed	1	0: Enable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	This parameter specifies whether the AC drive allows reverse operation. Value description 0: Reverse operation is inhibited. 1: Reverse operation is allowed. 3 to 7: DI1 to DI5 - Whether the forward operation is allowed depends on the terminal state of the DI. Other: B connector - Whether the forward operation is allowed depends on other B connectors. Additional information: After the DI terminal is assigned with function 79 (Reverse running enable), the value of d1-02 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).

3.6.2 Dead Zone Time of Forward/Reverse Run Switchover

Description

This function is used to specify the transition period when the output is 0 Hz during forward/reverse run switchover of the AC drive. The transition period is called dead zone time of forward/reverse run switchover, which can be set through P0-26.

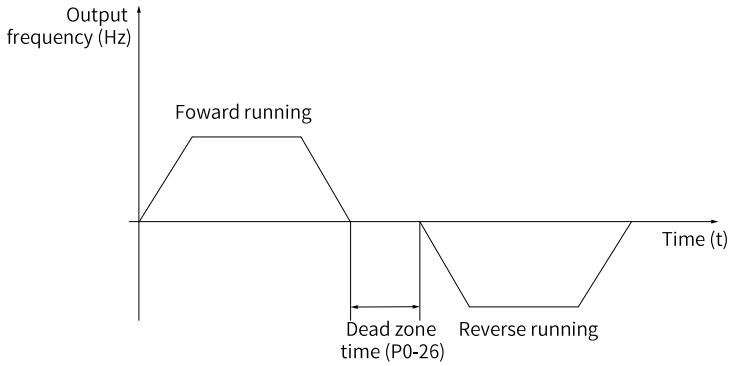


Figure 3-47 Dead zone time of forward/reverse run switchover

3.7 Control Terminal

The product supports seven control terminals, including digital input (DI), digital output (DO/RO), virtual digital input (VDI), virtual digital input (VDO), high-speed digital input (HDI), analog input (AI), and analog output (AO). Model MD600S is equipped with DI1 to DI4, RO1, AI1, and AO1 as standard. Model MD600A is equipped with DI1 to DI5, RO1, DO1, DO2, and AI1 as standard. DI4 of MD600S and MD600A can be used as high-speed digital input terminals. Other terminals can be used with any function.

3.7.1 Digital Input (DI) Terminal Functions

The AC drive provides multiple multi-functional DIs, among which DI5 can be used as the pulse input terminal. Each DI can be assigned with a specific function.

The DI terminal configuration mode includes the DI function selection and selecting DI terminal as the parameter source. You can control the function in either mode according to the application requirements.

Description

The DI function refers to the digital input terminal. Model MD600S and MD600A are equipped with four and five multi-functional DIs, respectively, among which DI4 can be used as the pulse input terminal. Each DI can be assigned with a specific function.

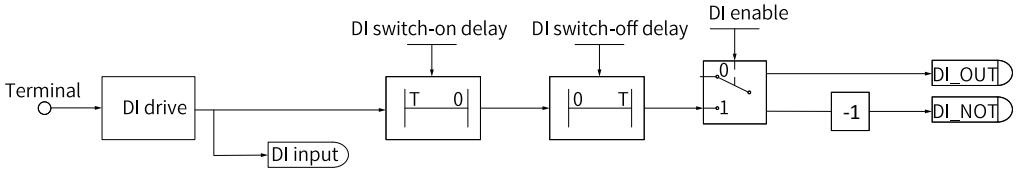


Figure 3-48 DI data flow diagram

DI function selection

The terminal function selection refers to setting parameters (E0-00 to E0-04) to assign the function to the DI terminal and control the function through the DI terminal. For example, set E0-00 (DI1 function

selection) to 70 (Control channel selection). 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.

Parameter	Name	Default	Value Range	Descriptions
E0-00 (F0-10)	DI1 function selection	1	0 to 80	For details, see *"Table 3–14" on page 241*.
E0-01 (F0-11)	DI2 function	4		
E0-02 (F0-12)	DI3 function selection	9		
E0-03 (F0-13)	DI4 function selection	12		
E0-04 (F0-14)	DI5 function selection	0		
E0-10	VDI1 function selection	0		
E0-11	VDI1 function selection	0		
E0-12	VDI1 function selection	0		
E0-13	VDI1 function selection	0		
E0-14	VDI5 function	0		
E0-15	VDI1 function selection	0		

The following table shows the functions that can be allocated to DI terminals. Each DI can be assigned with a specific function, and the function cannot be allocated to other terminals. For terminal function 30 (Pulse frequency input), this function is valid only for DI4 (E0-03: DI4 function selection). Other terminals cannot be allocated to this function.

Table 3–14 Terminal function description

Value Range	Function	Description
0	Invalid	Set 0 for reserved terminals to avoid malfunction.
1	Terminal start/stop module A_IN1	Input 1 of terminal module A. The function is determined by terminal module mode (valid when the command source is terminal control).
2	Terminal start/stop module A_IN2	Input 2 of terminal module A. The function is determined by terminal module mode (valid when the command source is terminal control).
3	Terminal start/stop module A_IN3	Input 3 of terminal module A. The function is determined by terminal module mode (valid when the command source is terminal control).
4	Terminal start/stop module A jog 1(JOG1)	The terminal is used to set the AC drive to jog forwardly. In the jogging mode, the drive runs at a low speed temporarily, which is generally used for maintenance and commissioning of the equipment on site. (Valid when the command source is terminal control).
5	Terminal start/stop module A jog 2(JOG2)	The terminal is used to set the AC drive to jog reversely. In the jogging mode, the drive runs at a low speed temporarily, which is generally used for maintenance and commissioning of the equipment on site. (Valid when the command source is terminal control).
6	Function as UP key for frequency adjustment	The terminal is used to increase the frequency when the frequency is set through the terminal. When this terminal is active, it works as if  is kept pressed down. When this terminal is inactive, it works as if is released.

Value Range	Function	Description
7	Function as DOWN key for frequency adjustment	The terminal is used to decrease the frequency when the frequency is set through the terminal. When this terminal is active, it works as if  is kept pressed down. When this terminal is inactive, it works as if is released.
8	Coast to stop	The AC drive stops output to shut down. At this time, the power supply of the motor is cut off and the driving system is in the free braking state. The AC drive immediately stops output after the terminal is active, and the load coasts to stop based on the mechanical inertia.
9	Fault reset (RESET)	The terminal is used to reset faults of the AC drive and reset upon detection of a rising edge on the DI signal. When active, the terminal has the same function as the STOP/RES key on the operating panel. Remote fault reset is also supported.
10	Running pause (controlled by terminals)	The AC drive decelerates to stop with all the operating parameters memorized (such as PLC, wobble frequency, and PID parameters). When the terminal is inactive, the drive resumes to the status before decelerating to stop. (Valid when the command source is terminal control).
11	External fault normally open (NO) input	When the terminal is active, the AC drive is normal. When the terminal is inactive, it is equivalent to an external fault signal. After receiving the external signal, the AC drive reports E015.1, and acts according to the value of H1-02 (Fault protection action selection).
12	Multi-reference terminal 1	Multi-reference is selected as the main frequency source. 16 speeds or 16 references can be set through combinations of 16 states of these four terminals. It 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.
13	Multi-reference terminal 2	
14	Multi-reference terminal 3	
15	Multi-reference terminal 4	
16	Acceleration/Deceleration selection terminal 1	Four groups of acceleration/deceleration time can be selected through combinations of four states of these two terminals. The acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to the acceleration/deceleration base frequency (F0-46). The deceleration time indicates the time required by the AC drive to decelerate from the acceleration/deceleration base frequency (F0-46) to 0 Hz.
17	Acceleration/Deceleration selection terminal 2	
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 is selected, the frequency set by  or  key 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.
21	Acceleration/Deceleration inhibition	Do not adjust the frequency during AC drive running (except stop command). The AC drive runs at the current operating frequency without being affected by external input frequency when the terminal is active.
22	PID invalid	PID calculation pauses and maintains the current output. When the terminal is active, the AC drive maintains the current PID output and no PID adjustment is performed. When the terminal is inactive, the PID calculation continues based on the current output.
23	Simple PLC status reset	When the terminal is active, the simple PLC is restored to the initial state.
29	Torque control prohibited	When the terminal is active, the drive switches from the torque control mode to the speed control mode. When the terminal is inactive, the drive switches back to the torque control mode.
30	Pulse frequency input (valid only for DI4)	This function is valid only for DI4. DI4 can be used as a high-speed digital input terminal (HDI) to receive pulse signals.

Value Range	Function	Description
32	Immediate DC braking	When the terminal is active, the AC drive directly switches over 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.
33	NC input of external fault	When the terminal is active, it is equivalent to an external fault input signal. When the terminal is active, the AC drive is in normal state. After receiving the external signal, the AC drive reports E015.2, and acts according to the value of H1-02 (Fault protection action selection).
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	Opposite to PID action direction	The terminal is used to reverse the PID action direction defined by P2-01 (PID action direction).
36	External stop terminal 1	The terminal is used to stop the AC drive and functions the same as the STOP/RES key on the operating panel.
38	PID integral pause	After this terminal is activated, the PID integral adjustment function pauses. However, the proportional and derivative adjustment functions are still valid.
43	PID parameter switchover	If PID parameters are switched through the DI (P2-11 = 1), the PID parameters P2-14 (proportional gain Kp1), P2-15 (integral time Ti1), and P2-16 (derivative time Td1) are used when the terminal is inactive; the PID parameters P2-17 (proportional gain Kp2), P2-18 (integral time Ti2), and P2-19 (derivative time Td2) are used when the terminal is active.
44	User-defined fault 1	The AC drive reports E027.1, and acts according to the value of H1-04 (Fault protection action selection).
45	User-defined fault 2	The AC drive reports E027.2, and acts according to the value of H1-04 (Fault protection action selection).
46	Speed control/Torque control selection	The terminal is used to switch the AC drive between speed control and torque control. When F0-02 (Speed/Torque control mode) is set to 0 and the terminal is active, the control mode is torque control mode. When the terminal is inactive, the control mode is speed control mode. When F0-02 (Speed/Torque control mode) is set to 1 and the terminal is active, the control mode is speed control mode. When the terminal is inactive, the control mode is torque control mode.
47	Emergency stop	Upon an emergency, the AC drive decelerates according to the setting of b7-34 (deceleration time for quick stop). In V/f control mode, if the deceleration time for emergency stop is set to 0s, the AC drive decelerates according to the minimum unit time. The input terminal does not need to be in the closed state continuously. Even if it is closed only for a moment (time longer than filter time and delay time), an emergency stop will occur immediately. Different from the general deceleration to stop, the emergency stop input terminal is opened after the deceleration time for emergency stop expires. In this case, if the operation signal is still active, the drive will not restart. To restart the drive, disconnect the operation terminal and input the operation command again.
49	Decelerate to DC braking	The drive decelerates to the start frequency of DC braking for stop (d0-27) and then enters the DC braking state.

Value Range	Function	Description
50	Clear current running time	The terminal is used to clear the current running time of the AC drive. If the current running time is shorter than the set value (greater than 0) of P0-17 and P0-19 and the terminal is active, the current running timing is cleared. If the current running time is longer than the set value (greater than 0) of P0-17 and P0-19, the current running timing is not cleared even if the terminal is active.
61	Terminal start/stop module B_IN1	Input 1 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).
62	Terminal start/stop module B_IN2	Input 2 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).
63	Terminal start/stop module B_IN3	Input 3 of terminal module B. The function is determined by terminal module mode (valid when the command source is terminal control).
64	Terminal start/stop module B jog 1(JOG1)	The AC drive runs at low speed for a short time in the jogging mode 1. The operation frequency and direction are determined by the jog 1 frequency, and the default is positive frequency. This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control)
65	Terminal start/stop module B jog 2(JOG2)	The AC drive runs at low speed for a short time in the jogging mode 2. The operation frequency and direction are determined by the jog 2 frequency, and the default is positive frequency. This is typically used for maintenance and commissioning on site. (Valid when the command source is terminal control).
66	Forced local control	In any other control mode, if the terminal is active, forced local control is valid.
67	Forced terminal control	In any other control mode, if the terminal is active, forced terminal control is valid.
68	Forced communication control	In any other control mode, if the terminal is active, forced communication control is valid.
69	Forced user-defined control	In any other control mode, if the terminal is active, forced user-defined control is valid.
70	Control channel selection	Select two control command channels through the terminal. When the terminal is inactive, control channel 1 is selected. When the terminal is active, control channel 2 is selected.
71	Set channel selection	Select set channels through the terminal. When the terminal is inactive, set channel 1 is selected. When the terminal is active, set channel 2 is selected.
72	Terminal module A/B selection	Select two groups of terminal channels through terminals. When the terminal is inactive, channel 1 is selected. When the terminal is active, channel 2 is selected.
77	Running enable (all modes)	When the terminal is active, running is allowed. Otherwise, running is not allowed or the AC drive must stop according to the setting of d0-07.
78	Forward operation permission	When the terminal is active, positive values are allowed for the frequency reference. When the terminal is inactive, the AC drive runs at 0 Hz when the frequency is set to positive values.
79	Reverse operation permission	When the terminal is active, negative values are allowed for the frequency reference. When the terminal is inactive, the AC drive runs at 0 Hz when the frequency is set to negative values.
80	RFG input clear	When the terminal is active, the AC drive runs at the frequency reference. When the terminal is inactive, the target frequency is set to zero, and the AC drive runs at 0 Hz.

DI terminal as parameter source

DI terminal as parameter source refers to selecting the DI terminals as the source of parameters and control the function through the DI terminal state. For example, set b0-02 (Control channel selection) to 3 (DI1) to select the active control channel 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.

The following table shows the commonly used parameters that can use DI terminals as input sources. Different parameters can select the same DI terminals as input sources. The parameters can be set according to the application requirements.

Param.	Name	Default	Value Range	Descriptions
b0-02	Control channel	0	0: Control channel 1 1: Control channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Set the active control channel. If this parameter is 0, control channel 1 is selected. If this parameter is 1, control channel 2 is selected. Value description 0: Channel 1 is selected. 1: Channel 2 is selected. 3 to 7: DI1 to DI5 - The channel selected depends on the terminal state of the DI. Other: B connector - The channel selected depends on the other B connector. Additional information: 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 (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b0-03	Set channel selection	0	0: Set channel 1 1: Set channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Set the active set channel. If this parameter is 0, set channel 1 is selected. If this parameter is 1, set channel 2 is selected. Value description 0: Set channel 1 is selected. 1: Set channel 2 is selected. 3 to 7: DI1 to DI5 - The channel selected depends on the terminal state of the DI. Other: B connector - The channel selected depends on the other B connector.

Param.	Name	Default	Value Range	Descriptions
b8-03	Multi-reference selection bit 0	0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the source of multi-reference selection bit 0. A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit1, bit0, bit2, and bit3. Value description 0: The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 12 (Multi-reference terminal 1), the value of b8-03 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b8-04	Multi-reference bit 1			
b8-05	Multi-reference bit 2			
b8-06	Multi-reference bit 3			
b9-02	Terminal start/ stop module A_ IN1	0	0: Inactive 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: 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 from the 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 7: DI1 to DI5: The signal source is DI1 to DI5. When DI1 to DI5 is active, INX is active. Other: Connector B – The signal is from the selected connector B. When the bit signal is active, INX is active. Additional information: After the DI terminal is assigned with function 1 (Terminal start/stop module A_INX), the value is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b9-03	Terminal start/ stop module A_ IN2			
b9-04	Terminal start/ stop module A_ IN3			

Param.	Name	Default	Value Range	Descriptions
d0--01 (F0-02)	Motor control mode	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 7: DI1 to DI5 - Depends on the 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. Additional information: Torque control is invalid in V/f mode.

Special terminal function

In the terminal functions described in the preceding section, there are some special functions that can be controlled by allocating the functions to the terminals or by setting the parameters with the DI terminals as the sources.

The following table shows the relationship between special DI functions and parameters. If E0-00 to E0-04 are set to special functions, the parameters corresponding to special functions are automatically switched to the connector parameter (L4-48 to L4-52) that represents the DI terminal. In this case, the function parameters cannot be modified during this period. If the DI terminal is allocated to other functions, the parameters corresponding to special functions are restored to default values. In this case, any input source can be selected.

Param.r	Name	Default	Value Range	Descriptions
L4-48	DI1 (forcibly modified by E0-00)	-	-	The value of the parameter is L4-48 (1448 displayed on the operating panel), indicating that DI1 terminal is allocated to this function.
L4-49	DI2 (forcibly modified by E0-01)	-	-	The value of the parameter is L4-49 (1449 displayed on the operating panel), indicating that DI2 terminal is allocated to this function.
L4-50	DI3 (forcibly modified by E0-02)	-	-	The value of the parameter is L4-50 (1450 displayed on the operating panel), indicating that DI3 terminal is allocated to this function.
L4-51	DI4 (forcibly modified by E0-03)	-	-	The value of the parameter is L4-51 (1451 displayed on the operating panel), indicating that DI4 terminal is allocated to this function.
L4-52	DI5 (forcibly modified by E0-04)	-	-	The value of the parameter is L4-52 (1452 displayed on the operating panel), indicating that DI5 terminal is allocated to this function.

For example, when E0-01 (DI2 function selection) = 4 (Terminal start/stop module A jog 1), the value of the corresponding parameter b9-02 (terminal start/stop module A_IN1) is switched to L4-49 (DI2 (forcibly modified by E0-01) and the number of connector L4-49 (1449) is displayed on the operating

panel. The value of b9-02 cannot be modified. The DI2 terminal controls whether the jog 1 signal of the start/stop module is active. After E0-01 (DI2 function selection) is set to another function, b9-02 is restored to the default value and can be any input source.

Special Functions	Corresponding Parameters	Description
1: Terminal start/stop module A_IN1	b9-02: Terminal start/stop module A_IN1	After the terminals are allocated to the functions listed in the table, the connectors displayed for the corresponding parameters are L4-48 to L4-52 (connector number value 1448 to 1552 displayed on the operating panel).
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: Terminal start/stop module A jog 1(JOG1)	b9-07: Source of terminal start/stop module A jog 1(JOG1)	
5: Terminal start/stop module A jog 2(JOG2)	b9-08: Source of terminal start/stop module A jog 2(JOG2)	
8: Coast to stop	b2-00: User-defined OFF2 (coast to stop) source 2 b4-00: User-defined OFF2 (coast to stop) source 2	
9: Fault reset (RESET)	b2-04: Fault reset source 2 b4-04: Fault reset source 2	
10: Running pause (controlled by terminals)	b9-05: Running permission source of terminal start/stop module A b9-13: Running permission source of terminal start/stop module B	
11: NO input of external fault	H2-00: Source of external fault 1 (NO)	
12: Multi-reference terminal 1	b8-03: Multi-reference selection bit 0	
13: Multi-reference terminal 2	b8-04: Multi-reference selection bit 1	
14: Multi-reference terminal 3	b8-05: Multi-reference selection bit 2	
15: Multi-reference terminal 4	b8-06: Multi-reference selection bit 3	
16: Terminal 1 for acceleration/ deceleration selection	b7-02: Ramp selection bit 0	
17: Terminal 2 for acceleration/ deceleration selection	b7-03: Ramp selection bit 1	
21: Acceleration/Deceleration inhibition	b2-07: RFG pause source b4-07: RFG pause source	
23: Simple PLC state reset	P1-04: Simple PLC state reset	
33: External fault 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: User-defined OFF3 (quick stop) source 2 b4-02: User-defined OFF3 (quick stop) source 2	
61: Terminal start/stop module B_IN1	b9-10: Terminal start/stop module B_IN1	
62: Terminal start/stop module B_IN2	b9-11: Terminal start/stop module B_IN2	

Special Functions	Corresponding Parameters	Description
63: Terminal start/stop module B_IN3	b9-12: Terminal start/stop module B_IN3	After the terminals are allocated to the functions listed in the table, the connectors displayed for the corresponding parameters are L4-48 to L4-52 (connector number value 1448 to 1552 displayed on the operating panel).
64: Terminal start/stop module B jog 1 (JOG1)	b9-15: Source of terminal start/stop module B jog 1(JOG1)	
65: Terminal start/stop module B jog 2 (JOG2)	b9-16: Source of terminal start/stop module B jog 2(JOG2)	
70: Control channel selection	b0-02: Control channel selection	
71: Set channel selection	b0-03: Set channel selection	
72: Terminal module A/B selection	b9-00: Terminal start/stop module A/B selection	
78: Forward running enable	d1-01: Positive speed enable	
79: Reverse running enable	d1-02: Negative speed enable	
80: Set RFG input to zero	b2-08: Source of setting RFG reference to 0 b4-08: Source of setting RFG reference to 0	

Setting

The DI terminals can be set through parameter groups (E0-00 to E0-57). For a list of related parameters, see E0-00 to E0-57. For details on DI function selection, see parameters E0-00 to E0-04 and E0-10 to E0-15.

Instances

When the DI1 and DI2 active mode selection (E0-57) is set to high level active (0x0000), to perform the function: "DI1 starts in the forward direction and DI2 starts in the forward direction," do as follows.

1. Set the DI1 function to "Terminal start/stop module A_IN1" (E0-00 = 01).
2. Set the DI2 function to "Terminal start/stop module A_IN2" (E0-01 = 02).
3. Set the terminal start/stop module mode, "IN1 starts in the forward direction, IN2 starts in the reverse direction" (b9-01 = 3).
4. Set terminals as the main command source of control channel 1 (b1-00 =1).

After setting the preceding steps, when DI1 input is active and DI2 is inactive, the AC drive is in forward running state. When DI2 input is active and DI1 is inactive, the AC drive is in reverse running state.

DI5 is unique to MD600A, and MD600S only features DI1 to DI4.

Table 3–15 Other Related DI Parameters

Param.	Name	Default	Value Range	Descriptions
E0-16	DI input filter time 1	0.010s	0.000s to 1.000s	This parameter defines the filter time 1 for the AC drive to respond to changes in DI terminal status.
E0-17	DI input filter time 2	0.010s	0.000s to 1.000s	This parameter defines the filter time 2 for the AC drive to respond to changes in DI terminal status.

Param.	Name	Default	Value Range	Descriptions
E0-18	DI input filter time selection	0x0	bit0 to bit3: Filter time of DI1 and DI4 0: Filter time 1 1: Filter time 2 Bit 4: DI5 filter time (MD600A) 0: Filter time 1 1: Filter time 2 bit5 to bit15: Reserved	Defines the filter time of which DI is active. Value description bit0 to 4: DI1 to DI5 filter time - Select the filter time of DI1 to DI5. 0: Filter time 1 - The filter time of DI1 to DI5 is defined by E0-16. 1: Filter time 2 - The filter time of DI1 to DI5 is defined by E0-17.
E0-19	Step value of terminal functioning as UP/ DOWN keys	1.000 Hz/s	0.001 Hz/s to 65.535 Hz/s	This parameter defines the change rate when the frequency is adjusted through terminal UP/DOWN. Additional information: When the DI terminal function is set to the function of terminal UP or DOWN, this parameter must be set (values of E0-00 to E0-15 are 6 or 7).
E0-20	DI1 switch-on delay time	0.0s	0.0s to 3600.0s	Defines the delay coefficient when each terminal is switched on. Additional information: It can be superimposed with the filter time.
E0-21	DI1 switch-off delay time	0.0s	0.0s to 3600.0s	
E0-22	DI2 switch-on delay time	0.0s	0.0s to 3600.0s	
E0-23	DI2 switch-off delay time	0.0s	0.0s to 3600.0s	
E0-24	DI3 switch-on delay time	0.0s	0.0s to 3600.0s	
E0-25	DI3 switch-off delay time	0.0s	0.0s to 3600.0s	
E0-26	DI4 switch-on delay time	0.0s	0.0s to 3600.0s	
E0-27	DI4 switch-off delay time	0.0s	0.0s to 3600.0s	
E0-28	DI5 switch-on delay time (MD600A)	0.0s	0.0s to 3600.0s	
E0-29	DI5 switch-off delay time (MD600A)	0.0s	0.0s to 3600.0s	

Param.	Name	Default	Value Range	Descriptions
E0-40	DI force enable	0	bit0 to bit3: DI1 to DI4 0: Hardware 1: Forced value Bit 4: DI5(MD600A) 0: Hardware 1: Forced value bit5 to bit15: Reserved	This parameter specifies the hardware sources of DI1 to DI5 (in bit order). When the source value is 0, the source is hardware sampling. When the source value is 1, the source is forced setpoint. Value description bit0 to bit3: DI1 to DI4 0: Hardware 1: Forced value Bit 4: DI5(MD600A) 0: Hardware 1: Forced value
E0-50	VDI1 source	1	1: Forced value 4: AI1 11: DI1 12: DI2 13: DI3 14: DI4/HDI 15: DI5 (MD600A) 22-26: VDI2 to VDI6 51: RO1 55: DO1 (MD600A) 56: DO2 (MD600A) 61-66: VDO1 to VDO6	Sets the VDI1 source. Value description Forced value The forced value is set according to E0-56. 4: AI1 - The DI setting source is based on the comparison between AI1 input and E2-35 and E2-36 settings. 11: DI1 - Source is set according to DI1 output state. 12: DI2 - Source is set according to DI2 output state. 13: DI3 - Source is set according to DI3 output state. 14: DI4/HDI - Source is set according to DI4 output state. 15: DI5 (MD600A) - Set the source according to DI5 output state. 22 to 26: VDI2 to VDI6 - Set the source according to the output state of VDI2 to VDI6. 51: RO1 - Source is set according to RO1 output state. 55: DO1 (MD600A) - Set the source according to DO1 output state. 56: DO2 (MD600A) - Set the source according to DO2 output state. 61 to 66: VDO1 to VDO6 - Set the source according to the output state of VDO1 to VDO6.
E0-51	VDI2 source	1	Same as E0-50	Same as E0-50
E0-52	VDI3 source	1	Same as E0-50	Same as E0-50
E0-53	VDI4 source	1	Same as E0-50	Same as E0-50
E0-54	VDI5 source	1	Same as E0-50	Same as E0-50
E0-55	VDI6 source	1	Same as E0-50	Same as E0-50

Param.	Name	Default	Value Range	Descriptions
E0-56	DI forced data	0x0	bit0 to bit2: DI1 to DI3 setting 0: Invalid level 1: Valid level bit3: DI4/HDI setting 0: Invalid level 1: Valid level bit 4: DI5 setting (MD600A) 0: Invalid level 1: Valid level bit5 to bit9: Reserved 0: Invalid level 1: Valid level bit10 to bit15: VDI1 to VDI6 setting 0: Invalid level 1: Valid level	This parameter sets the level status of the forced value of DI1 to DI5 and VDI1 to VDI6 (in bit order). Value description bit0 to bit2: DI1 to DI3 setting 0: Invalid level 1: Valid level bit3: DI4/HDI setting 0: Invalid level 1: Valid level bit 4: DI5 setting (MD600A) 0: Invalid level 1: Valid level bit5 to bit9: Reserved 0: Invalid level 1: Valid level bit10 to bit15: VDI1 to VDI6 setting 0: Invalid level 1: Valid level
E0-57	DI active mode selection	0x0	bit0 to bit3: DI1 to DI4 active mode 0: Active high 1: Active low bit4: DI5 active mode (MD600A) 0: Active high 1: Active low bit5 to bit9: Reserved 0: Active high 1: Active low bit10 to 15: VDI1 to VDI6 active mode 0: Active high 1: Active low	This parameter forcibly sets the active mode of DI1 to DI5 and VDI1 to VDI6 (in bit order). bit0 to bit3: DI1 to DI4 active mode 0: Active high 1: Active low bit4: DI5 active mode (MD600A) 0: Active high 1: Active low bit5 to bit9: Reserved 0: Active high 1: Active low bit10 to 15: VDI1 to VDI6 active mode 0: Active high 1: Active low

3.7.2 Digital Output (DO) Terminal Functions

Description

The DO/RO function refers to the digital output terminal. The MD600S is equipped with one multi-function relay output REALY1 (RO1) as standard. The MD600A is equipped with three digital output terminals, that is, one RO, and two DOs as standard. Each DO/RO terminal can be assigned with a specific function.

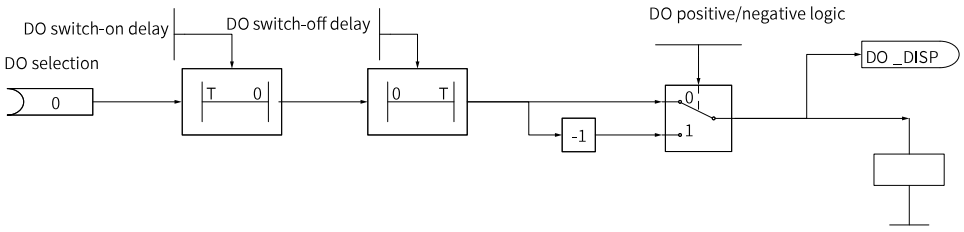


Figure 3-49 DO data flow diagram

Setting

The DO/RO terminals can be set through parameter groups (E1-00 to E1-38). For a list of related parameters, see E1-00 to E1-38. For details on DO/RO function selection, see parameters E1-00 and E1-04 to E1-05 (MD600A).

Instances

When the RO1 output source (E1-36) is set to “output function” (0000), to perform the following function: "RO1 outputs an active signal when the AC drive fails,” do as follows.

1. Allocate RO1 with function "Fault output" (E1-00 = 02).
2. Sets the polarity of the RO, DO, and VDO terminals (according to the bit sequence).
   Value description

   0: Positive logic

   The output levels of RO, FMR, DO, and VDO are set to a positive logic.

   1: Negative logic

   Set the output levels of RO, FMR, DO, and VDO to take the negative logic.

   Set the output source of RO1 to “Output function” (E1-36 = 0000).

After setting the preceding steps, when a fault of the AC drive occurs, the RO1 outputs an active signal. When the fault is cleared, the RO1 relay outputs an inactive level.

DO1 and DO2 terminals are unique to MD600A and MD600S features a single RO1 terminal.

Param.	Name	Default	Value Range	Descriptions
E1-00	RO1 output function selection	2	0 to 43	See . *“Table 3–16 Description of E1-00” on page 257*
E1-04	DO1 function selection (for MD600A)	1		
E1-05	DO2 function selection (for MD600A)	4		
E1-16	RO1 switch-on delay time	0.0s	0.0s to 3600.0s	Sets the RO1 switch-on delay time. RO outputs an active signal only after the set delay time elapses.
E1-17	RO1 switch-off delay time	0.0s	0.0s to 3600.0s	Sets the RO1 switch-off delay time. RO outputs an inactive signal only after the set delay time elapses.
E1-24	DO1 switch-on delay time (MD600A)	0.0s	0.0s to 3600.0s	DO1 switch-on delay time DO outputs an active signal only after the set delay time elapses.

Param.	Name	Default	Value Range	Descriptions
E1-25	DO1 switch-off delay time (MD600A)	0.0s	0.0s to 3600.0s	Sets the DO1 switch-off delay time. DO outputs an inactive signal only after the set delay time elapses.
E1-26	DO2 switch-on delay time (MD600A)	0.0s	0.0s to 3600.0s	DO2 switch-on delay time DO outputs an active signal only after the set delay time elapses.
E1-27	DO2 switch-off delay time (MD600A)	0.0s	0.0s to 3600.0s	Sets the DO2 switch-off delay time. DO outputs an inactive signal only after the set delay time elapses.
E1-36	DO/RO/VDO output source	0x0	Bit 0: RO1 output source 0: Output function 1: Forced value bit1 to bit3: Reserved 0: Output function 1: Forced value bit4 to bit5: DO1 to DO2 output source (MD600A) 0: Output function 1: Forced value bit6 to bit9: Reserved 0: Output function 1: Forced value bit10 to bit15: VDO1 to VDO6 output source 0: Output function 1: Forced value	Sets the output source of RO, DO, and VDO (according to the bit sequence). Value description 0: The DO/RO/VDO output depends on E1-00, E1-04 to E1-05, and E1-10 to E1-15. 1: The DO/RO/VDO output depends on E1-37.

Param.	Name	Default	Value Range	Descriptions
E1-37	DO/RO/VDO forced data	0x0	Bit 0: RO1 setting 0: Low level 1: High level bit1 to bit3: Reserved 0: Low level 1: High level bit4: DO1 setting (MD600A) 0: Low level 1: High level bit5: DO2 setting (MD600A) 0: Low level 1: High level bit6 to bit9: Reserved 0: Low level 1: High level bit10 to bit15: VDO1 to VDO6 settings 0: Low level 1: High level	This parameter is used to set the level state of RO/DO/VDO forcibly according to the bit sequence. Value description 0: Force low level of RO, FMR, DO, and VDO. 1: Force high level of RO, FMR, DO, and VDO. Additional information: Valid when the corresponding bit of E1-36 is 1. The output has no relation with hardware.
E1-38	DO/RO/VDO polarity selection	0	Bit 0: RO1 0: Positive logic 1: Negative logic bit1 to bit3: Reserved 0: Positive logic 1: Negative logic Bit 4: DO1(MD600A) 0: Positive logic 1: Negative logic bit5: DO2(MD600A) 0: Positive logic 1: Negative logic bit6 to bit9: Reserved 0: Positive logic 1: Negative logic bit10 to bit15: VDO1 to VDO6 0: Positive logic 1: Negative logic	bit0 to bit15 of this parameter specify the polarities of the DO, RO, and VDO terminals. 0: Positive logic The output levels of DO and VDO are set to a positive logic 1: Negative logic The output levels of DO and VDO are set to a negative logic

Table 3–16 Description of E1-00

Value Range	Function	Description
0	No output	The output terminal has no function.
1	AC drive running	When the drive is operating and outputs frequency (can be zero), the terminal outputs an active signal.
2	Fault output	When the AC drive stops due to a fault (coast to stop, stop at maximum capability, quick stop, or decelerate to stop), the terminal outputs the active signal.
3	Frequency-level detection FDT1 output	When the running frequency exceeds the frequency detection value, the terminal outputs an active signal. When the running frequency falls below the result of the frequency detection value minus the FDT hysteresis (P0-34 x P0-35), the terminal stops outputting the active signal.
4	Frequency reached	When the running frequency of the AC drive is within a specific range (target frequency ± P0-38 x A2-04), the terminal outputs an active signal.
5	Running at zero speed (no output at stop)	The terminal outputs an active signal when the AC drive is running and its output frequency is 0. When the AC drive is in the stop state, the signal is inactive.
6	Motor overload pre-alarm	Before motor overload protection, the servo drive determines whether the motor load exceeds the overload warning threshold according to the overload warning coefficient (d1-47). If the threshold is exceeded, the terminal outputs an active signal. (For calculation of the alarm threshold, see the description of motor overload protection.)
7	Drive overload pre-alarm	The terminal outputs an active signal 10s before AC drive overload protection applies.
11	Simple PLC cycle completed	When the simple PLC completes one cycle, the terminal outputs a pulse signal with the width of 250 ms.
12	Cumulative running time reached	If the accumulative operating time of the AC drive exceeds the time set by the combination of P0-17 and P0-19, the terminal outputs an active signal
14	Torque limit reach	The terminal outputs an active signal when the output torque reaches the torque limit in the speed control mode.
15	Ready to run	The terminal outputs an active signal when the drive is in the normal state after power-on.
17	Frequency upper limit reached	The upper limit is the smaller value by comparing the maximum motor frequency and the upper limit frequency of D1-04 and D1-07 (forward/reverse). When the running frequency reaches the upper limit, the terminal outputs an active signal
18	Frequency lower limit reached (no output at stop)	The lower limit is the larger value by comparing the motor minimum frequency and the lower limit frequency of DI-05 and D1-08 (forward/reverse). If P0-11 is set to 1 (stop) and 3 (coast to stop), the AC drive does not run and the terminal outputs an inactive signal when the set frequency is lower than the value of C4-11. If P0-11 is set to 0 (run at frequency lower limit) or 2 (run at zero speed), the terminal outputs an active signal and the AC drive runs when the operation frequency reaches the frequency lower limit.
19	Undervoltage state output	The terminal outputs an active signal when the drive is in the undervoltage state.
20	Communication control	The active or inactive state of the terminal is controlled by the setpoint of communication address 0x2001 or 0x7312. (The n0-12 compatibility mode must be enabled to write to 0x2001 address.)

Value Range	Function	Description
23	Running at zero speed 2 (output at stop)	The terminal outputs an active signal when the AC drive is running and its output frequency is 0. The signal is still active when the AC drive stops.
24	Cumulative power-on time reached	The terminal outputs an active signal when the cumulative power-on time of the AC drive (Ad-02/Ad-03) exceeds the time defined by P0-16/P0-18.
25	Frequency-level detection FDT2 output	The terminal outputs an active signal when the running frequency exceeds the frequency detection value and stops outputting the active signal when the running frequency is lower than the result of the detection value minus the frequency detection hysteresis (P0-36 x P0-37).
26	Frequency 1 reached	The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by P0-39 (Detection frequency 1). Frequency detection range: (P0-39 – P0-40) x C4-10 (maximum frequency) to (P0-39 + P0-40) x C4-10.
27	Frequency 2 reached	The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by P0-41 (Detection frequency 2). Frequency detection range: (P0-41 – P0-42) x C4-10 (maximum frequency) to (P0-41 + P0-42) x C4-10.
28	Current 1 reached	The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by P0-43 (Detection current 1). Current detection range = (P0-43 – P0-44) x C4-03 (rated motor current) to (P0-43 + P0-44) x C4-03.
29	Current 2 reached	The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by P0-45 (Detection current 2). Current detection range = (P0-45 – P0-46) x C4-03 (rated motor current) to (P0-45 + P0-46) x C4-03.
30	Timing reached	When the timing function set by P0-13 is enabled and the operating time reaches the set timing duration, the terminal outputs an active signal. The timing duration is defined by P0-14 and P0-15.
31	AI1 input limit exceeded	An “active” signal will be outputted when AI1 value is higher than E2-14 or lower than E3-15.
32	Three phase loss	The terminal outputs an "active" signal when the AC drive encounters phase loss.
33	Reverse running	The terminal outputs an active signal when the drive is operating in the reverse direction.
34	Zero current state	When the output current of the drive is within the zero current range for a duration longer than that defined by P0-48 (zero current detection delay), the terminal outputs an active signal. Zero current detection range: 0 to P0-47 x Rated motor current.
35	Module temperature reached	The terminal outputs an active signal when A2-33 (Heatsink temperature of the inverter module) reaches the value of P0-33 (module temperature threshold).
36	Output current overlimit	When the output current of the AC drive is higher than P0-49 (output current overlimit threshold) for a period longer than P0-50 (Delay time for output current overlimit detection), the terminal outputs an active signal.
37	Frequency lower limit reached (output at stop)	The lower limit frequency is the larger value by comparing the minimum motor frequency and the lower limit frequency of DI-05 and D1-08 (forward + reverse). When the set target frequency reaches the lower limit, the terminal outputs an active signal even the AC drive is in the stop state.
38	Abnormality (fault/ minor fault/warning)	When the AC drive encounters abnormality including a fault/minor fault/ warning, the RO terminal outputs an active signal.
40	Current operating time reached	When the current operating time of the drive exceeds the time defined by P0-20 (Current running time reach), the terminal outputs an active signal.

Value Range	Function	Description
41	Fault output (excluding undervoltage)	41: Fault output (undervoltage excluded) When a fault occurs on the AC drive (undervoltage excluded), the DO terminal outputs an active signal.
43	Minor fault or warning	When the AC drive encounters abnormality including a minor fault/warning, the RO terminal outputs an active signal. For fault protection action, refer to H1-00 to H1-13.

Note

By default, the output is active at high level and inactive at low level.

3.7.3 Virtual Digital Input Terminal (VDI) Functions

Description

The VDI function refers to the virtual digital input terminal. The AC drive is equipped with six multi-functional DI terminals (VDI1 to VDI6) by default. Each VDI terminal can be assigned with a specific function like DI.

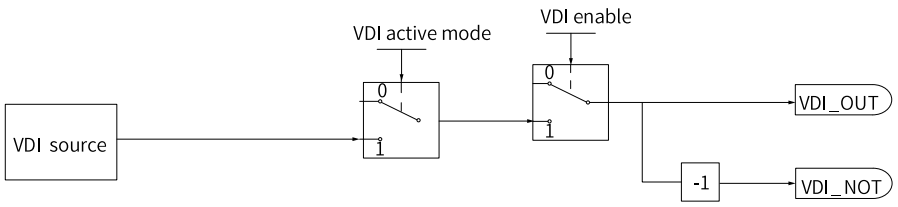


Figure 3-50 VDI data flow diagram

Setting

The VDI terminals can be set through parameter groups (E0-10 to E0-15). For a list of related parameters, see E0-00 to E0-57. For details on VDI function selection, see parameters E0-10 to E0-15.

Instances

When the VDI1 and VDI2 active mode selection (E0-52) is set to high level active (0x0000), 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 = 01).
2. Set the VDI2 function to "Terminal control IN2" (E0-11 = 02).
3. Set b1 to 1: The command source to terminal control.
4. Set the start/stop module mode (b9-01 = 3).
5. Set the VDI forced data (E0-56).

After setting the preceding steps, when VDI1 forced input is active (E0-56=0x0400) and VDI2 is inactive, the AC drive is in forward running state. When VDI2 input is active (E0-56=0x0800) and VDI1 is inactive, the AC drive is in reverse running state.

Parameter	Description	Default	Value Range	Descriptions
E0-10	VDI1 function selection	0	0 to 80. Function 30 (pulse frequency input) is only available for E0-03.	For details, see *"3.7.1 Digital Input (DI) Terminal Functions" on page 240*.
E0-11	VDI1 function selection	0		
E0-12	VDI1 function selection	0		
E0-13	VDI1 function selection	0		
E0-14	VDI5 function	0		
E0-15	VDI1 function selection	0		
E0-50	VDI1 source	1	1: Forced value 4: AI1 11-13: DI1 to DI3 14: DI4/HDI 15: DI5 (MD600A) 22-26: VDI2 to VDI6 51: RO1 55: DO1 (MD600A) 56: DO2 (MD600A) 61-66: VDO1 to VDO6	Sets the VDI1 source. Forced value The forced value is set according to E0-56. 4: AI1 - The DI setting source is based on the comparison between AI1 input and E2-35 and E2-36 settings. 5: AI2 - The DI setting source is based on the comparison between AI1 input and E2-35 and E2-36 settings. 11 to 15: DI1 to VDI6 - Set the source according to the output state of DI1 to DI5. 17: DI7/HDI - Source is set according to DI5 output state. 22 to 26: VDI2 to VDI6 - Set the source according to the output state of VDI2 to VDI6. 51: RO1 - Source is set according to RO1 output state. 52: FMR - Source is set according to FMR output state. 53: DO1 - Source is set according to DO1 output state. 61 to 66: VDO1 to VDO6 - Set the source according to the output state of VDO1 to VDO6.
E0-51	VDI2 source	1	Same as E0-50	Same as E0-50
E0-52	VDI3 source	1	Same as E0-50	Same as E0-50
E0-53	VDI4 source	1	Same as E0-50	Same as E0-50
E0-54	VDI5 source	1	Same as E0-50	Same as E0-50
E0-55	VDI6 source	1	Same as E0-50	Same as E0-50

3.7.4 Virtual Digital Output Terminal (VDO) Functions

Description

The VDO function refers to the virtual digital output terminal. The AC drive is equipped with six multi-function relays (VDO1 to VDO6) as standard. Each VDO terminal can be assigned with a specific function like DO. The VDO and VDO can be used together to implement flexible control methods and simple logic control.

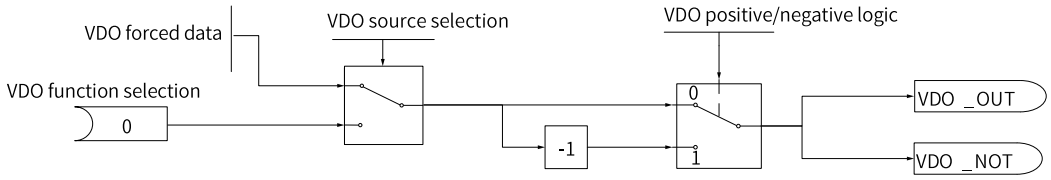


Figure 3-51 VDO data flow diagram

Setting

The VDO terminals can be set through parameter groups (E1-10 to E1-15). For a list of related parameters, see E1-00 to E1-38. For details on VDO function selection, see parameters E1-10 to E1-15.

Instances

When the RO1 output source (E1-36) is set to “output function” (0000), to perform the following function: "RO1 outputs an active signal when the AC drive fails,” do as follows. Do as follows.

1. Allocate VDO1 with function "Fault output" (E1-10 = 02).
2. Set the output source of VDO1 to “Output function” (E1-36 = 0000).

After setting the preceding steps, when a fault of the AC drive occurs, the VDO1 outputs an active signal. When the fault is cleared, the VDO1 relay outputs an inactive level.

Parameter	Name	Default	Value Range	Descriptions
E1-10	VDO1 function selection	0	0 to 43	For details, see . *“Table 3–16” on page 257*
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

3.7.5 High-Speed Digital Input (HDI)

Description

The HDI function refers to the high-speed digital input terminal. Model MD600S and MD600A are equipped with one multi-functional DI (DI4 is used as the pulse input terminal).

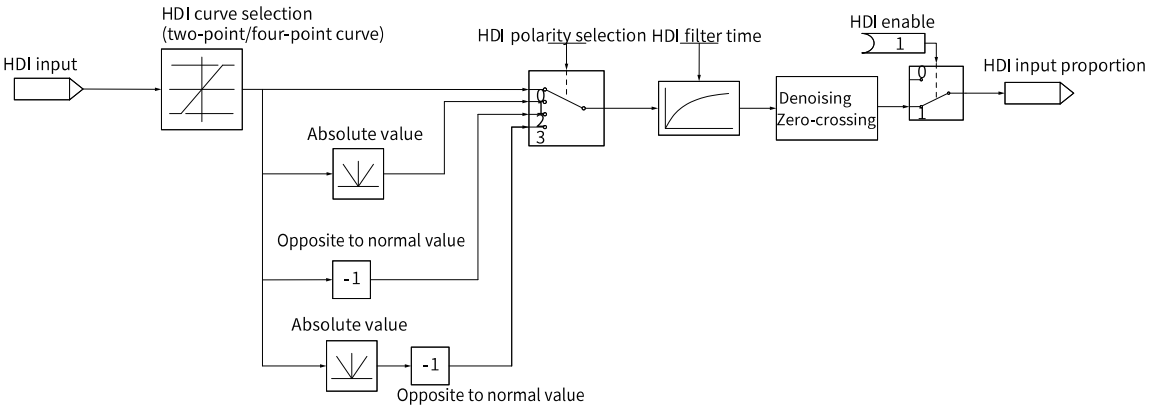


Figure 3-52 HDI data flow diagram

Setting

The HDI terminal can be set by setting parameter E0-03 (DI4 function selection) to function 30. For details of the HDI terminal, see parameter group E4. Pulse input is only available for DI4. Specifications of pulse reference signal: 15 V to 30 V (voltage) and 0 KHz to 20 KHz (frequency)

You can set the relationship between the percentage and the pulse frequency input from DI4, such as defined by two-point curve and four-point curve. Set the two-point curve through E4-07 to E4-11, and set the four-point curve through E4-12 to E4-19. When pulse input is used as the frequency source, the pulse input 100% corresponds to the value of A2-04 (per-unit base value of frequency).

Take the two-point curve setting as an example. To set the relationship between the HDI frequency input and the two-point curve to "0 kHz to 10 kHz corresponds to 0% to 100%", set the two-point curve parameters as follows:

- Set E4-08 to 0.00 kHz.
- Set E4-09 to 0.0%.
- Set E4-10 to 10.00 kHz.
- Set E4-11 to 100.0%.

The two-point curve is shown in the following figure.

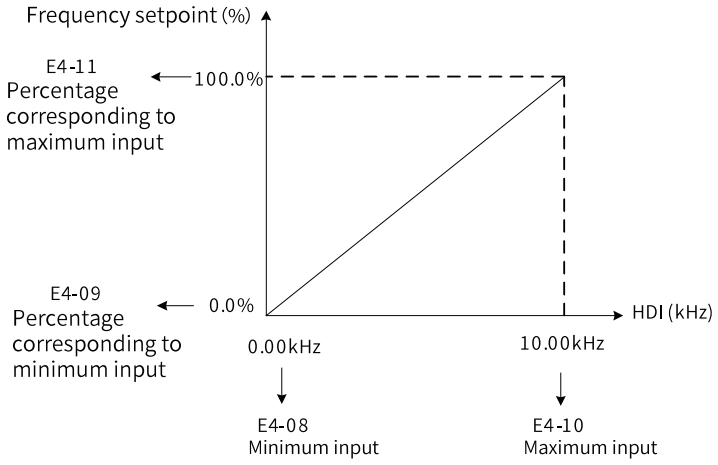


Figure 3-53 HDI two-point curve

The four-point curve is similar to the two-point curve. The difference is that the four-point curve divides the curve into three segments, enabling more flexible relationship. Depending on the application scenario, you can select a two-point curve or a four-point curve through E4-07.

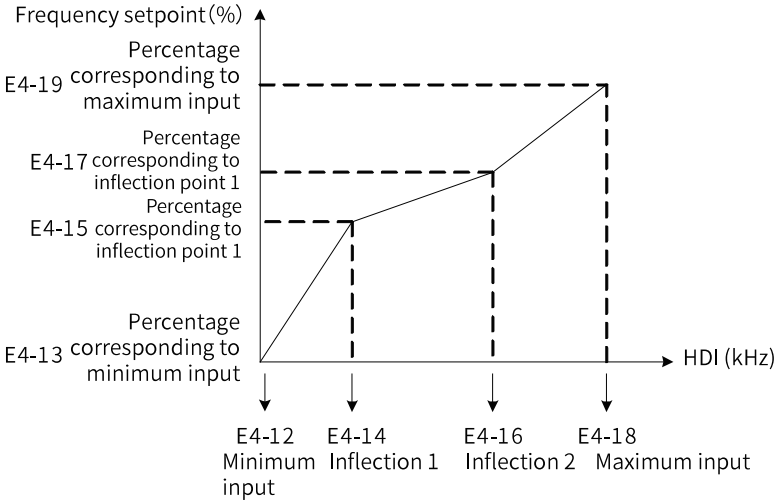


Figure 3-54 HDI four-point curve

Instances

To perform the following function: "HDI as main frequency source", do as follows.

1. Assign the function "High-speed pulse input" to DI4 terminal (Set E0-03 to 30).
2. To set the function of HDI curve to "0 Hz to 20 kHz corresponds to 0% to 100%",

- Set E4-08 to 0.00 kHz.
- Set E4-09 to 0.0%.
- Set E4-10 to 20.00 kHz.
- Set E4-11 to 100.0%.

3. Set the frequency source to HDI pulse input (Set b5-00 = 5).

After setting the preceding steps, when HDI input is 0 Hz, the main frequency is set to 0 Hz. When HDI input is 10 kHz, the main frequency is set to 50% of C4-06 [Rated motor frequency].

Param.	Name	Default	Value Range	Descriptions
E4-00	DI4/HDI terminal type selection	0	0 to 1	Defines the DI function assigned to DI4. Value description 0: Use as HDI - DI4 terminal is used as HDI. 1: Used as DI - DI4 is used as normal DI.
E4-01	HDI input	0	0 to 1	Displays HDI state. Value description 0: Disable HDI is disabled. 1: Enabled HDI is enabled. Additional information: Whether HDI is enabled is determined by E4-00.

Param.	Name	Default	Value Range	Descriptions
E4-02	HDI hardware source selection	0	0 to 1	Used to select the HDI source. 0: Input from the DI4 terminal 1: Forced value
E4-03	HDI forced setpoint	1.00 kHz	0.00 kHz to 100.00 kHz	Sets the forced HDI value. Additional information: Valid when HDI input is enabled and the value of E4-02 is set to 1.
E4-07	HDI curve setting	0	Ones: HDO selection Selects the HDI curve. 0: Two-point curve 1: 4-point curve Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Selects the HDI curve, two-point curve or four-point curve. Value description 0: Select the two-point curve. 1: Select the four-point curve.
E4-08	Minimum input of two-point HDI curve	0.00 kHz	0.00 kHz to E4-10	Sets the minimum input point of x axis on HDI two-point curve, that is, the minimum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-08 corresponds to the x axis of the minimum pulse input, that is, the minimum input frequency of the pulse.

Param.	Name	Default	Value Range	Descriptions
E4-09	Percentage corresponding to minimum input of two-point HDI curve	0.0%	-800.0% to 800.0%	Sets the y axis corresponding to the minimum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the minimum pulse input. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-09 corresponds to the y axis of minimum pulse input, that is, the set value corresponding to the minimum pulse input.
E4-10	Maximum input of two-point HDI curve	20.00 kHz	E4-08 to 20.00 kHz	Sets the maximum input point of x axis on HDI two-point curve, that is, the maximum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-10 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.
E4-11	Percentage corresponding to maximum input of two-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 2-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 2-point linear graph with two points: a minimum input point and a maximum input point. E4-11 corresponds to the y axis of maximum pulse input, that is, the set value corresponding to the maximum pulse input.

Param.	Name	Default	Value Range	Descriptions
E4-12	Minimum input of four-point HDI curve	0.00 kHz	0.00 kHz to E4-14	Sets the minimum input point of x axis on HDI four-point curve, that is, the minimum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. E4-12 corresponds to the x axis of the minimum pulse input, that is, the minimum input frequency of the pulse.
E4-13	Percentage corresponding to minimum input of four-point HDI curve	-100.0%	-800.0% to 800.0%	Sets the y axis corresponding to HDI curve minimum input point, that is, the per-unit value in percentage corresponding to the minimum pulse input. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. E4-13 corresponds to the y axis of minimum pulse input, that is, the set value corresponding to the minimum pulse input.
E4-14	Inflection point 1 input of four-point HDI curve	5.00 kHz	E4-12 to E4-16	Sets the inflection point 1 of x axis on HDI four-point curve, that is, the pulse input frequency at inflection point 1. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. This parameter defines the x-axis value of the inflection 1 input point on the HDI 4-point pulse curve, that is, the inflection 1 pulse input frequency.

Param.	Name	Default	Value Range	Descriptions
E4-15	Percentage corresponding to inflection point 1 input of four-point HDI curve	-30.0%	-800.0% to 800.0%	This parameter defines the y axis corresponding to inflection point 1 on the HDI 4-point pulse curve, that is, the per-unit percentage value corresponding to the value of inflection point 1. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. This parameter defines the y-axis value of the inflection 1 input point on the HDI 4-point pulse curve, that is, the set value corresponding to the inflection 1 pulse input frequency.
E4-16	Inflection point 2 input of four-point HDI curve	10.00 kHz	E4-14 to E4-18	Sets the inflection point 2 of x axis on HDI four-point curve, that is, the pulse input frequency at inflection point 2. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. This parameter defines the x-axis value of the inflection 2 input point on the HDI 4-point pulse curve, that is, the inflection 2 pulse input frequency.
E4-17	Percentage corresponding to inflection point 2 input of four-point HDI curve	30.0%	-800.0% to 800.0%	This parameter defines the y axis corresponding to inflection point 2 on the HDI 4-point pulse curve, that is, the per-unit percentage value corresponding to the value of inflection point 2. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. This parameter defines the y-axis value of the inflection 2 input point on the HDI 4-point pulse curve, that is, the set value corresponding to the inflection 2 pulse input frequency.

Param.	Name	Default	Value Range	Descriptions
E4-18	Maximum input of four-point HDI curve	20.00 kHz	E4-16 to 20.00 kHz	Sets the maximum input point of x axis on HDI four-point curve, that is, the maximum pulse input frequency. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. E4-18 corresponds to the x axis of the maximum pulse input, that is, the maximum input frequency of the pulse.
E4-19	Percentage corresponding to maximum input of four-point HDI curve	100.0%	-800.0% to 800.0%	Sets the y axis corresponding to the maximum input point on HDI 4-point curve, that is, the per-unit value in percentage corresponding to the maximum pulse input. Additional information: When the high-speed pulse at the DI4 terminal is used as the source of the main frequency reference, it is necessary to define a curve that maps pulse frequencies to frequency references, where the frequency references are percentages of the rated frequency (C4-06). The x axis of the curve represents the pulse frequencies at the DI4 terminal, and the y axis represents the percentages of the rated frequency (C4-06). The curve is a 4-point linear graph with four points: a minimum input point, two inflection points, and a maximum input point. E4-19 corresponds to the y axis of maximum pulse input, that is, the set value corresponding to the maximum pulse input.
E4-32	HDI filter time	0.10	0.00s to 10.00s	Set the HDI filter time Additional information: 1. Filter the per-unit percentage value obtained after the pulse input is processed by the HDI curve (not filtering the HDI sampling value). 2. When on-site signals are prone to interference, you may increase the HDI filter time to enhance the stability of the per-unit percentage value input to the AC drive.

Param.	Name	Default	Value Range	Descriptions
E4-33	HDI polarity selection	0	0 to 3	Defines the processing mode of HDI sampling values. Value description Ones: HDI 0: Norma value - The per-unit value in percentage obtained after the HDI input is processed by the HDI curve. 1: Absolute value - The absolute value of the per-unit value in percentage obtained after the HDI input is processed by the HDI curve. 2: Opposite to the normal value - Opposite to the per-unit value in percentage obtained after the HDI input is processed by the HDI curve. 3: Opposite to the absolute value - Opposite to the absolute value of the per-unit value in percentage obtained after the HDI input is processed by the HDI curve.
E4-34	HDI denoising threshold	0.0%	0.0% to 10.0%	Sets the HDI denoising time. Additional information: The following value refers to the per-unit value in percentage obtained after HDI input is processed by the HDI curve. If the absolute value of the difference between the current value and the previous value is within the threshold range, the noise is removed. That means the per-unit percentage value after the AI curve processing remains unchanged from the previous value.
E4-35	HDI curve upper/lower limit	0	Ones: HDI 0: Limited 1: Not limited Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Defines the output when the HDI pulse input is lower than the minimum input of the curve. Value description Ones position: 0: Limited - When HDI input is lower than minimum input of curve, the per unit percentage value on the curve is the corresponding value of minimum input. 1: Not limited - When the HDI input is lower than the minimum input of the curve, the interpolation calculation continues based on the curve.
E4-36	HDI impulse noise	0 ms	0 ms to 1000 ms	Set the filter duration time of HDI impulse noise. The impulse noise threshold is 250 Hz. Additional information: 1. For HDI hardware sampling, if the absolute value of the difference between this input and the last input is greater than the threshold of 250 Hz and the filter duration time is maintained, the current HDI signal is input normally. 2. If the absolute value of the difference between this input and the last input is less than the threshold of 250 Hz, the current HDI signal is directly accepted as input.

3.7.6 Analog Input Terminal (AI)

Description

The AI function refers to the analog input terminal. The MD600S and MD600A are equipped with an analog input terminal (input range: -10 V to 10 V). The AI terminal can select input curve processing or gain and deviation processing to implement corresponding functions.

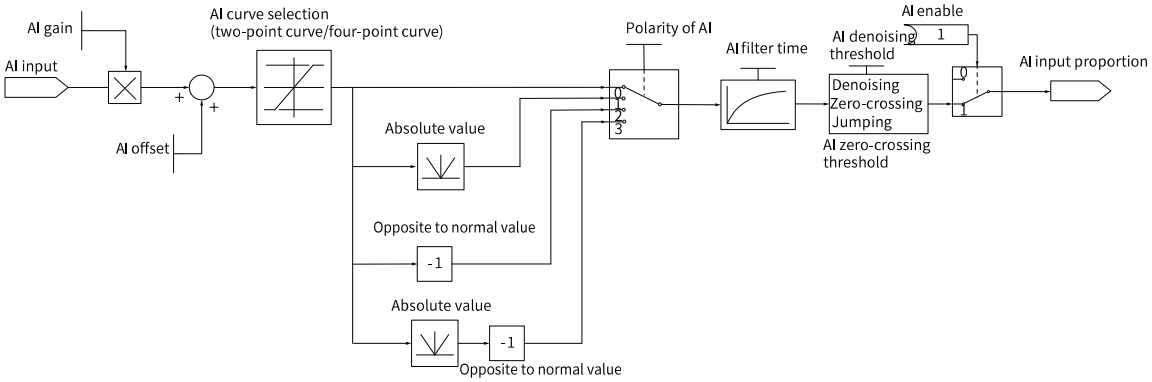


Figure 3-55 AI data flow diagram

Setting

The AI terminals can be set through parameter groups (E2-00 to E0-68). For a list of related parameters, see E2-00 to E0-68.

- **Curve setting methods**
  There are five types of AI curves in total. Curves 1, 2, and 3 are 2-point curves, with relevant parameters being E2-40 to E2-67. Curves 4 and 5 are four-point curves.

  In the following example, AI curve 1 is set through E2-40 to E2-43.

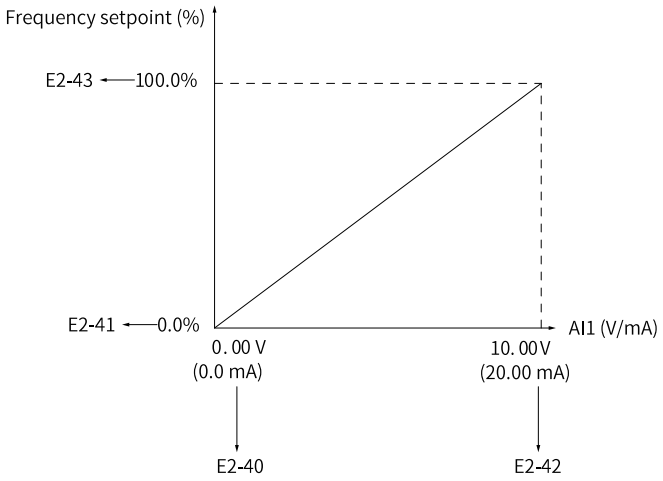


Figure 3-56 Setting AI curve 1

When the AI is used as the frequency setting source, the voltage/current input 100% corresponds to the value of A2-04 (per-unit base value of frequency).

When the analog current input is used, 0 mA to 20 mA current corresponds to 0 V to 10 V voltage.

Curve 2 and curve 3 are set in a similar way as curve 1. E2-44 to E2-47 are used to set curve 2. E2-48 to E2-51 are used to set curve 3.

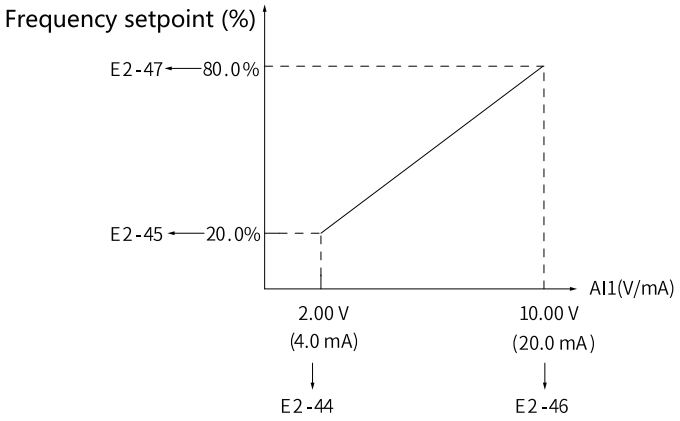


Figure 3-57 Setting AI curve 2

The function of curve 4 and curve 5 is similar to that of curve 1 to curve 3, but curve 1 to curve 3 are straight lines, and curve 4 and curve 5 are 4-point curves. The x axis in AI curves 4 and 5 represents the analog input voltage (or current), and the y axis represents the set value corresponding to the analog input, that is, the percentage relative to the per-unit base value of frequency (A2-04). The four points on curves 4 and 5 are the minimum input point, inflection point 1, inflection point 2, and maximum input point.

When setting curve 4 and curve 5, the minimum input voltage, inflection point 1 voltage, inflection point 2 voltage, and maximum input voltage must be increased in ascending order. E2-52 to E2-59 are used to set curve 4. E2-60 to E2-67 are used to set curve 5.

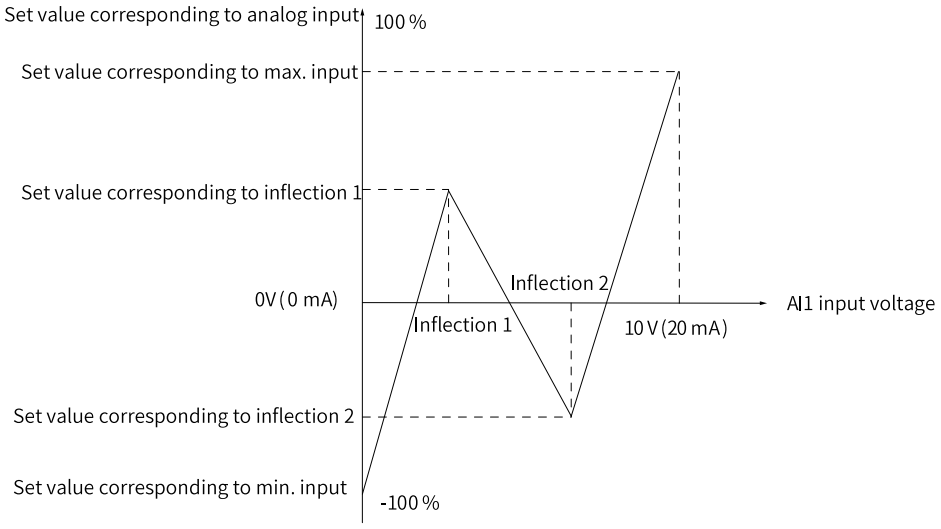


Figure 3-58 Schematic diagram for curve 4 and curve 5

- **Select AI curve and filtering for AI terminal**

  The ones place of E2-38 is used to set the curve for AI1. The AI can use any of the five curves.

  The longer the AI input filter time, the stronger the anti-interference capability, but the slower the adjustment response. The shorter the filter time, the quicker the adjustment response, but the weaker the anti-interference capability. If the analog signal is prone to interference, increase the

filter time to stabilize the detected analog signal. However, increasing the filter time will slow the response speed of analog detection. Set the filter time properly based on actual conditions.

- **Select AI as the main frequency reference source**

  The control board provides one analog input (AI) terminal (AI1). AI1 supports voltage input of 0 V to 10 V or current input of 0 mA to 20 mA, which can be selected by DIP switch S3 on the control board. The following describes how to set the AI terminal as the main frequency reference source.

Terminal Assignment			DIP Switch Description
Pin	ON	OFF	
S3	Current	Voltage	ON: Current input mode and the input range is 0 mA to 20 mA
			OFF: Voltage input mode and the input range is -10 V to 10 V.

For example, assume that curve 1 is selected for AI1 (the ones place of E2-38 is set to 1) and voltage-type AI1 is used as the main frequency reference source. To make input voltage of 2 V to 10 V be mapped to frequency of 10 Hz to 40 Hz, set as follows.

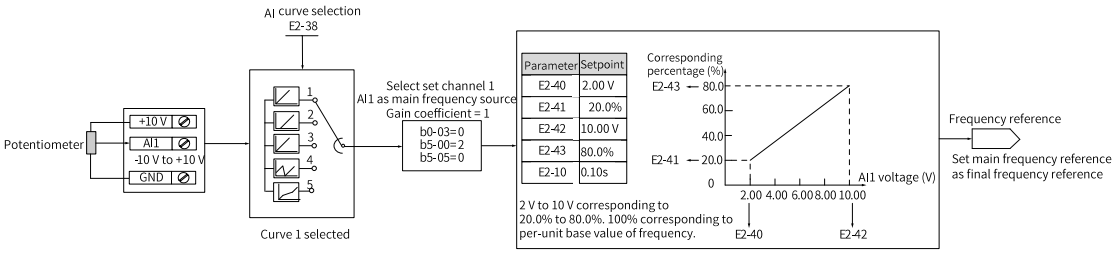


Figure 3-59 Parameter settings for voltage-type AI1 to be used as the main frequency reference source

AI1 supports analog voltage input (0 V to 10 V) or analog current input (0 mA to 20 mA).

When AI1 is used for analog current input, input current of 0 mA to 20 mA corresponds to input voltage of 0 V to 10 V. If the input current ranges from 4 mA to 20 mA, current of 4 mA corresponds to voltage of 2 V, and current of 20 mA corresponds to voltage of 10 V.

For example, assume that curve 2 is selected for AI1 (the ones place of E2-38 is set to 2) and current-type AI1 is used as the main frequency reference source. To make input current of 4 mA to 20 mA be mapped to frequency of 0 Hz to 50 Hz, set as follows.

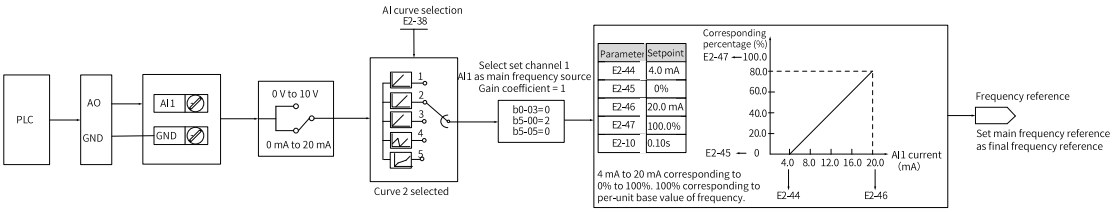


Figure 3-60 Parameter setting for current-type AI2 to be used as main frequency reference source

- **Use AI as DI**

  The parameters E2-35 (High level judgment threshold when AI uses as DI) and E2-36 (Low level judgment threshold when AI uses as DI) are set to use AI as DI. When an AI is used as an DI, the AI state is high level if the input voltage of the AI is higher than 7 V and is low level if the input voltage of the AI is lower than 3 V. The AI is in hysteresis state if the input voltage ranges from 3 V and 7 V. The following figure shows the relationship between AI input voltages and DI states.

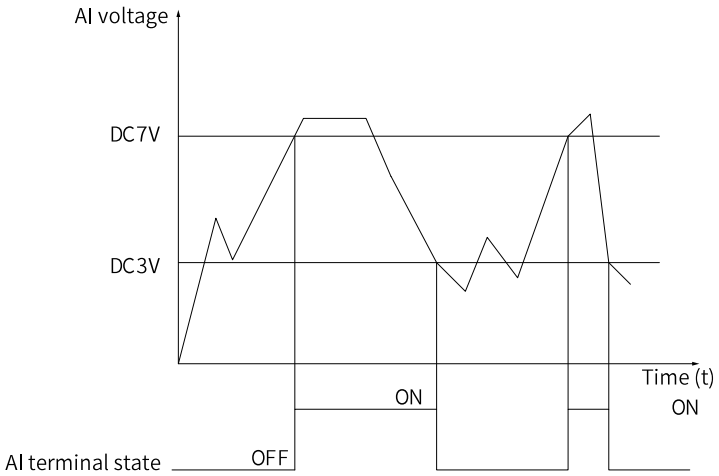


Figure 3-61 Relationship between AI input voltages and DI states

Instances

The following functions are performed: "AI as running frequency source". Do as follows.

1. Set AI1 curve to "0 V to 10 V corresponds to 0% to 100%":
   Set E2-40 (minimum input of AI curve 1) to 0.00 V.

   Set E2-41 (Percentage corresponding to minimum input of AI curve 1) to 0.0%.

   Set E2-42 (maximum input of AI curve 1) to 10.00 V.

   Set E2-43 (Percentage corresponding to maximum input of AI curve 1) to 100.0%.

2. Set the frequency source to AI1 (b5-00 = 02).

After setting the preceding steps, when AI1 input 5 V power, the AC drive obtains the AI1 curve conversion of 50%, and the AC drive runs at 50% of C4-06 [Rated motor frequency]. When AI1 input voltage is changed, the running frequency changes according to the AI1 curve.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
E2-00	AI hardware source selection	0	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	This parameter specifies the hardware source of AI. Value description Ones: AI1 source 0: hardware sampling. The AI value is sourced from hardware sampling. 1: Forced value. AI1 voltage is set forcibly through E2-01.
E2-01	AI1 forced value	0.00 V	-10.00 V to 10.00 V	Set the forced value of AI1. Additional information: Valid when the ones place of E2-00 is set to 1.

Param.	Name	Default	Value Range	Descriptions
E2-07	AI1 gain	0	-10.00 to 10.00	This parameter defines the gain multiple of AI1 analog sampling voltage. Additional information: Used with E2-08, the AI1 input voltage can be amplified and offset (y=kx+b).
E2-08	AI1 offset	0.00V	-10.00 V to 10.00 V	Defines the offset coefficient of AI1 analog sampling voltage. Additional information: Used with E2-07, the AI1 input voltage can be amplified and offset (y=kx+b).
E2-09	AI1 denoising threshold	0.0%	0.0% to 100.0%	Defines the AI1 denoising threshold. Additional information: The following value refers to the per-unit value in percentage obtained after AI1 is processed by the AI curve. If the absolute value of the difference between the current value and the previous value is within the threshold range, the noise is removed. That means the per-unit percentage value after the AI curve processing remains unchanged from the previous value.
E2-10	AI1 filter time	0.10s	0.00s to 10.00s	This parameter indicates the software filter time of AI1. Additional information: 1. The filter acts directly on AI hardware sampling. 2. The longer the AI filter time, the stronger the anti-interference capability and the slower the speed of response to analog detection. The shorter the AI filter time, the weaker the anti-interference capability and the faster the speed of response to analog detection. 3. When on-site analog signals are prone to interference, you may increase the AI filter time to enhance the stability of the analog signals.
E2-11	Threshold for AI1 set to zero	0.0%	100.0%	Defines the threshold that AI1 is set to zero. If the per-unit percentage value after the AI curve processing is within this range, 0.0% is output to eliminate the fluctuation near the zero point.
E2-12	AI1 jump point	0.0%	-800.0% to 800.0%	This parameter defines the jump point for AI1. If the difference between the value (per-unit value in percentage obtained after AI1 is processed by the AI curve) and the jump point is within the jump amplitude (E2-13), the value of the jump point will be output.
E2-13	AI1 jump amplitude	0.1%	0.0% to 100.0%	This parameter defines the jump amplitude for AI1. If the difference between the value (per-unit value in percentage obtained after AI1 is processed by the AI curve) and the jump point (E2-12) is within the jump amplitude (E2-13), the value of the jump point will be output.

Param.	Name	Default	Value Range	Descriptions
E2-14	AI1 input upper limit	8.00V	E2-15 to 10.00 V	Sets the upper protective limits of the AI voltage to define whether AI1 voltage is within the set range. Additional information: When the AI1 voltage is higher than the value of E2-14 or lower than the value of E2-15, the DO assigned with "AI1 input limit exceeded" outputs an active signal. In addition, whether the AI disconnection fault E154.3 is reported is also decided by H1-14 fault action protection.
E2-15	AI1 input lower limit	2.00V	0.00 V to E2-14	Sets the lower protective limits of the AI voltage to define whether AI1 voltage is within the set range. Additional information: When the AI1 voltage is higher than the value of E2-15 or lower than the value of E2-14, the DO assigned with "AI1 input limit exceeded" outputs an active signal. In addition, whether the AI disconnection fault E154.3 is reported is also decided by H1-14 fault action protection.
E2-34	AI input protection time	0.01s	0.00S to 1.00s	When the continuous duration of AI input overrun is greater than or equal to the value of this parameter, the AI1 input limit exceeded flag is set.
E2-35	High level judgment threshold when AI uses as DI	7.0V	5.5 V to 9.0 V	Defines the threshold for judging high level when the AI is used as the DI.
E2-36	Low level judgment threshold when AI uses as DI	3.0V	1.0 V to 4.5 V	Defines the threshold for judging low level when the AI is used as the DI.
E2-37	AI polarity selection	0	Ones position: AI1 polarity 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Set AI1 input polarity. Value description Ones: AI1 polarity 0: Normal AI1 input value. 1: Absolute value of AI1 input. 2: Opposite to the normal value. 3: Opposite to the absolute value.

Param.	Name	Default	Value Range	Descriptions
E2-38	AI curve selection	0x0111	Ones place: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens place: Reserved 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds place: MD-BP-M potentiometer curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Thousands place: Reserved	Defines the input/output curve of AI1 and MD-BP-M potentiometers. Value description Ones place: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens place: Reserved 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds place: MD-BP-M potentiometer curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67)

Param.	Name	Default	Value Range	Descriptions
E2-39	AI lower limit selection	0x0	Ones place: Selection when AI1 value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Tens position: Reserved 0: Corresponding to the minimum input 1: 0.0% Hundreds position: Selection when MD- BP-M potentiometer value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Thousands position: Reserved	Defines the output when the AI1 and MD-BP-M potentiometer input is lower than the minimum input of the curve. Value description Ones place: Selection when AI1 value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Tens position: Reserved 0: Corresponding to the minimum input 1: 0.0% Hundreds position: Selection when MD- BP-M potentiometer value < minimum input value 0: Corresponding to the minimum input 1: 0.0%
E2-40	Minimum input of AI curve 1	0.00 V	-10.00 V to E2-42	This parameter defines the minimum input point of x axis on AI curve 1, that is, the minimum analog input voltage (or minimum analog input current). Additional information: 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. The meaning is determined by the AI function. For example, if the AI terminal is selected as the frequency input, the y axis represents the per-unit percentage of the rated motor frequency. 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related parameters are E2-52 to E2-67.
E2-41	Percentage correspond-ing to minimum input of AI curve 1	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.

Param.	Name	Default	Value Range	Descriptions
E2-42	Maximum input of AI curve 1	10.00 V	E2-40 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 1, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.
E2-43	Percentage correspond-ing to maximum input of AI curve 1	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 1 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.
E2-44	Minimum input of AI curve 2	0.00 V	-10.00 V to E2-46	This parameter defines the minimum input point of x axis on AI curve 2, that is, the minimum analog input voltage (or minimum analog input current). Additional information: See E2-40.
E2-45	Percentage correspond-ing to minimum input of AI curve 2	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.
E2-46	Maximum input of AI curve 2	10.00 V	E2-44 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 2, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.
E2-47	Percentage correspond-ing to maximum input of AI curve 2	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 2 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.
E2-48	Minimum input of AI curve 3	0.00 V	-10.00 V to E2-50	This parameter defines the minimum input point of x axis on AI curve 3, that is, the minimum analog input voltage (or minimum analog input current). Additional information: See E2-40.
E2-49	Percentage correspond-ing to minimum input of AI curve 3	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 3 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.
E2-50	Maximum input of AI curve 3	10.00 V	E2-48 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 3, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.

Param.	Name	Default	Value Range	Descriptions
E2-51	Percentage correspond-ing to maximum input of AI curve 3	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 3 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.
E2-52	Minimum input of AI curve 4	0.00 V	-10.00 V to E2-54	This parameter defines the minimum input point of x axis on AI curve 4, that is, the minimum analog input voltage (or minimum analog input current). Additional information: 1. The x axis of the AI curve indicates the analog input voltage (or analog input current), and the y axis indicates the per-unit percentage of the analog input voltage. For example, if the AI terminal is selected as the frequency input, the y axis represents the per-unit percentage of the maximum frequency (C4-10). 2. There are five types of AI curves. Curves 1 to 3 are two-point curves, which are the minimum input point and the maximum input point. The related parameters are E2-40 to E2-51. Curve 4 and curve 5 are four-point curves, that is, the maximum, minimum, and intermediate two inflection points. The related parameters are E2-52 to E2-67.
E2-53	Percentage correspond-ing to minimum input of AI curve 4	0.0%	-800.0% to 800.0%	Sets the y axis of AI curve 4 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.
E2-54	Inflection point 1 input of AI curve 4	3.00 V	E2-52 to E2-56	This parameter defines the inflection 1 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. Additional information: See E2-40.
E2-55	Percentage correspond-ing to inflection point 1 input of AI curve 4	30.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 1 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 1. Additional information: See E2-40.
E2-56	Inflection point 2 input of AI curve 4	6.00 V	E2-54 to E2-58	This parameter defines the inflection 2 of x axis on AI curve 4, that is, the analog input voltage (or analog input current) at inflection 1. Additional information: See E2-40.
E2-57	Percentage correspond-ing to inflection 2 input of AI curve 4	60.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 4, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. Additional information: See E2-40.

Param.	Name	Default	Value Range	Descriptions
E2-58	Maximum input of AI curve 4	10.00 V	E2-56 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 4, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.
E2-59	Percentage correspond-ing to maximum input of AI curve 4	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 4 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.
E2-60	Minimum input of AI curve 5	-10.00 V	-10.00 V to E2-62	This parameter defines the minimum input point of x axis on AI curve 5, that is, the minimum analog input voltage (or minimum analog input current). Additional information: See E2-40.
E2-61	Percentage correspond-ing to minimum input of AI curve 5	-100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 5 minimum input, that is, the per-unit value in percentage corresponding to the minimum analog input. Additional information: See E2-40.
E2-62	Inflection point 1 input of AI curve 5	-3.00 V	E2-60 to E2-64	This parameter defines the inflection 1 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. Additional information: See E2-40.
E2-63	Percentage correspond-ing to inflection point 1 input of AI curve 5	-30.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 1 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. Additional information: See E2-40.
E2-64	Inflection point 2 input of AI curve 5	3.00 V	E2-62 to E2-66	This parameter defines the inflection 2 of x axis on AI curve 5, that is, the analog input voltage (or analog input current) at inflection 1. Additional information: See E2-40.
E2-65	Percentage correspond-ing to inflection 2 input of AI curve 5	30.0%	-800.0% to 800.0%	This parameter defines the y-axis corresponding to inflection point 2 of AI curve 5, that is, the per-unit percentage value corresponding to the analog input of inflection point 2. Additional information: See E2-40.
E2-66	Maximum input of AI curve 5	10.00 V	E2-64 to 10.00 V	This parameter defines the maximum input point of x axis on AI curve 5, that is, the maximum analog input voltage (or maximum analog input current). Additional information: See E2-40.

Param.	Name	Default	Value Range	Descriptions
E2-67	Percentage correspond-ing to maximum input of AI curve 5	100.0%	-800.0% to 800.0%	Sets the y axis of AI curve 5 maximum input, that is, the per-unit value in percentage corresponding to the maximum analog input. Additional information: See E2-40.
E2-68	AI automatic adjustment curve	0	0 to 4134	Set the automatic AI curve correction function. Value description Ones: Sets the point on the curve of the current operation. 0: Disable 1: Select the first point of the correction curve. 2: Select the second point of the correction curve. 3: Select the third point of the correction curve. 4: Select the fourth point of the correction curve. Tens position: Sets which AI channel is corrected. 0: Disable 1: Select AI1 correction as the current action. Hundreds position: Set whether automatic curve correction is enabled. 0: Automatic curve correction disabled 1: Automatic curve correction is enabled. Thousands: Sets the curve type. 0: Enabling or channel is not selected 2: Select the two-point curve. 4: Select the four-point curve. Ten thousands position: Reserved

3.7.7 Analog Output (AO) Terminals

Description

The AO function refers to the analog output terminal. The MD600S is equipped with an analog output terminal (AO1). The MD600A does not have AO terminal. The AO terminal can select any function of the analog output terminal, and the corresponding curve or gain and deviation parameters.

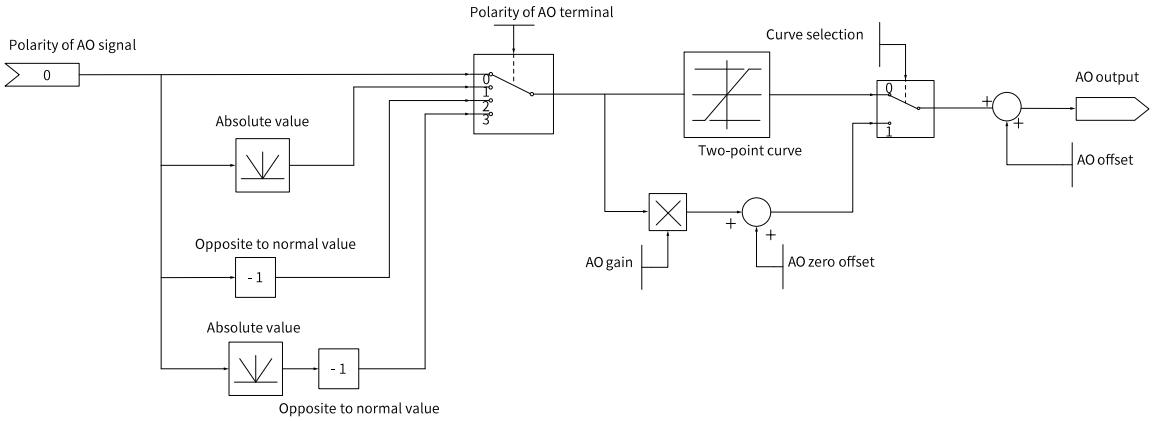


Figure 3-62 AO data flow diagram

Setting

The AO terminals can be set through parameter groups (E3-00 to E3-27). For a list of related parameters, see E3-00 to E3-27. For details on AO function selection, see parameter E3-00.

- Allocate AO1 with function "Operating frequency" (E3-00 = 0).
- To set AO1 curve to "0 V to 10 V corresponds to 0% to 100%":

Set E3-05 to 0.0%, and E3-06 to 0.00 V.

Set E3-07 to 100.0%, and E3-08 to 10.00 V.

Instances

To perform the following function: "AO1 outputs operating frequency", do as follows.

- Allocate AO1 with function "Operating frequency" (E3-00 = 0).
- To set AO1 curve to "0 V to 10 V corresponds to 0% to 100%":
  Set E3-05 to 0.0%, and E3-06 to 0.00 V.

  Set E3-07 to 100.0%, and E3-08 to 10.00 V.

After setting the preceding steps, when the AC drive is running, the AO outputs the voltage that corresponds to the ratio of the AC drive running frequency to rated motor frequency. For example, the rated frequency is 50 Hz and operating frequency is 25 Hz, AO1 gets 50% input, and the output AO corresponds to 5 V.

Parameter	Description	Default	Value Range	Descriptions
E3-00	AO1 output function selection	0	0 to 16	See the following table.
E3-03	AO polarity selection	0	Ones: HDO selection AO1 selection 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Sets the AO output polarity. Value description 0: Normal The output value on the AO curve is not changed. 1: Absolute value The absolute value of the output value on the AO curve is used. 2: Opposite to normal value The value opposite to the output value on the AO curve is used. 3: Opposite to absolute value The value opposite to the absolute value of the output value on the AO curve is used.
E3-04	AO curve selection	0	Ones position: AO1 curve 0: Two-point curve 1: Gain + deviation Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Selects the AO curve. Value description 0: 2-point curve The 2-point curve is selected and set by parameters E3-05 to E3-08. 1: Gain+Offset The gain and deviation is selected and set by parameters E3-17 and E3-18.
E3-05	Minimum input of AO1 curve	0.0%	-800.00% to E3-07	Defines the minimum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-06	Setting corresponding to AO1 curve minimum input	0.00 V	0.00 V to 10.00 V	Defines the y-axis corresponding to the minimum input point of the AO curve, that is, the AO analog voltage.
E3-07	Maximum input of AO1 curve	100.0%	E3-05 to 800%	Defines the maximum x-axis input point of the AO curve, that is, the per-unit percentage of the selected AO function.
E3-08	Setting corresponding to AO1 curve maximum input	10.00 V	0.00 V to 10.00 V	Defines the y-axis corresponding to the maximum input point of the AO curve, that is, the AO analog voltage.

Parameter	Description	Default	Value Range	Descriptions
E3-17	AO1 zero offset coefficient	0.0%	-100.0% to 100.0%	Set the AO zero offset coefficient, which is b in the formula Y=kX+b, as a percentage of 10 V or 20 mA. Additional information: 1. Active when E3-04 is set to 1. 2. In the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). 100% of the AO zero offset coefficient corresponds to 10 V or 20 mA. The standard output refers to the value corresponding to the analog output of 0 V to 10 V (or 0 mA to 20 mA) without zero offset or gain correction.
E3-18	AO1 gain	1.00	-10.00 to 10.00	Sets the AO gain, that is, k in the formula Y = kX + b, as a percentage of 10 V or 20 mA. Additional information: 1: Active when E3-04 is set to 1. 2. In the AO curve, if b indicates zero offset, k indicates gain, and X indicates standard output, the actual output Y is kX plus b (Y = kX + b). 100% of the AO zero offset coefficient corresponds to 10 V or 20 mA. The standard output refers to the value corresponding to the analog output of 0 V to 10 V (or 0 mA to 20 mA) without zero offset or gain correction.
E3-23	AO1 output offset	0.00 V	-10.00 V to 10.00 V	Set the output offset voltage of the AO. The voltage calculated by the AO curve plus this offset gets the final output.
E3-26	AO hardware source selection	0	Ones: HDO selection AO1 source 0: Output function 1: Forced value Tens position: Reserved Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	This parameter specifies the hardware source of AO. Value description 0: Output function The reference source is selected according to parameter E3-00. 1: Forced setpoint The forced output value is selected according to parameter E3-27.
E3-27	AO1 forced value	0.00 V	0.00 V to 10.00 V	Sets the forced value of AO1. Additional information: Active when [E3-26] is 1

The analog output 0 V to 10 V corresponds to 0% to 100%. When the AO function is set to 1 (frequency setting), and the drive frequency is set to 50% of the maximum frequency, the output voltage of the AO is 5 V (50% x 10 V).

Table 3–17 AO functions

Setpoint	Function	Description
0	Operating frequency	The AO outputs the voltage that corresponds to the ratio of the AC drive running frequency to rated motor frequency. The value 100.0% corresponds to the rated motor frequency.
1	Frequency reference	The AO outputs the voltage that corresponds to the ratio of the AC drive frequency reference to rated motor frequency. The value 100.0% corresponds to the rated motor frequency.
2	Output current	The AO outputs the voltage that corresponds to the ratio of the AC drive output current to rated motor current. 100.0% corresponds to the rated motor current.
3	Motor output torque (absolute value)	The AO outputs the voltage that corresponds to the ratio of the AC drive output ratio to rated motor torque. 100.0% corresponds to two times the rated motor torque (absolute value).
4	Output power	The AO outputs the voltage that corresponds to the ratio of the AC drive output power ratio to motor rated power. 100.0% corresponds to two times the rated motor power.
5	Output voltage	The AO outputs the voltage that corresponds to the ratio of the AC drive output voltage to rated motor voltage. 100.0% corresponds to the rated motor voltage.
6	Pulse input	The AO output voltage follows the HDI input frequency. 50.0% corresponds to 20.0 kHz.
7	AI1	The AO output voltage follows the AI1 input voltage. 100.0% corresponds to 10 V.
12	Communication control	The AO outputs the voltage that corresponds to the ratio of data that is written to 2002h/7313h address to 32767. (100.0% corresponds to AO communication setting)
13	Motor speed	The AO outputs the voltage that corresponds to the ratio of the motor speed to the motor speed at rated motor frequency (100.0% corresponds to the speed at the rated frequency).
14	Output current (100.0% corresponds to 1000.0 A)	The AO outputs the voltage that corresponds to the ratio of the AC drive output current to 1000 A.
15	Bus voltage (100.0% corresponds to 1000.0 V.)	The AO outputs the voltage that corresponds to the ratio of the AC drive bus voltage to 1000 V.
16	Motor output torque (actual value, proportion to the rated motor torque)	The AO outputs the voltage that corresponds to the ratio of the AC drive output ratio to rated motor torque. 100.0% corresponds to two times the rated motor torque, 50.0% corresponds to 0, and 0 corresponds to negative two times the rated motor torque.

The following is an example of how to calculate AO zero offset coefficient (E3-17) and AO gain (E3-18).

Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2).

Formula for calculating the gain:

$$K = \frac{(Y1\text{-}Y2)\cdot X_{MAX}}{(X1\text{-}X2)\cdot Y_{MAX}}$$

Formula for calculating zero offset coefficient:

$$b = \frac{(X1 \cdot Y2 - X2 \cdot Y1)}{(X1 - X2) \cdot Y_{MAX}} * 100\%$$

Xmax is the rated output frequency 50 Hz (assume that the maximum frequency C4-06 is 50 Hz). Ymax is the voltage and the value is 10 V. The value of E3-18 (AO gain) is -0.5 and the value of E3-17 (AO zero offset coefficient) is 80%.

Table 3–18 Relationship between analog output content and corresponding maximum values (Xmax)

Analog Output Content	Corresponding Max. Value (Xmax)
Operating frequency	Rated output frequency
Frequency reference	Rated output frequency
Output current	2 x Rated motor current
Output torque (absolute value)	2 x Rated motor torque
Output power	2 x Rated power
Output voltage	1.2 x Rated drive voltage
Pulse input	20.00 kHz
AI1	10 V
Communication	100.0%
Motor speed	Speed at the rated output frequency
Output current	1000.0A
Output voltage	1000.0V
Output torque (actual value)	2 x Rated motor torque

3.8 DO Function

3.8.1 Accumulative Running Time Reached

Description

When Ad-02 (cumulative power-on hours) x 3600 + Ad-03 (cumulative power-on seconds) exceeds P0-16 (cumulative power-on hours reached) x 3600 + P0-16 (cumulative power-on seconds reached), the DO assigned with cumulative power-on time reached function outputs an active signal.

When Ad-00 (cumulative running hours) x 3600 + Ad-01 (cumulative running seconds) exceeds P0-17 (cumulative running hours reached) x 3600 + P0-16 (cumulative running seconds reached), the DO assigned with cumulative running time reached function outputs an active signal.

Related Parameters

Table 3–19 Related parameters about cumulative time reached 1

Parameter	Name	Default	Value Range	Descriptions
P0-16	Cumulative power-on hours reached	0h	0h to 65535h	1. The cumulative power-on hours reached is decided by P0-16 and P0-18. When Ad-02 (cumulative power-on hours) x 3600 + Ad-03 (cumulative power-on seconds) exceeds P0-16 (cumulative power-on hours reached) x 3600 + P0-16 (cumulative power-on seconds reached), the DO assigned with cumulative power-on time reached function outputs an active signal. 2. Set P0-16 and P0-18 to 0 to disable the function.
P0-18	Cumulative power-on seconds reached	0s	0s to 3599s	

Table 3–20 Related parameters about cumulative time reached 2

Parameter	Name	Default	Value Range	Descriptions
P0-17	Cumulative running hours reached	0h	0h to 65535h	Cumulative running seconds reached Additional information: 1. The cumulative running hours reached is decided by P0-17 and P0-19. When Ad-00 (cumulative running hours) x 3600 + Ad-01 (cumulative running seconds) exceeds P0-17 (cumulative running hours reached) x 3600 + P0-16 (cumulative running seconds reached), the DO assigned with cumulative running time reached function outputs an active signal. 2. Set P0-17 and P0-19 to 0 to disable the function.

3.8.2 Frequency Detection Value

Description

When the running frequency of the AC drive is within the range (frequency detection value ± frequency detection amplitude), the DO is assigned with function 26/27: frequency 1/2 reached and outputs an active signal.

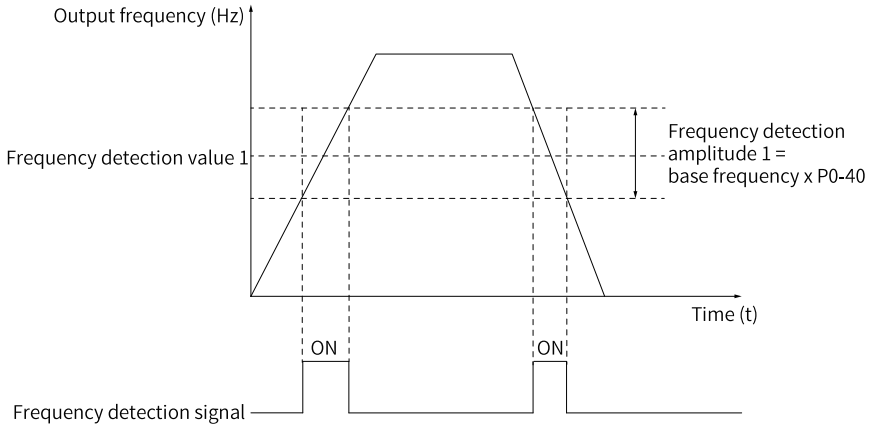


Figure 3-63 Frequency detection value

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-39	Frequency detection value 1	50.00 Hz	0.00 Hz to A2-17	Set the frequency detection value 1 of the running frequency of the AC drive. Additional information: When the running frequency of the AC drive is in the range of (frequency detection value 1 ± frequency detection amplitude 1), the DO terminal outputs an "active" signal.
P0-40	Frequency detection amplitude 1	0.1%	0.1% to 100.0%	Set the frequency detection amplitude 1 of the AC drive running frequency: the percentage value of P0-39. Additional information: When the running frequency of the AC drive is in the range of (frequency detection value 1 ± frequency detection amplitude), the DO terminal outputs an "active" signal.
P0-41	Frequency detection value 2	50.00 Hz	0–A2-17	Set the frequency detection value 2 of the running frequency of the AC drive. Additional information: When the running frequency of the AC drive is in the range of (frequency detection value 2 ± frequency detection amplitude 2), the DO terminal outputs an "active" signal.
P0-42	Frequency detection amplitude 2	0.1%	0.1% to 100.0%	Set the frequency detection amplitude 2 of the AC drive running frequency: the percentage value of P0-41. Additional information: When the running frequency of the AC drive is in the range of (frequency detection value 2 ± frequency detection amplitude 2), the DO terminal outputs an "active" signal.

3.8.3 Current Running Time Reach

Description

When the running time of the AC drive exceeds the set value of the current running time threshold, the DO assigned with function 40: current running time reached and outputs an active signal.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-20	Current running time reached	0.0 min	0.0 min to 6500.0 min	It is used to set the accumulative running time threshold of the AC drive. Additional information: 1. If the current running time reaches the value set in this parameter, the corresponding DO becomes ON, indicating that the current running time is reached. 2. Set to 0 to disable the function.

3.8.4 AI Input Limit Exceeded

Description

This section introduces the upper and lower protective limits of the AI voltage to detect and judge the input AI voltage. If the input is not within the upper and lower protective limits, the AI1 input limit exceeded flag is reported.

Setting

The upper and lower protective limits of the AI voltage can be set in the parameter groups (E2-14 to E2-15 and E2-34). For details, see E2-14 to E2-15 and E2-34 in group E2.

Instances

To perform the function "The RO output is turned on or off based on whether the AI input exceeds the limit," do as follows.

1. Set the upper and lower protective limits of AI1 to 4 V to 8 V (E2-14 = 8 V, E2-15 = 4 V, and E2-34 = 0.00s).
2. Allocate RO with function 31 "AI1 input limit exceeded" (E1-00 = 31).

After the preceding settings, the RO output is turned on when AI1 is 3 V; the RO output is turned off when AI1 is 5 V.

Parameter	Name	Default	Value Range	Descriptions
E2-14	AI1 input upper limit	8.00V	E2-15 to 10.00 V	Sets the upper protective limits of the AI voltage to define whether AI1 voltage is within the set range. Additional information: When the AI1 voltage is higher than the value of E2-14 or lower than the value of E2-15, the DO assigned with “AI1 input limit exceeded” outputs an active signal. In addition, whether the AI disconnection fault E154.3 is reported is also decided by H1-14 fault action protection.
E2-15	AI1 input lower limit	2.00V	0.00 V to E2-14	Sets the lower protective limits of the AI voltage to define whether AI1 voltage is within the set range. Additional information: When the AI1 voltage is higher than the value of E2-15 or lower than the value of E2-14, the DO assigned with “AI1 input limit exceeded” outputs an active signal. In addition, whether the AI disconnection fault E154.3 is reported is also decided by H1-14 fault action protection.
E2-34	AI input protection time	0.01s	0.00S to 1.00s	When the continuous duration of AI input overrun is greater than or equal to the value of this parameter, the AI1 input limit exceeded flag is set.

3.8.5 AC drive overtemperature threshold reached

Description

When the temperature of the inverter heatsink reaches the value of P0-33, the DO is assigned with function 35 (AC drive overtemperature threshold reached) and outputs an active signal.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P0-33	AC drive overtemperature threshold reached	75°C	0°C to 100°C	Sets the overtemperature threshold of the inverter heatsink. Additional information: When the inverter heatsink temperature (U0-82) reaches the value of P0-33, the multi-function DO terminal of the AC drive outputs the "AC drive overtemperature threshold reached" ON signal.
U2-68	Module temperature	0.0°C	0.0°C to 6553.5°C	Displays the temperature of the AC drive heatsink module in °C.

3.8.6 Detection Frequency Amplitude

Description

P0-38 defines the detection frequency amplitude. When the running frequency of the AC drive is within the set range (set frequency ± A2-04 x P0-38), the DO terminal is assigned with function 4: detection frequency amplitude. The following figure shows the time sequence diagram of the frequency detection range.

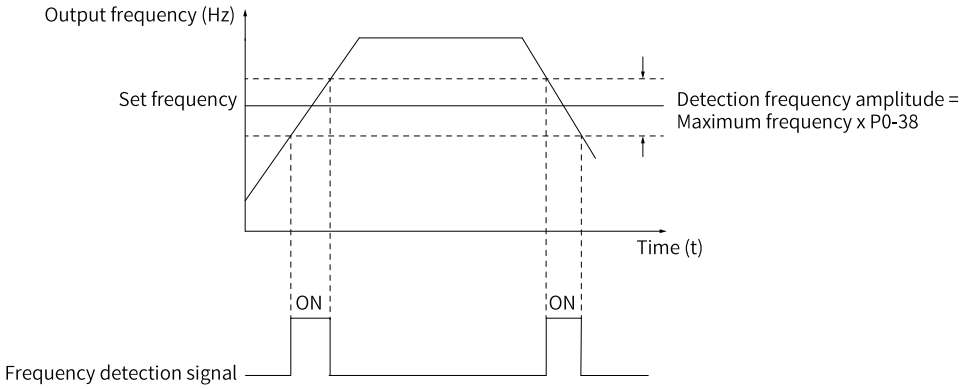


Figure 3-64 Time sequence of the frequency detection range

Related Parameters

Param.	Parameter Name	Default	Value Range	Descriptions
P0-38	Detection frequency amplitude	0.0%	0.0% to 100.0%	Set the detection frequency amplitude of the AC drive running frequency as a percentage of the per-unit base value of frequency (A2-04). Additional information: When the operation frequency of the AC drive is in the range of target frequency ± Per-unit frequency x P0-38, the DO terminal outputs an "active" signal.

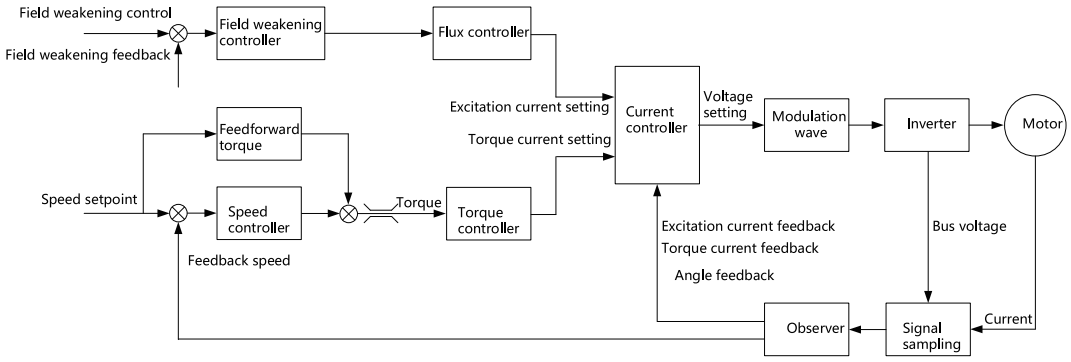
4 Motor Control

4.1 Vector Control

4.1.1 SVC control

The following figure shows the sensorless vector control (SVC), including sampling and wave generation, loop control, and model observation.

- Sampling and wave generation: Signal sampling, modulation wave.
- Loop control: Field weakening controller, flux controller, speed controller, torque controller, current controller.
- Model observation: Observer



Scenario

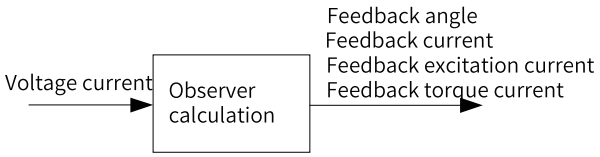
Vector control usually requires the encoder to collect the motor speed and position. Sensorless vector control (SVC) can perform excellent vector control without encoder feedback. You need to set the control mode (d0-00) to SVC control (0).

The SVC and V/f control mode both do mot require encoder signal feedback. The difference is mainly as follows:

- [d0-00] is set to 0 (SVC control). The SVC mode is a kind of speed, torque closed-loop control. This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters.
- [d0-00] is set to 2 (V/f control). V/f control is an open-loop control of the constant voltage frequency ratio. This mode is not highly dependent on parameters. It is simple, reliable, and easy to use, but has poor dynamic performance and speed accuracy compared with SVC. The V/f control of the asynchronous motor does not control the torque. Therefore, the setting related to the torque limit does not take effect.

Working Principle

In the SVC control mode, the feedback speed and angle required for vector control are estimated by the motor model and output current. The estimation is through the observer module.



Related Parameters

Param.	Name	Default	Value Range	Descriptions
d0-00	Motor control mode	0	0 to 2	It is used to set the motor control mode based on the application scenario and motor type. Value description 0: SVC It is the magnetic field oriented vector control mode without sensor. This mode features excellent dynamic performance and steady-state accuracy, but it is highly dependent on parameters and needs prior auto-tuning of motor parameters. 2: V/f It is the open-loop control with the constant voltage-to-frequency ratio. This mode is not highly dependent on parameters. It is simple, reliable, and easy to use, but has poor dynamic performance compared with SVC.

Function Applications

The speed and position of the motor are estimated based on motor voltage, current, and motor parameters in SVC control mode. Therefore, complete motor parameters are required for SVC control. It is recommended to perform dynamic auto-tuning before running. If dynamic no-load auto-tuning is not performed, optimal control effect cannot be achieved and oscillation or overcurrent may occur due to inaccurate motor parameters.

- Stator resistance, rotor resistance, leakage inductance, mutual inductance, and dead zone auto-tuning curve of the AC drive need to be auto-tuned for asynchronous motors.
- Stator resistance, d-axis inductance, q-axis inductance, rated back EMF dead zone auto-tuning curve of the AC drive need to be auto-tuned for synchronous motors.

Synchronous motor speed open-loop (IF) control

In the case of low-speed running, the motor speed and angle cannot be accurately calculated, affecting the control accuracy and even the observation may fail and the motor cannot run reliably.

Synchronous motor SVC low-speed IF application

For permanent magnet synchronous motors, open-loop low-speed IF control can be enabled if there is long-term operation at low or zero speed. Low-speed IF control, also known as current/frequency control, operates on an open-loop speed control principle. This method offers limited control accuracy and dynamic performance compared to a closed-loop speed control mode. If the application involves periods of low-speed or zero-speed operation where precise control and rapid response are essential, it is recommended to select products that install the encoder to run in FVC mode.

Param.	Name	Default	Value Range	Descriptions
d0-85	Low speed handling mode	0x0101	Ones position: Synchronous motor V/f low-speed processing (reserved) 0: Disable 1: Speed open-loop Tens position: Synchronous motor SVC low-speed processing 0: Disable 1: Speed open-loop 2: Reserved Hundreds position: Synchronous motor TLC low-speed processing (reserved) 0: Disable 1: Speed open-loop 2: Reserved Thousands position: Asynchronous motor SVC low-speed processing (reserved) 0: Disable 1: Speed open-loop	This parameter sets the low speed open loop processing mode. Additional information: With the function enabled, if the operation frequency is lower than the switchover frequency (d0-87), the drive outputs the current specified by d0-86. If the operation frequency is higher than the result of d0-87 plus and d0-88, the motor switches to the SVC mode or the synchronous motor switches to the V/f mode. The speed open loop function can improve the load capacity at low speed.
d0-86	Speed open loop current	100%	0% to 250%	This parameter sets the speed open loop current. Additional information: If the speed open loop function is enabled and the operation frequency is lower than the switchover frequency (d0-87), the drive outputs the current specified by d0-86. If the operation frequency is higher than the result of d0-87 plus d0-88 for the time set by d0-89, the drive switches to normal operation. The speed open loop function can improve the load capacity at low speed.

Param.	Name	Default	Value Range	Descriptions
d0-87	Speed open loop switchover frequency	10.0%	0.0% to 100.0%	This parameter sets the speed open loop switchover frequency. Additional information: If the speed open loop function is enabled and the operation frequency is lower than the switchover frequency (d0-87), the drive outputs the current specified by d0-86. If the operation frequency is higher than the result of d0-87 plus d0-88 for the time set by d0-89, the drive switches to normal operation. The speed open loop function can improve the load capacity at low speed.
d0-88	Speed open loop switchover hysteresis frequency	2.5%	0.0% to 100.0%	This parameter sets the speed open loop switchover hysteresis. Additional information: If the speed open loop function is enabled and the operation frequency is lower than the switchover frequency (d0-87), the drive outputs the current specified by d0-86. If the operation frequency is higher than the result of d0-87 plus d0-88 for the time set by d0-89, the drive switches to normal operation. The speed open loop function can improve the load capacity at low speed.

When the IF speed open loop function is enabled, the motor switches to speed open loop control when running at low speed, and the AC drive outputs the current set by d0-86. At high speed, the AC drive switches to SVC control. There is a hysteresis interval between the speed open-loop IF and SVC over the speed. The switchover process is shown in the following figure.

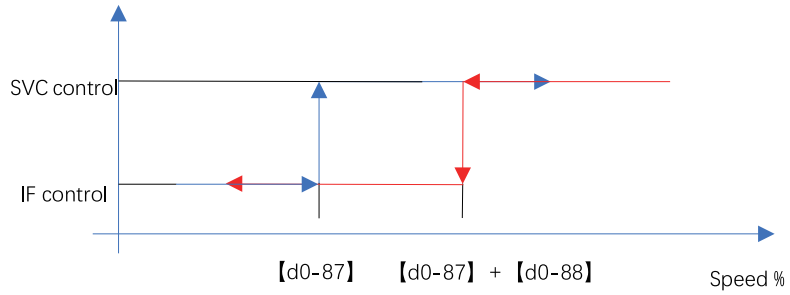


Figure 4-1

Asynchronous motor low-speed DC control

For asynchronous motors, the low-speed DC control mode can be enabled if there is long-term operation at low or zero speed. Low-speed DC control operates on an open-loop speed control principle. This method offers limited control accuracy and dynamic performance compared to a closed-loop speed control mode. If the application involves periods of low-speed or zero-speed

operation where precise control and rapid response are essential, it is recommended to select products that install the encoder to run in FVC mode.

Param.	Name	Default	Value Range	Descriptions
d6-27	Asynchronous motor SVC observer mode	0	0 to 3	This parameter specifies the asynchronous motor observer mode in SVC. To enable low-speed DC mode in SVC mode, set d6-27 to 2.
d6-31	Defines the DC starting frequency of asynchronous motor in SVC mode.	0.5%	0.1% to 20.0%	Defines the DC starting frequency of asynchronous motor in SVC mode. If the running frequency is lower than this frequency, the AC drive enters the DC control mode. If the running frequency is higher than this frequency, the AC drive exits the DC control mode.

SVC speed open-loop control often works with low frequency and the torque current must be set according to the maximum torque required by the load, resulting in excessive current in the low-frequency region of speed open loop and excessive motor heating. Besides, the AC drive frequency is also derated. Therefore, the speed open-loop torque should be set properly to avoid motor overheat or overload at low frequency.

Carrier ratio:

For medium to high-speed applications, it is recommended that the carrier frequency ÷ running frequency > 12, considering current harmonization and control stability.

Instances

- **Example of synchronous motor speed open-loop (IF) control**
  A film winding/unwinding machine runs without an encoder. During tension-building, the AC drive that controls unwinding during tension adjustment must keep the unwinding device running at zero speed. When the SVC is used, stable running at zero speed cannot be performed for a long time. The speed open-loop IF needs to be set as follows.

  1. Set d0-86 to 1 to enable the speed open-loop function.
  2. Observe that the torque corresponding to the tension, which is about 50% during normal operation. Therefore, set d0-86 to 70%.
  3. During normal acceleration/deceleration, for precise control and rapid response, you can set the switching frequency to a lower value, that is, d0-87 is set to 2% and set d0-88 to 2.

- **Example of asynchronous motor low-speed DC control**
  When a roller transmission device runs without an encoder using an asynchronous motor, there is a condition that requires the motor to be stable at 0 speed for a long time during production, and the motor rotates slightly at 0 speed using SVC. The low-speed DC mode needs to be set as follows.

  1. Set d6-27 to 2 to enable low-speed DC control mode.
  2. Set the frequency required to enter the low-speed DC mode according to actual requirements. For example, if a motor with a rated frequency of 50 Hz is expected to enter the low-speed DC mode below 0.5 Hz, set d6-31 to 1.0%.

4.1.2 Torque Control

4.1.2.1 Functions

Scenario

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 combined with overspeed control. When the motor output torque is not greater than 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 under torque control. When the motor speed exceeds the limit, the motor speed control is used. When the motor speed returns below the limit, the torque control is used.

Switch the torque control mode through d0-01. In the torque control mode, set the torque reference filter and acceleration/deceleration time through b5-16, b5-17, and b5-18. In the torque control mode, 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, resulting in loud noise or high mechanical stress.

Proper acceleration/deceleration time helps smooth changes in the motor speed. The acceleration/deceleration time in torque control represents the time needed for the torque to increase from 0 to the rated motor torque.

Working Principle

In the torque control mode, the torque setting is from the torque control reference which can be set by digital setting or other setting methods in the following table.

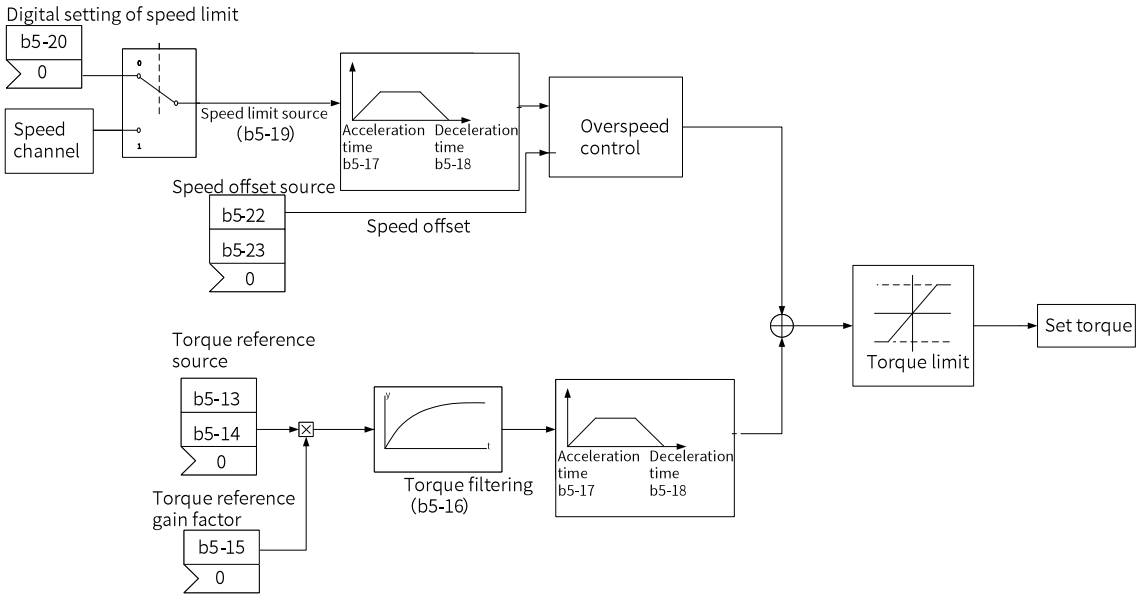


Figure 4-2 Diagram of torque control

Related Parameters

Parameter	Name	Default	Value Range	Description
d0-01 (F0-02)	Motor control method	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 7: DI1 to DI5 The control method depends on the terminal state of the DI. 0 indicates speed control and 1 indicates torque control. Others: B connector The control method depends on the status of B connector. 0 indicates speed control and 1 indicates torque control. Additional information: Torque control is invalid in V/f mode.

Parameter	Name	Default	Value Range	Description
b5-13	Torque reference source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the torque reference source. Value description2: AI1 The torque reference is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 0: Digital setting. The torque reference source is the "digital setting of torque reference". 2: AI1. The torque reference is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The torque reference is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the torque reference source, different combinations of DI terminal states correspond to different torque references. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. The torque reference is set through PID. 9: Communication. The torque reference source is 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. 10: Potentiometer MD-BP-M. The torque reference is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the torque reference. This mode is used for expansion of common sources.
b5-14	Torque reference digital setting	0.0%	-800.0% to 800.0%	This parameter defines the torque reference in the torque control mode. Additional information: The torque is a relative value. 100.0% corresponds to the rated AC drive torque. The setpoint ranges from -800.0% to 800.0%, indicating that the maximum torque of the drive is eight times the rated torque of the motor. When the torque reference value is positive, the drive operates in the forward direction. When the torque reference value is negative, the drive operates in the reverse direction.

Parameter	Name	Default	Value Range	Description
b5-15	Torque reference gain factor	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the source of the torque reference gain factor. Value description 0: 100%. The torque reference gain factor is set to 100%. 2: AI1. The torque reference gain factor is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The torque reference gain factor is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of torque reference gain factor. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication. The source of torque reference gain factor is 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. 10: Potentiometer MD-BP-M. The torque reference gain factor is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the torque reference gain factor. This mode is used for expansion of common sources.

Parameter	Name	Default	Value Range	Description
b5-16	Torque filter time	0	0 ms to 10000 ms	This parameter sets the torque filter time to filter out interference generated by the torque reference. Set this parameter according to the actual reference signal quality. The larger the value, the better the filtering effect, but the longer the torque reference delay.
b5-17	Torque accelera-tion time	0.000s	0–60.000s	This parameter sets the torque acceleration time.
b5-18	Torque decelera-tion time	0.000s	0–60.000s	This parameter sets the torque deceleration time.

Function Applications

In the torque control mode, 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, resulting in loud noise or high mechanical stress. Proper acceleration/deceleration time and filter time (defined by b5-17 and b5-18) helps smooth changes in the motor speed. The acceleration/deceleration time in torque control represents the time needed for the torque to increase from 0 to b5-14.

In the torque control mode, the acceleration/deceleration time is not required for start with small torque. For applications requiring quick torque response, set the acceleration/deceleration time to 0.00s.

For example, two AC drives are connected to drive the same load. To balance the load distribution, set one AC drive as the master and select the speed control mode. Set the other one as the slave and select the torque control mode. The slave receives the output torque of the master as the torque command and follows the master rapidly. In this case, the acceleration/deceleration time of the slave in the torque control mode is set to 0.00s.

4.1.2.2 Torque Reference Setting

The parameters related to the torque reference include the torque reference source and setpoint, torque reference filter time, and acceleration/deceleration time. The following table describes the torque reference setting and related parameters.

Param.	Name	Default	Value Range	Descriptions
F0-02 (d0-01)	Motor control method	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	This parameter set the motor control target according to the actual operating conditions. Value description 0: Speed control 1: Torque control 3 to 7: DI1 to DI5 The control method depends on the terminal state of the DI. 0 indicates speed control and 1 indicates torque control. Others: B connector The control method depends on the status of B connector. 0 indicates speed control and 1 indicates torque control. Additional information: Torque control is invalid in the V/f mode. The MD600 is in the speed control mode even if the torque control mode is set in the V/f mode.

Param.	Name	Default	Value Range	Descriptions
b5-13	Torque reference source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the torque reference source. Value description 0: Digital setting. The torque reference source is the "digital setting of torque reference". 2: AI1. The torque reference is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The torque reference is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC. Simple PLC is a operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. The torque reference is set through PID. 9: Communication. The torque reference source is 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. 10: Potentiometer MD-BP-M. The torque reference is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the torque reference. This mode is used for expansion of common sources.

Param.	Name	Default	Value Range	Descriptions
b5-14	Torque reference digital setting	0.0%	-800.0% to 800.0%	This parameter defines the torque reference in the torque control mode. Additional information: The torque is a relative value. 100.0% corresponds to the rated AC drive torque. The setpoint ranges from -800.0% to 800.0%, indicating that the maximum torque of the drive is eight times the rated torque of the motor. When the torque reference value is positive, the drive operates in the forward direction. When the torque reference value is negative, the drive operates in the reverse direction.

Param.	Name	Default	Value Range	Descriptions
b5-15	Torque reference gain factor	0	0: 100% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the source of the torque reference gain factor. Value description 0: 100%. The torque reference gain factor is set to 100%. 2: AI1. The torque reference gain factor is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The torque reference gain factor is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 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 reference values. 7: Simple PLC. Simple PLC is a operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the source of torque reference gain factor. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication. The source of torque reference gain factor is 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. 10: Potentiometer MD-BP-M. The torque reference gain factor is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the torque reference gain factor. This mode is used for expansion of common sources.

Param.	Name	Default	Value Range	Descriptions
b5-16	Torque filter time	0	0 ms to 10000 ms	This parameter specifies the torque filter time.
b5-17	Torque acceleration time	0.000s	0–60.000s	This parameter sets the torque acceleration time.
b5-18	Torque deceleration time	0.000s	0–60.000s	This parameter sets the torque deceleration time.

Set the torque reference acceleration/deceleration time.

In the torque control mode, set the torque reference filter and acceleration/deceleration time through b5-16, b5-17, and b5-18. In the torque control mode, 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, resulting in loud noise or high mechanical stress. Proper acceleration/deceleration time helps smooth changes in the motor speed. The acceleration/deceleration time in torque control represents the time needed for the torque to increase from 0 to the rated motor torque.

In the torque control mode, the acceleration/deceleration time is not required for start with small torque. For applications requiring quick torque response, set the acceleration/deceleration time to 0.00s.

For example, two AC drives are connected to drive the same load. To balance the load distribution, set one AC drive as the master and select the speed control mode. Set the other one as the slave and select the torque control mode. The slave receives the output torque of the master as the torque command and follows the master rapidly. In this case, the acceleration/deceleration time of the slave in the torque control mode is set to 0.00s.

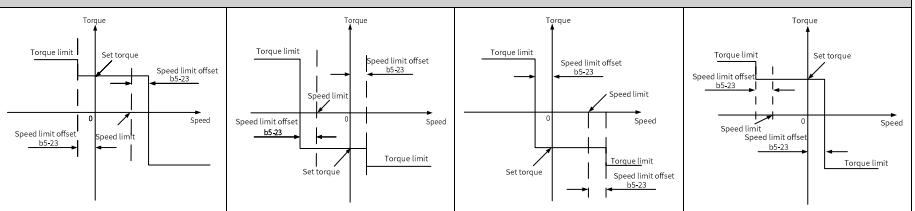
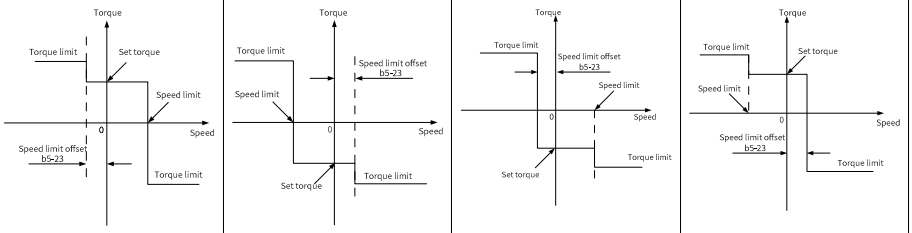
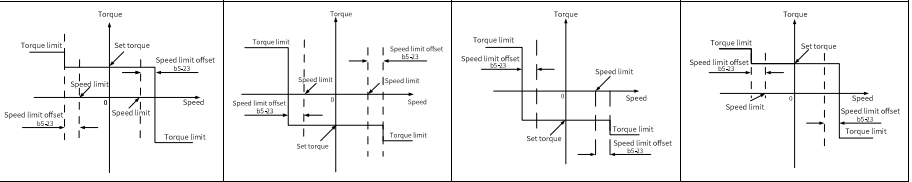
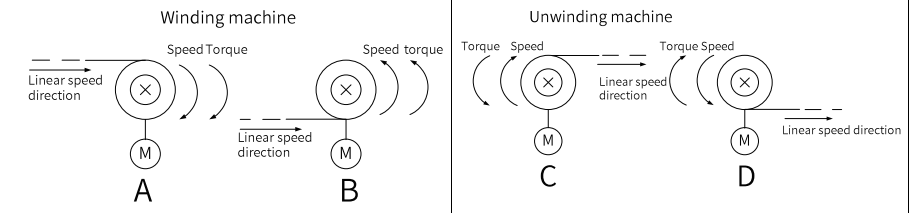
4.1.2.3 Overspeed Control

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 (that is, the frequency upper limit) must be restricted to prevent accidents such as runaway.

Overspeed control is used to protect against overspeed under torque control. After the motor runs at a speed greater than the overspeed limit, overspeed control is activated. In this case, speed control takes effect and the motor torque cannot be output according to the torque setpoint. If the speed returns to the overspeed limit range, torque control is restored.

The speed limit parameters of overspeed control include the speed limit and speed offset. In different speed limit and offset settings and motor running states, the overspeed control states of torque control are as follows:

Item	Operating Condition			
Operation Command	Forward running	Forward running	Forward running	Forward running
Torque reference direction	+	-	-	+
Speed limit direction	+	-	+	-
Speed limit direction	+	-	+	-
Normal running direction	Forward running	Reverse run	Forward running	Reverse run

Item	Operating Condition
Bi-directional speed limit offset (b5-21 = 0)	
Uni-directional speed limit offset (b5-21 = 1)	
Overspeed control mode (b5-21 = 2)	
Application Example	

The following table describes the configuration parameters related to overspeed control.

Param.	Name	Default	Value Range	Descriptions
b5-19	Speed limit source	0	0: Digital setting 1: Speed channel	This parameter sets the speed limit source. Value description 0: Digital setting. In torque mode, the speed limit source is digital setting and the speed limit set by the "digital setting of speed limit" parameter takes effect. 1: Speed channel. The speed limit in the torque mode is set through the speed channel.
b5-20	This parameter defines the digital setting of the speed limit.	0.0%	-800.0% to 800.0%	This parameter takes effect when b5-20 is set to 0.

Param.	Name	Default	Value Range	Descriptions
b5-21	Speed limit offset in torque mode	0	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control mode	This parameter sets the speed limit offset mode in the torque mode. Value description 0: The offset is valid for both directions. 1: The offset is valid only for unidirectional direction. 2: The offset is valid in both directions. The absolute value of the positive and negative speed limit is the speed limit plus the offset.

Param.	Name	Default	Value Range	Descriptions
b5-22	Speed limit offset source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the speed limit offset source. Value description 0: Digital settin.g The speed limit offset source is the "digital setting of speed limit offset". 2: AI1. The speed limit offset is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The speed limit offset is set by using the pulse frequency input through the DI4 and calculated according to the corresponding mapping curve. 6: Multi-reference. When multi-reference is used as the speed limit offset source, different combinations of DI terminal states correspond to different speed limit offsets. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Each reference is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/ deceleration time for each reference and supports up to 16 references. 8: PID. PID is selected as the speed limit offset source. 9: Communication. The speed limit offset source is communication. When selecting the source, you can set the speed limit offset through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The speed limit offset is set through the MD-BP-M potentiometer. Others: F connector. A parameter code is set for a floating-point connector, and the value of the connector is read as the speed limit offset. This mode is used for expansion of common sources.
b5-23	Speed limit offset digital setting	5.0%	0.0% to 800.0%	This parameter takes effect when b5-22 is set to 0 (Digital setting).

Examples of overspeed control in torque control mode

Example 1: Winding and unwinding in the tension control torque mode is a typical application scenario. As example A shown in the above table, down winding is applicable when the motor runs in the forward direction. Overspeed control is used to prevent the motor from accelerating continuously and to limit the motor to reverse rotation. In this case, the master controls the forward running of the winding machine. If the speed is 0 to 100%, 20% torque is required for winding, and reverse rotation is not allowed for winding. The main parameters of torque control are as follows:

Param.	Name	Value Range
b5-14	Torque reference digital setting	20.0%
b5-20	This parameter defines the digital setting of the speed limit.	100.0%
b5-21	Speed limit offset in torque mode	1
b5-23	Speed limit offset digital setting	0.0%

Example 2: As example C shown in the above table, the master controls the forward running of the winding machine. For example, 20% torque is required for unwinding and 5% speed reverse rotation is allowed. The main parameters of torque control are configured as follows:

Param.	Name	Value Range
b5-14	Torque reference digital setting	-20.0%
b5-20	This parameter defines the digital setting of the speed limit.	100.0%
b5-21	Speed limit offset in torque mode	1
b5-23	Speed limit offset digital setting	5.0%

Example 3: As shown in the following table, the motor runs in the forward direction. The torque setting of the motor is set by b5-14 and the speed limit of overspeed control is set by b5-20. The speed limit offset mode is unidirectional offset.

Assume that:

Before t1, the motor output torque is equal to the value of b5-14 and the motor running speed is lower than b5-20.

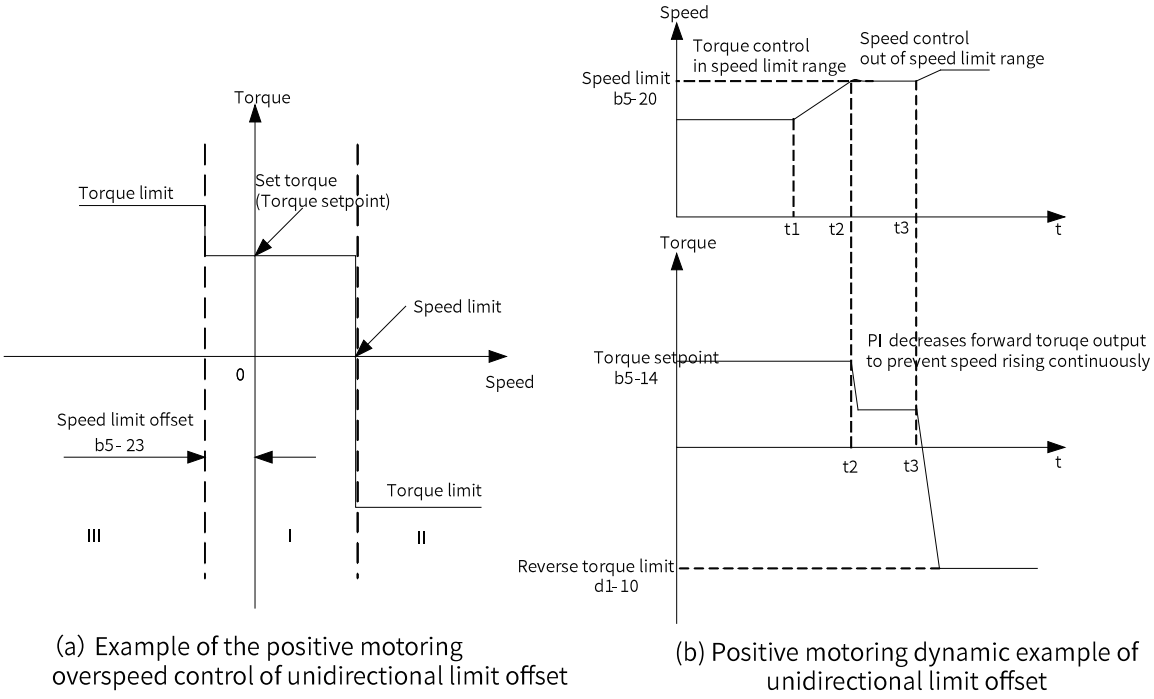
The load decreases abruptly at t1, and the load torque is smaller than the motor output torque. The motor accelerates, reaching b5-20 at t2. The speed limit is reached, and overspeed control takes effect.

After t2, the speed is stable at b5-20. The motor torque cannot be output according to the value set by b5-14. The actual output torque is determined by factors such as the actual load torque and friction.

At t3, the load continuously decreases or an external force is used to drag the motor in the forward direction. To prevent the speed from exceeding the speed limit range, the output forward torque decreases rapidly controlled by the PI control. After the final output torque reaches the negative torque limit, the overspeed control fails. After this, the speed exceeds the speed limit setting. In this case, check the system configuration.

The positive motoring dynamic example of unidirectional limit offset can be compared to the example of the positive motoring overspeed control of unidirectional limit offset in Figure (a), where the control before t3 corresponds to area I in Figure (a). In this case, within the speed limit, the output torque is the torque setpoint, and the output torque at the speed limit is smaller than the torque setpoint.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed limit.



(a) Example of the positive motoring overspeed control of unidirectional limit offset

(b) Positive motoring dynamic example of unidirectional limit offset

Figure 4-3 Example 1 of overspeed control

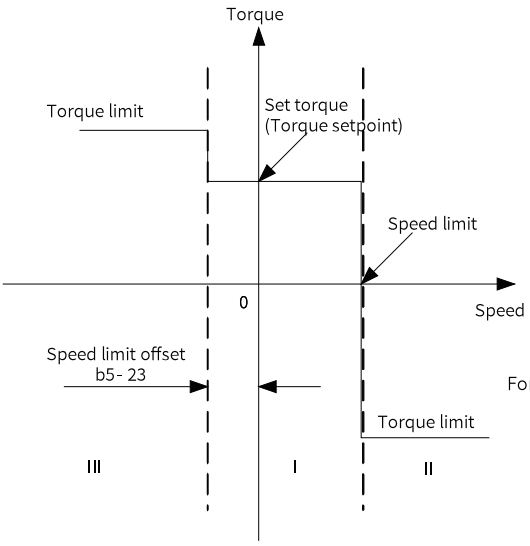
Example 4: As shown in the following figure, the setting and running state before t1 is the same as in the preceding example.

At t2, the load increases suddenly. Since system does not allow the reverse direction of higher speed, unidirectional speed offset is set. In this case, the motor output torque increases in the forward direction by the speed regulation PI, and the speed reaches the speed offset setting speed.

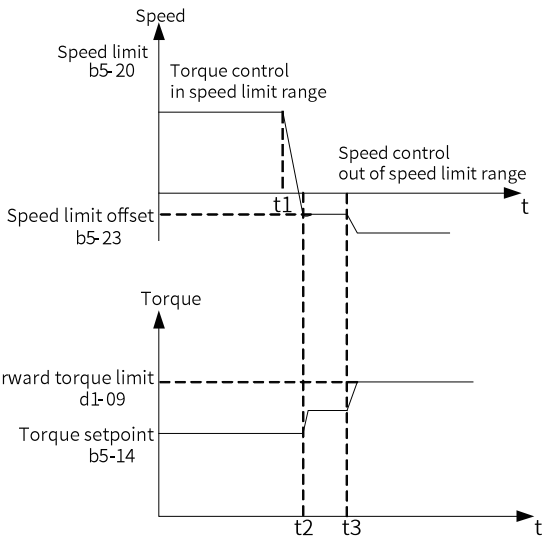
At t3, the load increases further or external force is used to drag the motor. To prevent the speed from exceeding the speed offset, the output forward torque increases controlled by the speed regulation PI. When the final output torque reaches the forward torque limit, the overspeed control fails, and the speed will exceed the speed offset setting. In this case, check the system configuration.

The positive motoring dynamic example of unidirectional limit offset can be compared to the example of the positive motoring overspeed control of unidirectional limit offset in Figure (c), where the control before t3 corresponds to area I in Figure (c). In this case, within the speed limit and speed offset, the output torque is the torque setpoint, and the output torque at the speed offset is larger than the torque setpoint.

After t3, the output torque reaches the torque limit, and the actual speed exceeds the speed offset.



(c) Example of the positive motoring overspeed control of unidirectional limit offset



(d) Positive motoring dynamic example of unidirectional limit offset

Figure 4-4 Example 2 of overspeed control

4.1.2.4 Stop at Torque Control

At torque control mode, the AC drive can coast to stop, switch to speed control mode and then stop or maintain torque control mode until zero speed and then block. Set the stop mode by d0-08.

Param.	Name	Default	Value Range	Descriptions
d0-08	Stop mode for torque control	1	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	Sets the stop mode in torque control. Value description 0: Coast to stop forcibly, and the drag system is in the free braking state. 1: Switch to speed mode and stop according to the stop mode active in the current speed mode. 2: 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, the motor stops. In this mode, the motor speed shall decrease to zero. Otherwise, the motor may not stop.

4.1.3 Speed Control

4.1.3.1 Speed Control

Scenario

In most applications, the motor speed needs to be controlled. In vector control, the speed can be controlled accurately.

Working Principle

The following figure shows the typical speed control diagram. The speed reference passes the speed limit, ramp generator (RFG), speed controller, and after superimposing additional torque, it goes through the torque limit and then through the current controller (ACR), and finally outputs voltage to the motor to complete the speed control.

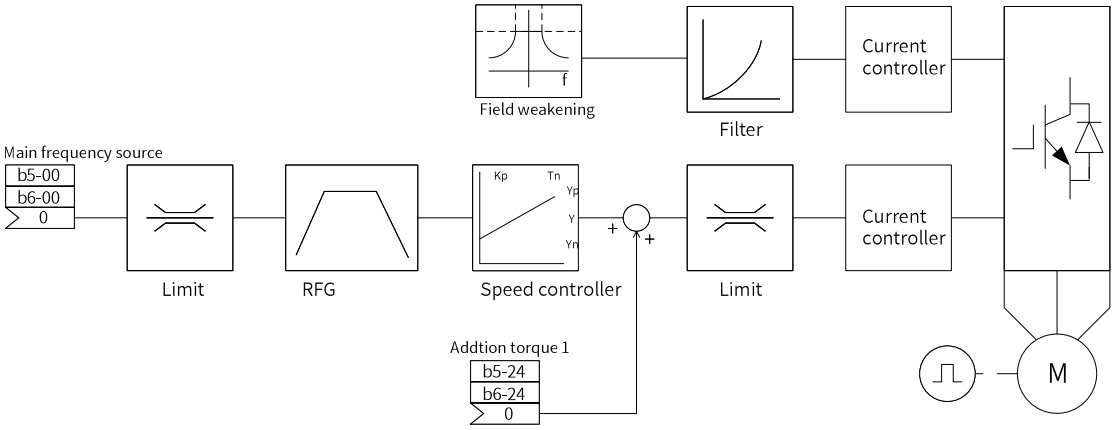


Figure 4-5 Typical block diagram of speed control

In the speed control mode, the speed setpoint is generated according to the following diagram. After superposed by the auxiliary frequency source, the main frequency source passing the RFG forms the frequency reference. Then the actual speed reference is generated after the frequency reference superimposes the additional speed reference.

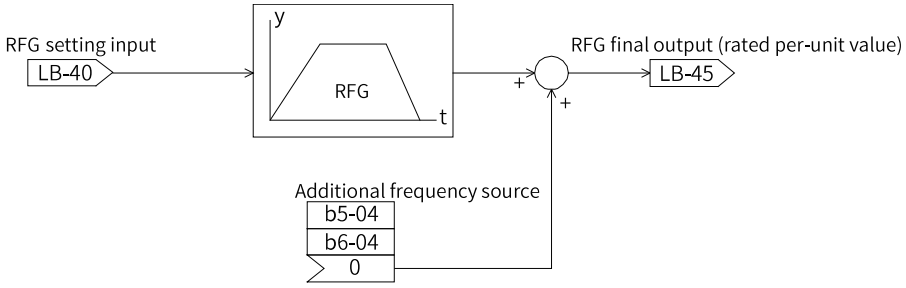


Figure 4-6 Speed reference

Related Parameters

Param.	Name	Default	Value Range	Description
F0-01	Motor control mode	2	0: SVC 2: V/f	It is used to set the motor control mode based on the application scenario and motor type. Value description 0: SVC, which stands for sensorless vector control. It is an open-loop vector control mode, which is applicable to high-performance control applications. In this case, one AC drive can drive only one motor. This mode applies to such loads as machine tools, centrifuges, wire drawing machines, and injection molding machines. Parameter auto-tuning is required in the FVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. 2: V/f, which stands for voltage/frequency control. It is an open loop control mode based on constant voltage and frequency ratio. This mode is applicable to scenarios without high requirements on load control performance, such as fans and water pumps and scenarios without high requirements on accuracy of parameters. This mode is simply and easy to use. The dynamic performance of the V/f control mode is not as good as that of the SVC mode.
d0-01	Motor control method	0	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the motor control method. Value description 0: Speed control 1: Torque control 3 to 7: DI1 to DI5 The control method depends on the terminal state of the DI. 0 indicates speed control and 1 indicates torque control. Other: B connector - Depends on the status of B connector. 0: speed control; 1: torque control. Remarks Torque control is invalid in V/f mode.

4.1.3.2 Speed Loop (Speed Controller)

Scenario

Under vector control, speed control can be implemented through the speed controller.

Working Principle

The speed controller obtains the speed reference (LC-00) from the reference channel, receives the feedback speed value (LC-10) in the feedback channel, and then generates the torque reference (LC-79) 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:

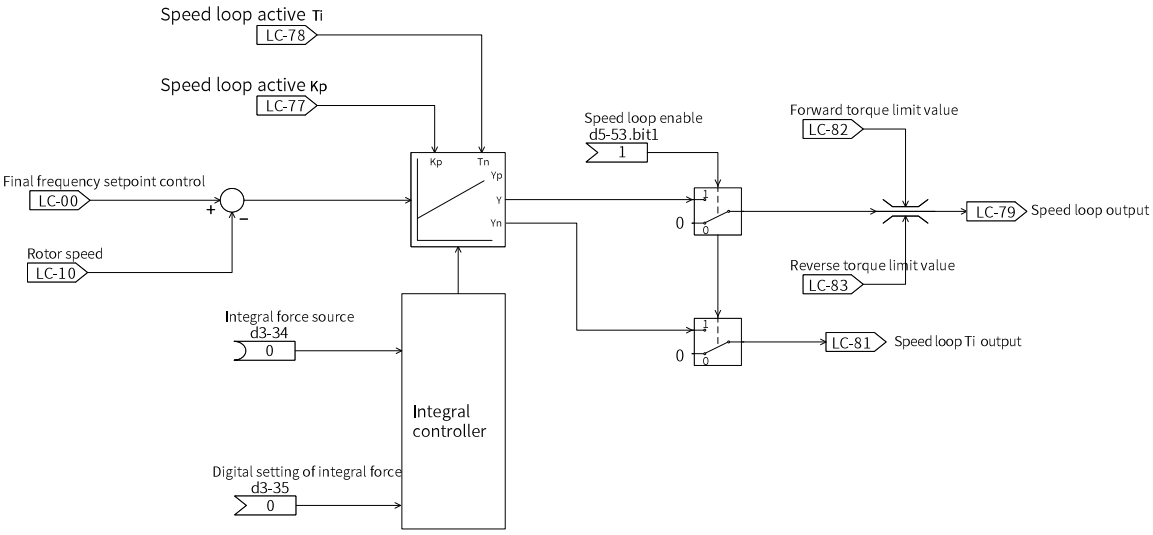


Figure 4-7 Speed controller function diagram

Under SVC control, the speed controller can be controlled by parameters d3-02 (Speed loop Kp in SVC mode) and d3-03 (Speed loop Ti in SVC mode). The relationship between the output of the speed controller 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 setting is shown in the following figure. For the speed deviation of Δf, the torque setting value of the proportional output is KpΔf. After Ti time, the torque setting value of the integral output is set to KpΔf.

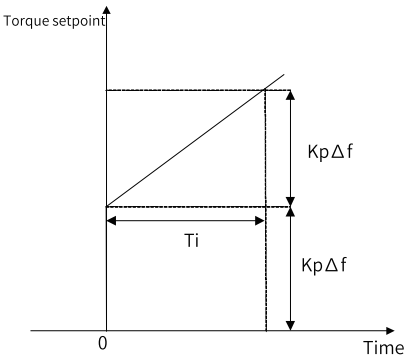


Figure 4-8 Torque reference diagram

The parameters Kp and Ti of the speed loop PI regulator can be optimized through the following auto-tuning.

C2-00 = 2: No-load dynamic auto-tuning of asynchronous motor

C2-00 = 12: No-load dynamic auto-tuning of synchronous motor

If you are still dissatisfied with the control effect after auto-tuning is completed, you can manually optimize the controller parameters. The effect of Kp and Ti on the controller is as follows:

- When Kp is small, the feedback speed overshoot is large. When Kp increases, the adjustment will become faster and the overshoot will decrease. If Kp is too large, the output torque and feedback speed will oscillate.

- When Ti decreases, the adjustment of the controller accelerates, and if Ti is too small, the output torque and feedback speed oscillation will also occur.

For details on how to optimize the speed controller parameters, see *"4.1.3.5 Speed Control Optimization" on page 330*.

The speed loop regulator may need special processing when it is used with the PLC to set the integral parameters. The following three functions are involved.

Speed loop integral forcing enable: Controlled by d3-33. d3-34 sets the integral forcing value, and the integral output value will be forced to the value set by d3-34 after the integral forcing is enabled.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
F2-02 (d3-02)	Speed loop Kp in SVC mode	5.00	0.00 to 100.00	This parameter sets the speed loop proportional gain in the SVC mode. F2-02 is the mapping of d3-02 (Speed loop Kp in SVC mode) in group F. The two parameters have the same function. Additional information: A larger value indicates a higher value of the speed loop gain and better speed following performance, but a greater possibility of oscillation.
F2-03 (d3-03)	Speed loop Ti in SVC mode	0.127s	0.000s to 20.000s	This parameter sets the speed loop integral time in the SVC mode. Additional information: A smaller value indicates a higher value of the speed loop gain and better speed following performance, but a greater possibility of oscillation.
d3-33	Integral force enable	0	0: Disabled 1: Enable Others: B connector	This parameter determines whether to forcibly change the speed loop integral. Value description 0: Invalid 1: Enable. When this function is enabled, the speed loop integral is determined by d3-34 (Integral forced value source) and d3-35 (Digital setting of integral forced value). Others: B connector. Whether to forcibly change speed loop integral depends on the value of the B connector.

Parameter	Name	Default	Value Range	Descriptions
d3-34	Integral force source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the source of the speed loop integral forced value. Value description 0: Set by the parameter (d3-35) 2: AI1. The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 3: AI2. The forward frequency upper limit is input by using current or voltage signals at the AI2 terminal and calculated according to the preset AI curve. 4: Reserved 5: HDI pulse. The forward frequency upper limit is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the forward 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 limit values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the forward 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 forward frequency upper limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency.

Parameter	Name	Default	Value Range	Descriptions
d3-34	Integral force source	0	0: Digital setting 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	9: Communication. The forward frequency upper limit is set through communication. When selecting the source, you can set the forward torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices. 10: MD-BP-M potentiometer. The integral forced value is set through MD-BP-M potentiometer. Others: F connector. A parameter No. is set for a float connector, and the value of the connector is read as the forward frequency upper limit. This mode is used for expansion of common sources.
d3-35	Digital setting of integral force	0.0%	-800.0% to 800.0%	This parameter sets the speed loop integral forced value. Additional information: When d3-33 (integral force) is enabled and d3-34 (integral force source) is set to "digital setting", the output of the speed loop integral comes from the setpoint of this parameter.

4.1.3.3 Speed Control Adapter

Scenario

Speed control adapters can optimize speed loop parameters under different operating conditions or based on the process requirements to suppress the overshoot or oscillation that may occur in the speed controller.

Working Principle

The adapter includes speed adaption and adaptive adaption.

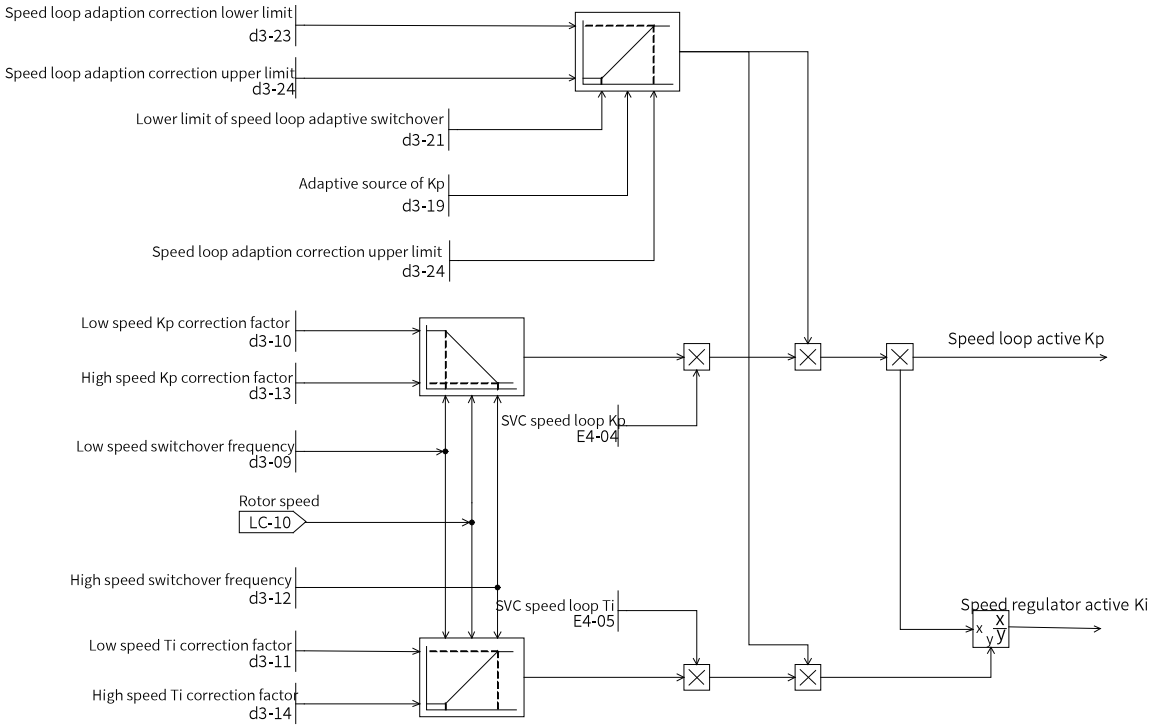


Figure 4-9 Speed Controller Adapter

Zero speed adaption: When zero speed is reached, the speed loop is adjusted separately. When the final set frequency of LC-00 is lower than the zero speed switchover frequency (defined by d3-06), the effective speed loop proportional factor is adjusted with d3-07 and d3-08. When the final set frequency of LC-00 is higher than the zero speed switchover frequency (defined by d3-06), the proportional correction factor of the speed loop at high speed and low speed is the final speed adaption coefficient.

Low-speed and High-speed adaption: Kp/Ti adjustment related to speed is enabled by default. During operation at high speed, current control becomes weak, resulting in decrease of the speed loop bandwidth. In this case, the enabled Kp and Ti parameters need to be adjusted in real time based on the feedback speed. After dynamic parameter auto-tuning, the base Kp and Ti (d3-02/d3-03) are obtained, and the speed adaptation coefficient is obtained through the calculation in the following figure. The following figure shows the speed control adapter function.

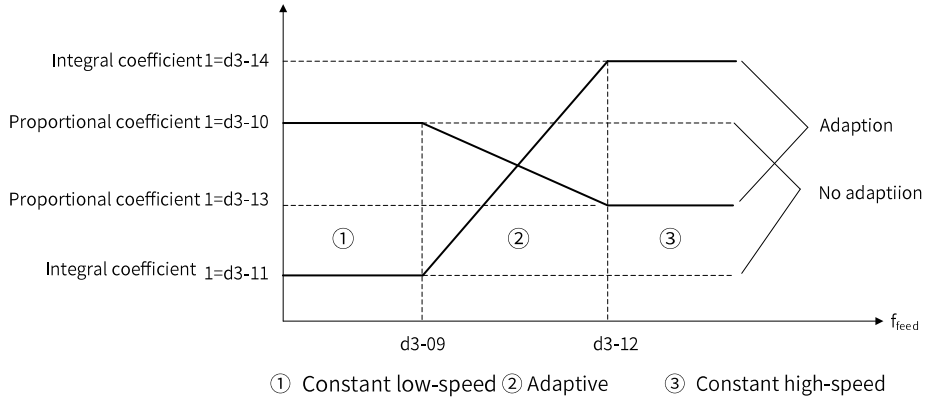


Figure 4-10 Low-speed and high-speed adapter

Adaptive adaption: The principle of adaptive adaptation and speed adaptation is the same, but the adjustment reference value range of the speed adapter 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 adaptive correction coefficient is calculated as follows:

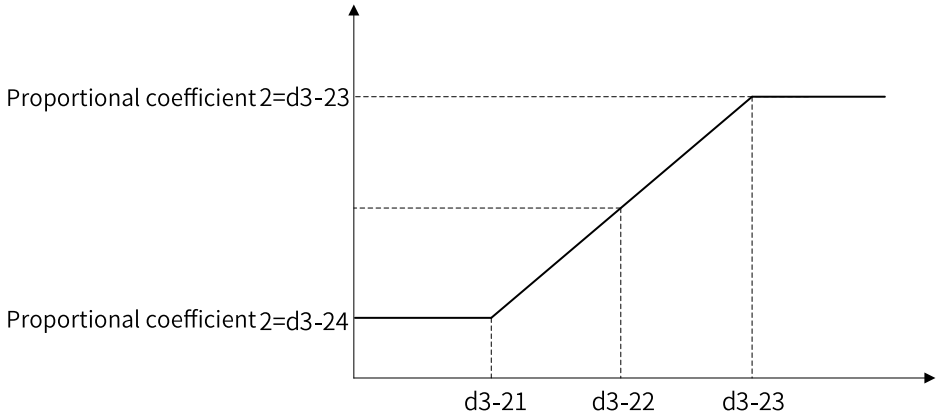


Figure 4-11 Adaptive adapter

The final active Kp and Ti are calculated as follows:

The final effective K_p = d3.02 x proportional coefficient 1 x proportional coefficient 2

The final effective T_i = d3.03 x integral coefficient 1

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
d3-06 (F2-04)	Zero speed switchover frequency	1.0%	0.0% to d3-09	This parameter sets the zero speed switchover frequency of the speed loop. Additional information: When the speed reference is lower than this frequency, the effective speed loop parameters are adjusted with the corresponding correction factors on the basis of the original speed loop parameters.
d3-07 (F2-05)	Zero speed Kp correction factor	100.0%	0.0% to 1000.0%	This parameter sets the proportional correction factor of the speed loop at zero speed. Additional information: When the speed reference is lower than the zero speed switchover frequency, the effective speed loop proportional factor is adjusted with this parameter.
d3-08 (F2-06)	Zero speed Ti correction factor	100.0%	0.0% to 1000.0%	This parameter sets the integral correction factor of the speed loop at zero speed. Additional information: When the speed reference is lower than the zero speed switchover frequency, the effective speed loop integral factor is adjusted with this parameter.

Parameter	Name	Default	Value Range	Descriptions
d3-09 (F2-07)	Low speed switchover frequency	10.0%	0.0% to d3-12	This parameter sets the low speed switchover frequency of the speed loop. Additional information: When the actual speed is less than the low speed switchover frequency, the effective speed loop parameters are adjusted with the corresponding correction factors on the basis of the original speed loop parameters.
d3-10 (F2-08)	Low speed Kp correction factor	100.0%	0.0% to 1000.0%	This parameter sets the proportional correction factor of the speed loop at low speed.
d3-11 (F2-09)	Low speed Ti correction factor	100.0%	0.0% to 1000.0%	This parameter sets the integral correction factor of the speed loop at low speed.
d3-12 (F2-10)	High speed switchover frequency	20.0%	d3-09 to 400.0%	This parameter sets the high speed switchover frequency of the speed loop.
d3-13 (F2-11)	High speed Kp correction factor	100.0%	0.0% to 1000.0%	This parameter sets the proportional correction factor of the speed loop at high speed.
d3-14 (F2-12)	High speed Ti correction factor	100.0%	0.0% to 1000.0%	This parameter sets the integral correction factor of the speed loop at high speed.

Parameter	Name	Default	Value Range	Descriptions
d3-19	Adaptive source of Kp	0	0: Disabled 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communica-tion 10: Potentiometer MD-BP-M Others: F connector	Sets the speed loop Kp self-adaption source. Value description 0: Invalid 2: AI1. The forward frequency upper limit is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse. The forward frequency upper limit is set through the pulse frequency of the DI4. The frequency is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the forward 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 limit values. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. Multi-reference parameters are used to set the forward 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 forward frequency upper limit is set through PID. As a general process control method, PID control is a closed-loop mechanism in which each controlled variable is stabilized at the target level. This is implemented through proportional, integral, and differential calculation of the difference between the feedback signal and the target signal of the controlled variable and through adjustment of the AC drive output frequency. 9: Communication. The forward frequency upper limit is set through communication. When selecting the source, you can set the forward torque limit through remote communication. It is applicable to scenarios requiring remote control or centralized control of multiple devices.

Parameter	Name	Default	Value Range	Descriptions
d3-19	Adaptive source of Kp	0	0: Disabled 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communica-tion 10: Potentiometer MD-BP-M Others: F connector	10: MD-BP-M potentiometer. The speed loop Kp self-adaption source is set through the MD-BP-M potentiometer. Others: F connector. A parameter No. is set for a float connector, and the value of the connector is read as the forward frequency upper limit. This mode is used for expansion of common sources. Note: When the value from the selected source is less than the speed loop self-adaption switchover lower limit (d3-21), the speed loop Kp is corrected with d3-24. When the value from the selected source is greater than the speed loop self-adaption switchover upper limit (d3-22), the speed loop Kp is corrected with d3-23. When the value from the selected source is in the range from d3-21 to d3-22, the Kp correction factor varies linearly in the range from d3-23 to d3-24.
d3-21	Defines the lower limit of speed loop adaptive switchover.	40.0%	0.0% to 1000.0%	This parameter sets the adaptive switchover lower limit of the speed loop. Additional information: When the speed loop Kp self-adaption source is valid and the value from the selected source is less than the value of d3-21 (Adaptive switchover lower limit of speed loop), the speed loop Kp is corrected with d3-24. When the value from the selected source is greater than the value of d3-22 (Adaptive switchover upper limit of speed loop), the speed loop Kp is corrected with d3-23. When the value from the selected source is in the range from d3-21 to d3-22, the Kp correction factor varies linearly in the range from d3-23 to d3-24.
d3-22	Defines the upper limit of speed loop adaptive switchover.	100.0%	0.0% to 1000.0%	This parameter sets the adaptive switchover upper limit of the speed loop. Additional information: When the speed loop Kp self-adaption source is valid and the value from the selected source is less than the value of d3-21 (Adaptive switchover lower limit of speed loop), the speed loop Kp is corrected with d3-24. When the value from the selected source is greater than the value of d3-22 (Adaptive switchover upper limit of speed loop), the speed loop Kp is corrected with d3-23. When the value from the selected source is in the range from d3-21 to d3-22, the Kp correction factor varies linearly in the range from d3-23 to d3-24.

Parameter	Name	Default	Value Range	Descriptions
d3-23	Lower limit of speed loop adaptive correction	100.0%	0.0% to 1000.0%	Sets the lower limit of speed loop adaptive correction. Additional information: When the speed loop Kp self-adaption source is valid and the value from the selected source is less than the value of d3-21 (Adaptive switchover lower limit of speed loop), the speed loop Kp is corrected with d3-23. When the value from the selected source is greater than the value of d3-22 (Adaptive switchover upper limit of speed loop), the speed loop Kp is corrected with d3-24. When the value from the selected source is in the range from d3-21 to d3-22, the Kp correction factor varies linearly in the range from d3-23 to d3-24.
d3-24	Speed loop adaption correction upper limit	100.0%	0.0% to 1000.0%	Sets the speed loop self-adaption correction upper limit. Additional information: When the speed loop Kp self-adaption source is valid and the value from the selected source is less than the value of d3-21 (Adaptive switchover lower limit of speed loop), the speed loop Kp is corrected with d3-23. When the value from the selected source is greater than the value of d3-22 (Adaptive switchover upper limit of speed loop), the speed loop Kp is corrected with d3-24. When the value from the selected source is in the range from d3-21 to d3-22, the Kp correction factor varies linearly in the range from d3-23 to d3-24.

Note

- The motor parameters in group F2 in the table are the mapping of motor parameters in group d3. The settings of the two groups are equivalent.
- d3-10 to d3-14: When the actual speed is less than the low speed switchover frequency, the effective speed loop parameters are adjusted with the low speed correction factors. When the actual speed is greater than the high speed switchover frequency, the effective speed loop parameters are adjusted with the high speed correction factors. When the actual speed is between the low speed and the high speed, the speed loop correction factors vary linearly.

Application Cases

In the application of the wire drawing machine, the faulty mechanical installation caused the 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 strengthened at low speed to suppress speed fluctuation as much as possible, and the speed loop needed to be reduced at high speed to reduce vibration.

Based on the actual commissioning, the speed loop parameters are adjusted automatically by using the low-speed and high-speed speed loop adaption function. The steps are as follows:

1. Set F2-07/d3-09 (Low speed switchover frequency) = 5 Hz.
2. Set low-speed loop proportional correction factor 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 factor (F2-11/d3-13) is reduced to 30%, and the integral correction factor (F2-12/d3-14) remains unchanged: 100%.

Finally, the vibration requirements are met.

4.1.3.4 Feedforward Torque (Acceleration Torque Compensation)

Scenario

According to the formula, to make the motor accelerate and decelerate in accordance with the given RFG curve, it is necessary to provide the motor with a suitable acceleration torque $T_a = T_e - T_L$. It cannot obtain a satisfactory effect by relying completely on the speed regulator, which may result in overshoot at the end of acceleration and speed lag at the beginning of acceleration.

Acceleration torque compensation can resolve this problem. In this solution, the required acceleration torque is directly calculated based on the auto-tuned moment of inertia and the expected acceleration, and then superimposed on the output of the speed regulator. This decreases the adjustment of the speed regulator and improves the speed following performance.

Working Principle

Acceleration torque compensation is implemented according to the motor motion equation. The motor motion equation is:

$$T_e - T_L = J\frac{d\omega}{dt}$$

where

T_e: motor electromagnetic torque

T_L: load torque and friction torque

J: moment of inertia, displayed in parameter d2-00 after auto-tuning. The per unit value is equal to the electromechanical time constant (d2-05).

$\frac{d\omega}{dt}$: motor speed change rate, which is calculated automatically in the system and related to the acceleration/deceleration time.

The speed change rate of the motor needs to be obtained. Therefore, the output acceleration rate of RFG is used for acceleration torque compensation. When the speed reference is generated only by RFG, this method can obtain accurate acceleration torque. The diagram of feedforward torque generation is shown below.

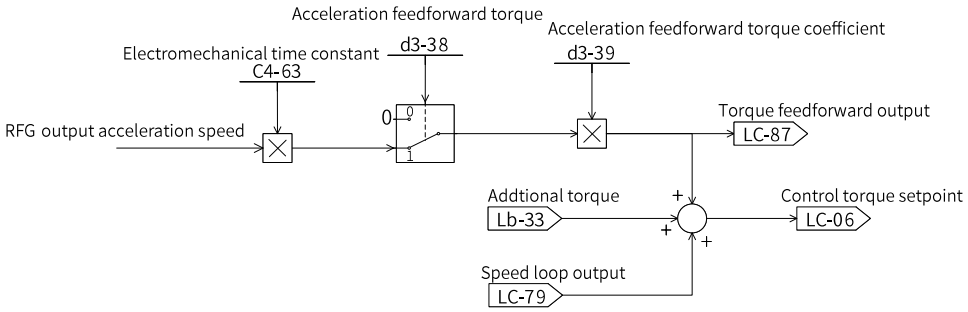
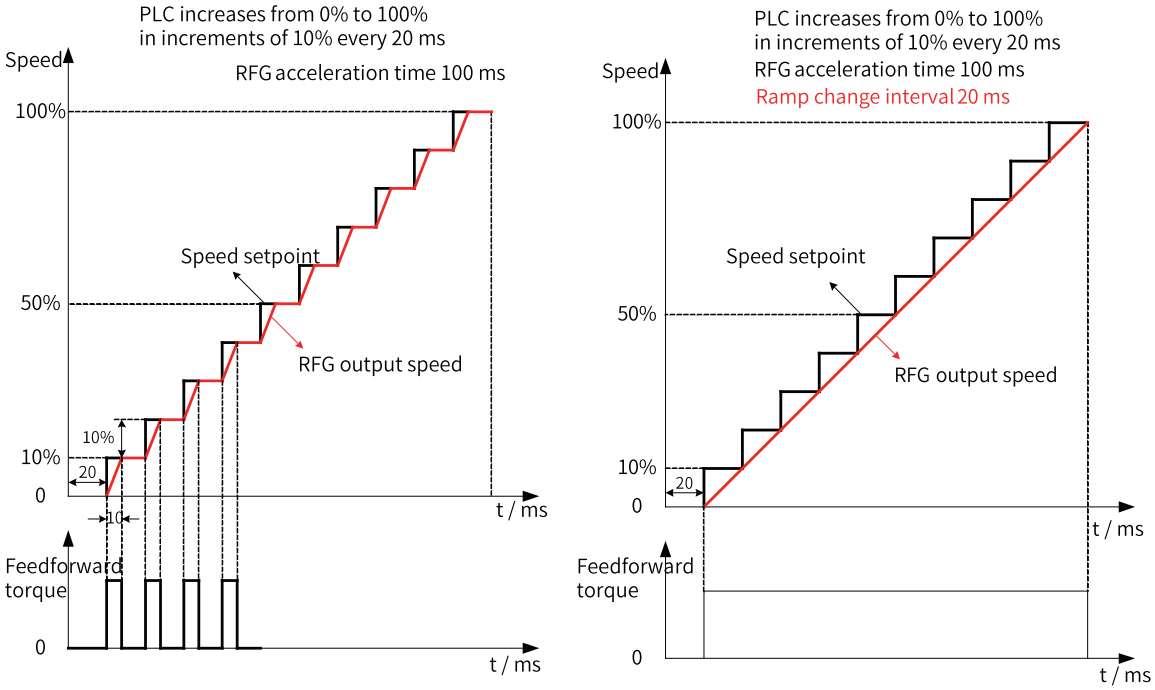


Figure 4-12 Diagram of feedforward torque generation

Frequency ramp change: If the speed reference is set through PLC communication, the speed reference is discontinuous due to the long communication period between PLC and AC drive. This will result in unsmooth RFG output speed and will further result in discontinuous calculated acceleration. The jumping feedforward torque calculated using the acceleration torque compensation function will lead to motor output torque oscillation, which may damage the rigid structure connected by gears.



You can solve this problem by using the frequency ramp change function. After b5-11 is set to 1 (enable), the slope of the speed ramp is controlled during the change of the speed reference, resulting in a continuous change. When the signal update interval of the external control system (interval of PLC transmission) is consistent with the frequency ramp change interval (b5-12), the RFG output speed reference is a straight line.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
d3-38	Feedforward torque enable	0	0 to 1	This parameter sets whether to enable acceleration feedforward torque. In speed mode, enabling feedforward torque can significantly improve the acceleration following effect. Value description 0: Disable 1: Enable Additional information: To ensure the feedforward effect, complete auto-tuning or inertia auto-tuning is required.
d3-39	Feedforward torque coefficient	100.0%	0.0% to 6553.0%	This parameter sets the feedforward torque.
d3-40	Feedforward acceleration speed source	0	0: RFG setting 1: Automatic calculation Others: F connector	Sets the feedforward torque calculation source Value description 0: RFG setting. The speed reference source is the RFG module. This option ensures better results. 1: Automatic calculation. If the speed reference source is not the RFG module, this parameter must be set to "Automatic calculation". Additional information: When the speed reference source is the RFG module, it is recommended to set this value to 0 as the acceleration torque source.

Parameter	Name	Default	Value Range	Descriptions
b5-11	Frequency ramp change	0	0: Disable 1: Enable 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Defines whether frequency ramp change function is enabled. When the bit signal is 0, the function is disabled. When the bit signal is 1, the function is enabled. Value description 0: Disable. The function is disabled. 1: Enable. The function is enabled. 3 to 7: DI1 to DI5 - Whether supplementary torque reference 2 is enabled depends on the terminal state of the DI. Other: B connector - Whether supplementary torque reference 2 is enabled depends on other B connectors. You can select other B connectors through the pop-up window. Additional information: 1. The frequency ramp change function enables the slope of the speed ramp to be controlled during the change of the speed reference, resulting in a continuous slope change rate. It is applicable to applications when the signal update time of the external control system is not continuous and the interval exists to make the RFG output speed reference to be a straight line. If the speed reference is set through PLC communication, the speed reference is discontinuous due to the long communication period between PLC and AC drive. This will result in unsmooth RFG output speed. When the speed reference of the PLC increases from 0% to 100% in increments of 10% every 20 ms and if the RFG speed output is too large and the time for acceleration from 0% to 10% is too short, the period within 20 ms is a process of acceleration and at constant speed. In this way, the speed output will not be a continuous line but a series of steps. The calculated acceleration is not continuous. The jumping feedforward torque calculated using the acceleration torque compensation function will lead to motor output torque oscillation, which may damage the rigid structure connected by gears. 2. When the set speed is sent to the AC drive through communication, the frequency ramp change function shall be enabled simultaneously if the acceleration torque feedforward function needs to be enabled.
b5-12	Frequency ramp change interval	50 ms	2 ms to 10000 ms	This parameter specifies the frequency ramp interval. Additional information: See b5-11 for the description of the frequency ramp function. When the signal update interval of the external control system (interval of PLC transmission) is consistent with the frequency ramp change interval, the RFG output speed reference is a straight line. It is necessary to set the frequency ramp change interval = the communication period of the speed reference.

Application Cases

In the textile production line, the SVC speed control mode is used. The host controller sends the speed reference and the communication cycle is 50 ms. After the SVC is activated and the system accelerates to the set speed, there is a large overshoot in speed. Customers wish to minimize this overshoot.

To solve the above problems, reduce overshoot by enabling acceleration torque feedforward function. The frequency ramp change function needs to be turned on, considering that the speed reference is sent through the PLC.

Follow the steps below.

1. Ensure that the motor performs complete overload auto-tuning or inertia auto-tuning. If not, perform inertia auto-tuning by setting C2-00 to 4.
2. After auto-tuning is performed, set b5-11 to 1 to enable the frequency ramp change function.
3. The frequency ramp change interval is set to 50 ms by setting b5-12 to 50, since the communication period with the PLC is 50 ms.
4. Enable acceleration feedforward torque function by setting set d3-38 to 1.
5. Select the acceleration feedforward torque source. Set d3-40 to 0 because the speed source is RFG when in speed mode.

If the speed is not set by the PLC or if the PLC sends the final target speed without an active ramp command from the host controller, skip steps 3 and 4 in the preceding steps and do not enable frequency ramp change function. Only RFG feedforward is enabled.

4.1.3.5 Speed Control Optimization

This section describes how to optimize speed control in vector control mode. The speed control optimization is simpler in V/f control mode, which is described in the V/f control section. The performance of speed control in vector control mode is divided into two categories:

1. Speed following the speed reference: Feedback speed following when the speed reference changes. As shown in the following figure *Poor speed following performance*, the speed cannot follow during acceleration/deceleration.
2. Anti-load disturbance performance: Whether the speed can maintain stably during load change. As shown in the following figure *Poor speed anti-load disturbance performance*, the speed cannot follow well during load change.

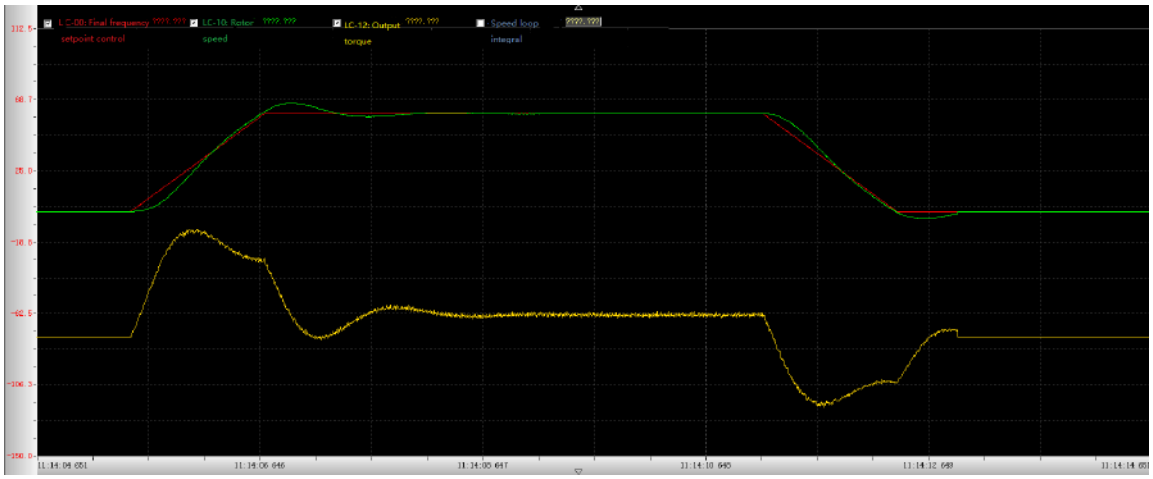


Figure 4-13 Poor speed following performance

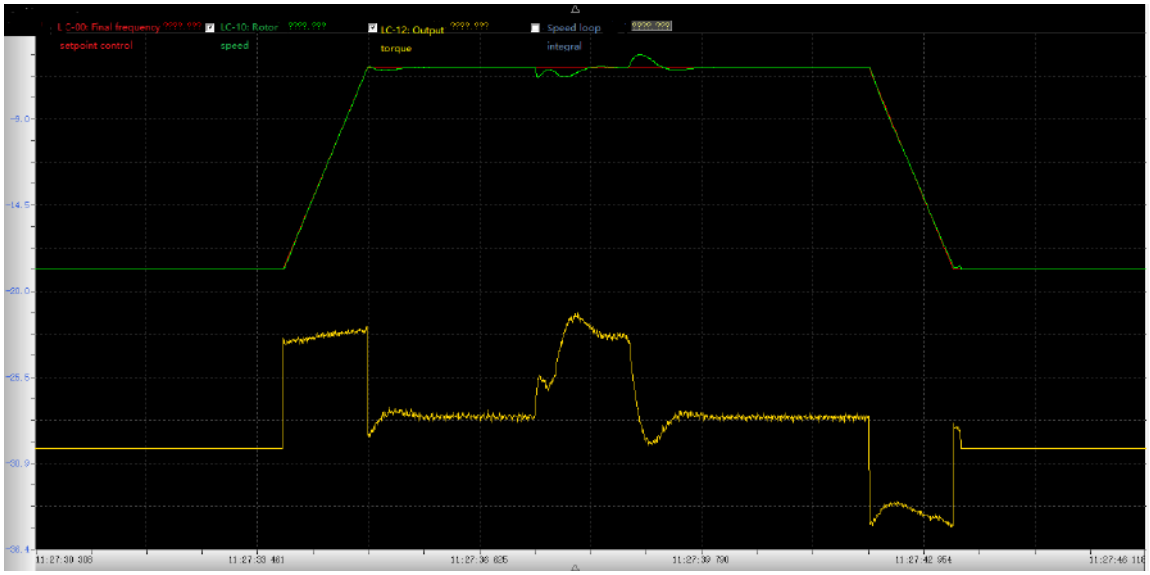


Figure 4-14 Poor speed anti-load disturbance performance

Acceleration feedforward is mainly used to improve the speed following capability. To improve the poor speed following performance, acceleration feedforward is preferred. The speed loop PID is used to improve the speed anti-load disturbance performance. If the speed cannot maintain stably as the load changes, the speed loop PID parameters need to be set.

It is a common misconception that increase the speed loop PI parameters when speed follow performance is poor. However, in applications with high inertia and fast acceleration, this method cannot achieve a good speed follow effect, and oscillation may occur.

Use acceleration feedforward torque, in the following scenarios:

- The feedback speed following perfomance is poor when the speed reference changes. (The application when the inertia system changes is introduced later.)
- Large inertia (large-mass load) applications
- Application in quick start/stop situations.

Summary: In most cases, priority should be given to acceleration feedforward adjustment before adjusting PI parameters.

Adjusting the acceleration feedforward

The acceleration feedforward torque calculation formula is as follows:

$$T_e = Ja$$

T_e: Motor output acceleration torque; J: Moment of inertia, system parameters, which need to be tuned or manually tested; a: Acceleration, which is related to acceleration/deceleration time.

The following figure shows commissioning the acceleration feedforward.

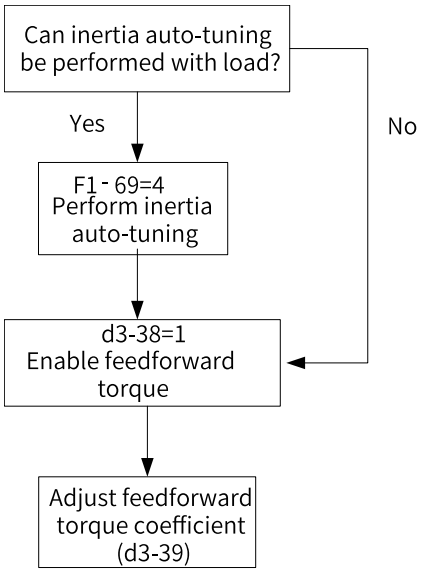


Figure 4-15 Commissioning the acceleration feedforward

Moment of inertia is an important parameter of acceleration feedforward and the inertia auto-tuning shall be performed initially. There are specific limitations to this process.

1. Inertia auto-tuning can be directly performed for systems with disks and rollers.
2. Inertia auto-tuning cannot be performed for changing loads, such as the fan and water pump.
3. Inertia auto-tuning is not performed for travel-limited applications.
4. Inertia auto-tuning is not performed for changing inertia systems (such as winding and unwinding machines, reciprocating cam slider mechanisms).

If inertia auto-tuning is not performed, the system will use a default moment of inertia. The acceleration torque feedforward can be also commissioned by adjusting acceleration feedforward torque coefficient (d3-39) during running. Set F2-02 to 5 and F2-03 to 2.0 ms. The commissioning process is as follows:

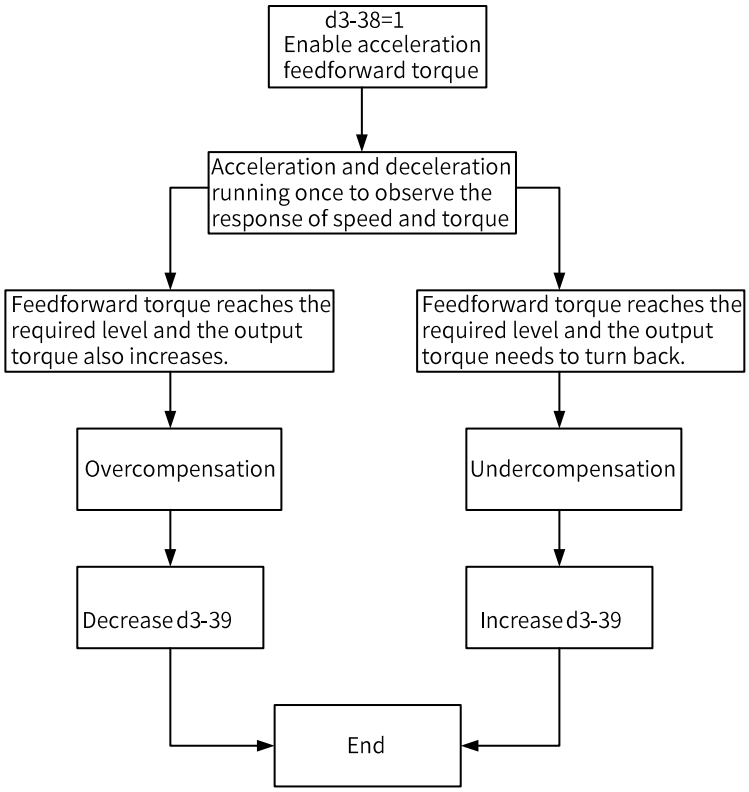


Figure 4-16 Commissioning Flowchart

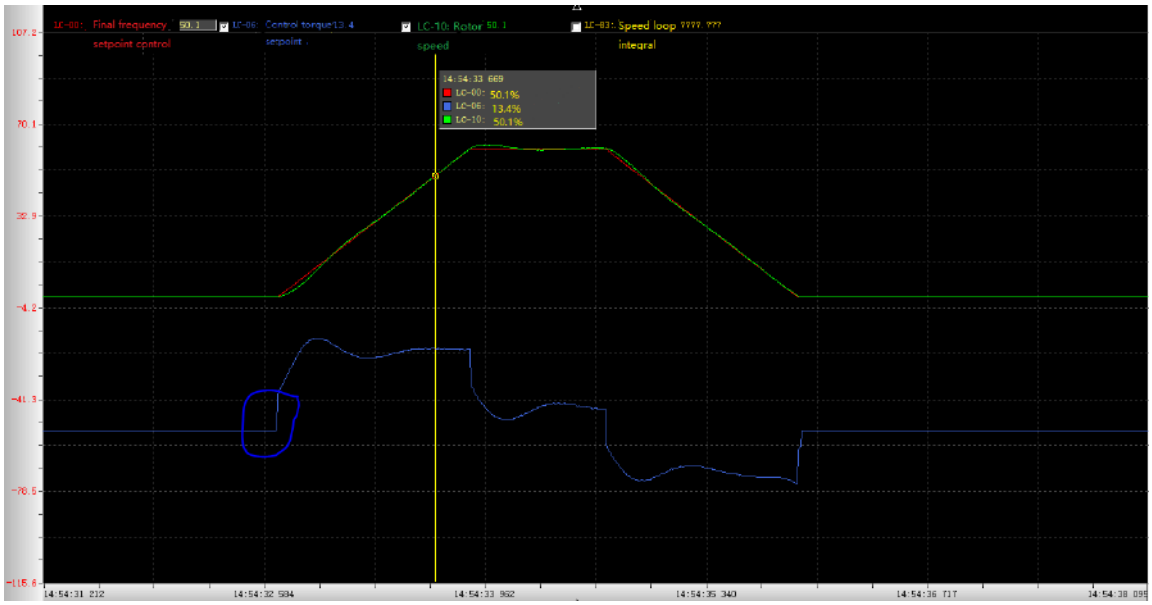


Figure 4-17 Acceleration torque feedforward undercompensation

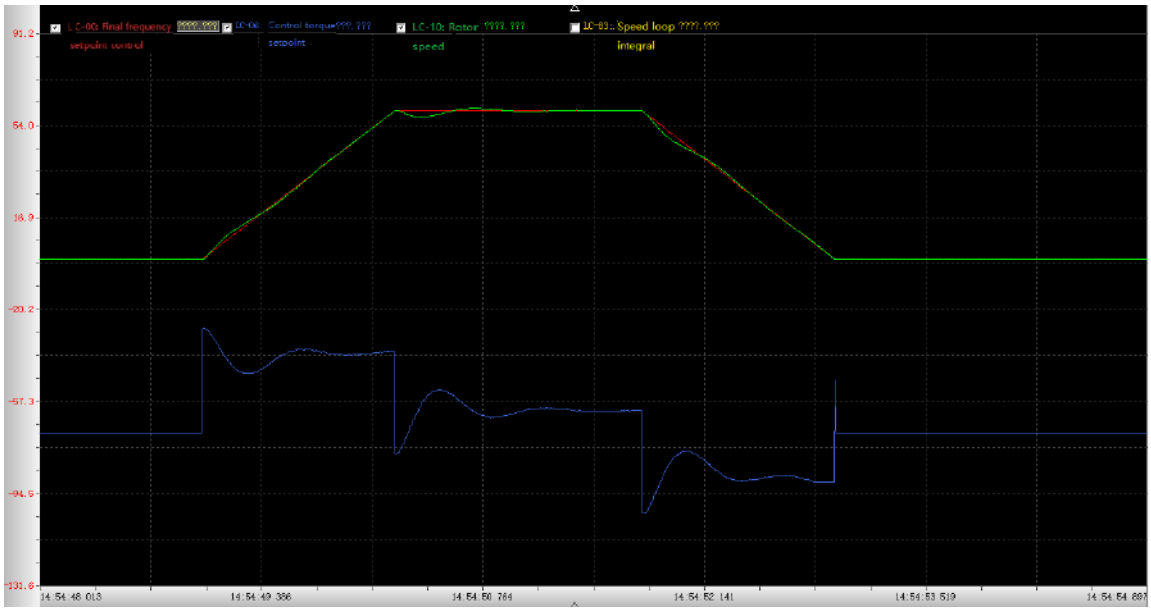


Figure 4-18 Acceleration torque feedforward overcompensation

Feedforward undercompensation: Feedforward torque does not reach the required level upon acceleration/deceleration start and completed. The PI controller must continue to compensate.

Feedforward overcompensation: Feedforward torque reaches the required level upon acceleration/deceleration start and completed. The PI controller needs to adjust the output torque back.

As shown in the following figure, feedforward torque is close to the required torque. When the speed reference changes, the feedback speed follows accurately. For flexible loads, sudden feedforward torque change will cause shock, mechanical oscillation or noise. To mitigate these issues, activating the S curve feature allows the feedforward torque to increase or decrease linearly, significantly reducing load fluctuations.

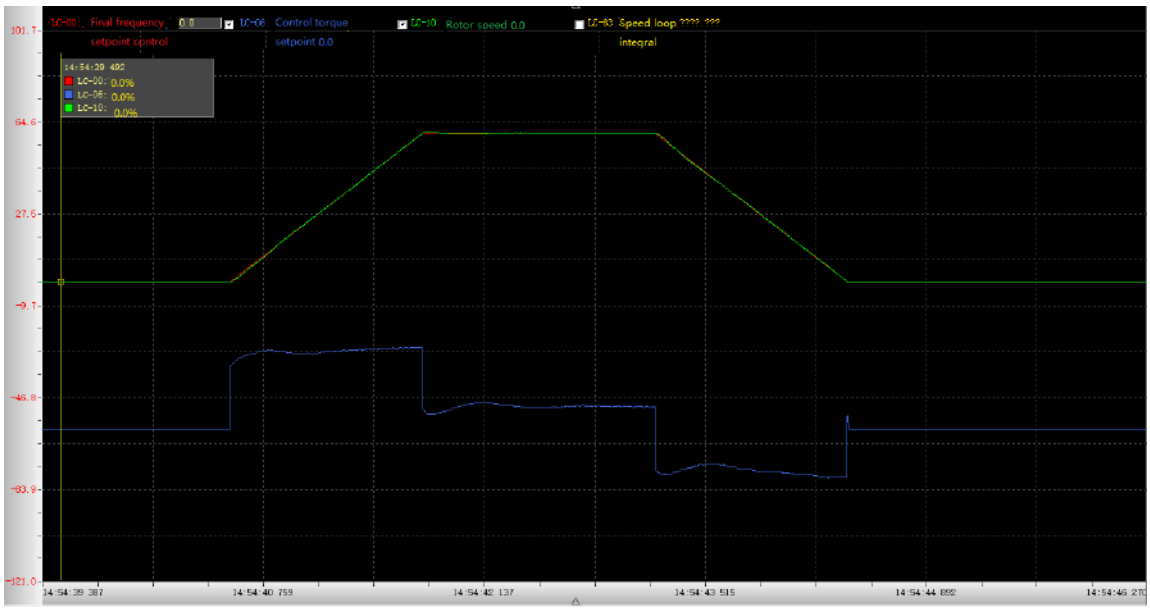


Figure 4-19 Accurate acceleration torque feedforward control

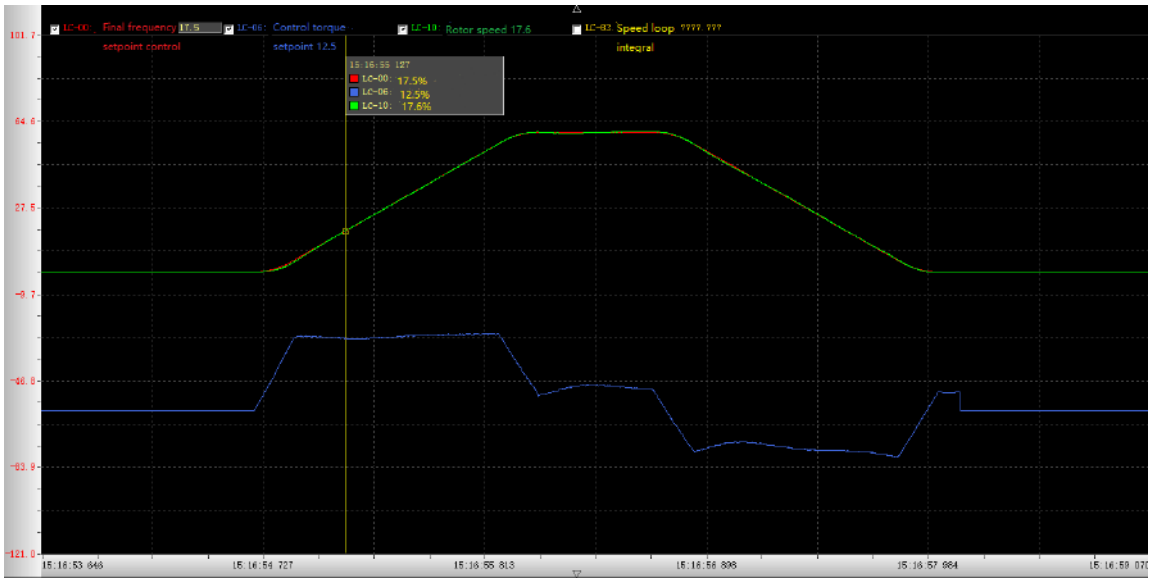


Figure 4-20 Acceleration torque feedforward control after acceleration/deceleration curve is enabled

If the PLC gives the speed references at a slow cycle such as setting the speed once every 100 ms, the feedback speed may exhibit sudden jumps, and the output torque will also show burr. In this case, you can enable the frequency ramp change function through b5-11, and set the cycle through b5-12 (the measurement interval in the commissioning software oscilloscope).

b5-11	Frequency ramp change	0 (Disable)	-
b5-12	.Frequency ramp change interval	50	ms

Adjusting the speed loop PI parameters

1. Set the speed loop Kp (F2-02) to 3 and the speed loop Ti (F2-03) to 2.0 seconds.
2. Increase the speed loop Kp (F2-02) gradually, and observe the speed feedback waveform and the set torque current.
3. During the increase of the Kp, ensure that the torque current fluctuation remains below 3%.
4. If the torque current fluctuation exceeds 3%, reduce the Kp value by one-third. The Kp value is set successfully.
5. Adjust the speed loop Ti (F2-03) based on the load characteristics. If Ti for large inertia or large mechanisms is small, the sudden unloading after loading will cause speed fluctuation, which may cause the bus voltage to rise, potentially leading to overheating, overloading the brake pipe IGBT, and the braking resistor. It is recommended to set the Ti of large machinery and systems with large inertia to 2s. For sites with high dynamic response, it is recommended that the integral time is no less than 0.1 s.

4.1.4 Overvoltage Suppression

Scenario

In high inertia or rapid deceleration applications, overvoltage may occur during deceleration. When the motor is in the power generation state, the DC bus voltage rises. The direct method for suppressing DC bus voltage increase is to reduce torque during electricity generation.

Working Principle

When the overvoltage suppression function 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. This function is used to suppress the rise of the bus voltage and prevent overvoltage. In this case, the deceleration time will be longer than the setting.

The following figure shows the overvoltage suppression process.

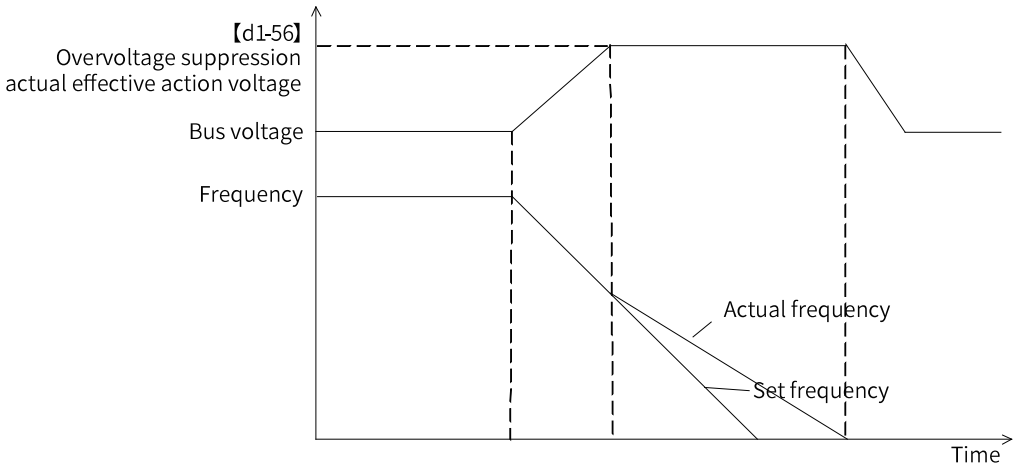


Figure 4-21 Overvoltage suppression control process

Related Parameters

Param.	Name	Default	Value Range	Parameter
d1-54 (F2-39)	Overvoltage suppression	1	0 to 1	Sets whether overvoltage suppression is enabled. Value description 0: Disable 1: After the overvoltage suppression function 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 setting. Additional information: When a braking resistor, braking unit, or energy feedback unit is used, set this parameter to 0. Otherwise, the deceleration time may be prolonged. F2-39 is the same parameter as d1-54. After F2-39 is modified, d1-54 is updated synchronously.
d1-55 (F2-40)	Overvoltage suppression action voltage	770.0V	330.0 V to 800.0 V	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. Additional information: Too large value may lead to overvoltage. F2-40 is the same parameter as d1-55. After F2-39 is modified, d1-54 is updated synchronously.

Param.	Name	Default	Value Range	Parameter
d1-56	Overvoltage suppression actual effective action voltage	770.0V	330.0 V to 800.0 V	Displays the actual bus voltage when overvoltage suppression is active. When the bus voltage is greater than this value, the overvoltage suppression function takes effect.
d1-57	Overvoltage suppression Kp adjustment	100%	0.0% to 1000%	Defines the proportional coefficient of the overvoltage suppression control loop. Additional information: Increasing the value of this parameter improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-58	Overvoltage suppression Ki adjustment	100%	0.0% to 1000%	Defines the integral coefficient of the overvoltage suppression control loop. Additional information: Increasing the value of this parameter improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.

Note

The parameter group F in the table is the mapping of parameter group d. The settings of the two groups are equivalent.

Precautions

- Set d1-55 to a relatively large value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is better to verify this trigger voltage during application.
- Use the V/f overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value less than the overvoltage suppression action voltage or disable the overvoltage suppression.
- In the case of common bus, enable the overvoltage suppression function on only one drive unit, typically the drive unit with the largest inertia, and disable this function on other drive units.
- In the torque control mode, exert caution before enabling the overvoltage suppression function. If the torque cannot adjust the system bus, the torque may be adjusted to the limit.
- In case of proactive load such as the lifting load, disable the overvoltage suppression function. Because overvoltage suppression will restrict the power generation torque, which may cause motor driven by the load, resulting in serious consequences such as heavy object falling.

Instances

In the case of short deceleration time and large motor inertia, an overvoltage fault may occur during deceleration or during speed overshoot.

Overvoltage suppression is enabled by default. The bus voltage rise is suppressed by suppressing the generating torque and reducing the generating power. The bus voltage will basically remain close to d1-56 (Overvoltage suppression actual effective action voltage), which can be reduced by setting d1-55 (Overvoltage suppression action voltage).

If the bus voltage cannot be suppressed, increase d1-57 (Overvoltage suppression Kp adjustment) and d1-58 (Overvoltage suppression Ki adjustment) to limit the generating power and improve the bus voltage control effect.

4.1.5 Undervoltage Suppression

Scenario

In the SVC control mode, when the power supply or DC bus incurs short-term power-off, undervoltage will occur if the fault is not handled in time, causing coast to stop. After the undervoltage suppression function is enabled, undervoltage can be suppressed in a short period, preventing stop upon instantaneous power-off. When the power supply or DC bus incurs long-term power failure, you need to enable the undervoltage suppression function for power generation to compensate for bus energy loss until all motors stop reliably.

Working Principle

After the bus voltage falls below the undervoltage suppression action voltage, the PID control of the bus voltage makes the motor decelerate and enter the power generation state to compensate for energy loss to stabilize the voltage in the DC bus.

The following figures show the overvoltage suppression process.

- If d1-63 is set to 1 (Undervoltage suppression. Restore to normal operation after voltage recovery), when the running frequency is higher than d1-72 plus d1-73, undervoltage suppression is performed. When the bus voltage recovers and the running frequency is higher than d1-72, the speed is accelerated to the original speed according to the set acceleration time after the bus voltage is restored, as shown in the following figure.

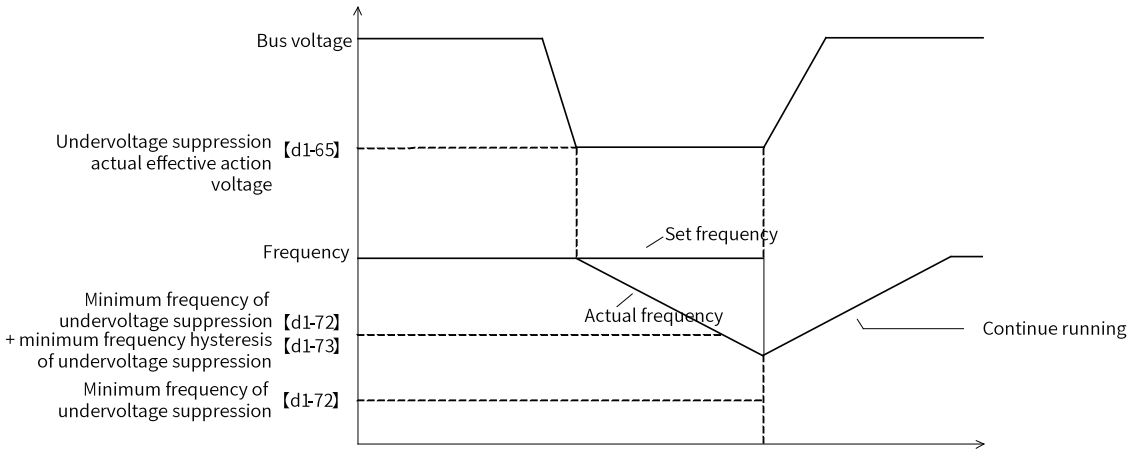


Figure 4-22 Undervoltage suppression. Restore to normal operation or decelerate to stop after voltage recovery.

- When the undervoltage action enable is selected, the running frequency is higher than d1-72 plus d1-73 when the undervoltage occurs. When the running frequency reaches d1-72 and the bus voltage is not restored, the undervoltage fault is reported and the motor stops.

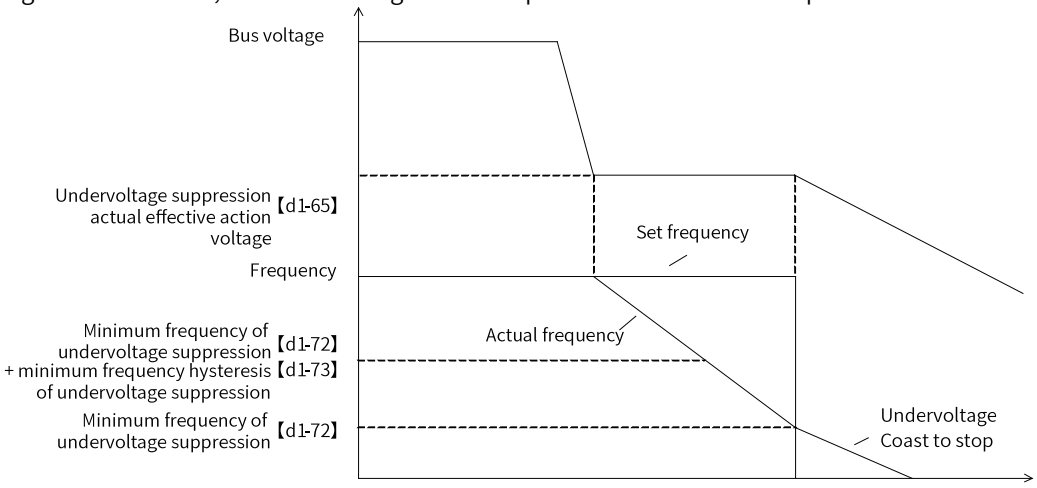


Figure 4-23 When undervoltage is suppressed, running frequency lower than minimum frequency of undervoltage suppression

- When the undervoltage action is enabled and the running frequency is lower than d1-72 plus d1-73 when undervoltage occurs, the undervoltage suppression function is disabled. The motor continues to run until the bus voltage is below A3-56 when the undervoltage fault is reported and the motor stops.

Related Parameters

Param.	Name	Default	Value Range	Parameter
d1-63	Undervoltage action selection	0	0: The DO does not act 1: Undervoltage suppression. Restore to normal operation after voltage recovery. 2: Reserved	Defines the response when the bus voltage reaches the undervoltage suppression point due to power failure. 0: The DO does not act 1: Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. If the bus voltage is restored during this period, the motor restores to the target speed according to the acceleration time. 2: Reserved
d1-64	Undervoltage suppression action voltage	430.0V	190.0 to 540.0 V	Sets the voltage threshold for undervoltage suppression. Additional information: When the bus voltage is lower than the undervoltage suppression point due to a power failure, the AC drive acts according to the action set in d1-63.
d1-65	Undervoltage suppression actual effective action voltage	430.0V	190.0 to 540.0 V	Displays the actual voltage of the undervoltage suppression threshold Additional information: The actual action voltage is internally limited when the undervoltage suppression threshold that does not match the model is set. Ready-only, unchangeable

Param.	Name	Default	Value Range	Parameter
d1-66	Undervoltage suppression Kp adjustment	100%	0.0% to 1000%	Defines the proportional coefficient of the undervoltage suppression control loop. Additional information: Low Kp setting will cause that the bus voltage cannot be maintained when the grid is powered off and the system may report undervoltage or overcurrent faults when the the motor is still rotating. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-67	Undervoltage suppression Ki adjustment	100%	0.0% to 1000%	Defines the integral coefficient of the undervoltage suppression control loop. Additional information: Low Ki setting will cause that the bus voltage cannot be maintained when the grid is powered off and the system may report undervoltage or overcurrent faults when the the motor is still rotating. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-72	Minimum frequency of undervoltage suppression (SVC)	3.00 Hz	0.00-10.00 Hz	Defines the minimum frequency of undervoltage suppression in vector mode. Additional information: In the vector mode, when the running frequency is lower than the value of d1-72, the system exits the undervoltage suppression state and enters the low-speed state. In the low-speed state, when the running frequency is higher than the sum of the value of d1-72 and the value of d1-73, the system exits the low-speed suppression state and enters undervoltage suppression state.
d1-73	Minimum frequency hysteresis of undervoltage suppression (SVC)	3.00 Hz	0.00-10.00 Hz	Defines the minimum frequency hysteresis of undervoltage suppression in vector mode. Additional information: When the running frequency is lower than the value of d1-72, the system exits the undervoltage suppression state and enters the low-speed state. In the low-speed state, when the running frequency is higher than the sum of the value of d1-72 and the value of d1-73, the system exits the low-speed suppression state and enters undervoltage suppression state..

Precautions

- Set d1-64 to a relatively small value to prevent incorrect trigger in the case of large grid voltage fluctuations. It is better to verify this trigger voltage during application.

Instances

In the field where the mains voltage is unstable, direct stop may occur due to undervoltage faults, causing technical problems. In this case, set d1-63 to 1 to decelerate during undervoltage to maintain the bus voltage.

If you want to restart operation after the bus resumes to normal, d1-63 can set to 1: Undervoltage suppression, and restore to normal operation after voltage recovery.

When undervoltage suppression is active, the motor enters the deceleration and power generation state and to keep the bus volatge at d1-65. If you want the bus voltage to maintain at a higher level, increase the value of d1-64.

If the bus voltage cannot be maintained when the load inertia is appropriate and the power generation is normal, increase d1-57 and d1-58 to improve the effect of bus voltage following d1-65 (undervoltage suppression actual active action voltage).

4.1.6 Current Limit

Scenario

In the case where the motor running current needs to be limited during SVC control, set F1-13 (Maximum motor current) and A3-05 (Maximum AC drive current) to ensure that the motor current during normal operation does not exceed the minimum values in F1-13 and A3-05.

Working Principle

The current regulator automatically controls the current, ensuring that the total current output does not exceed the limit value.

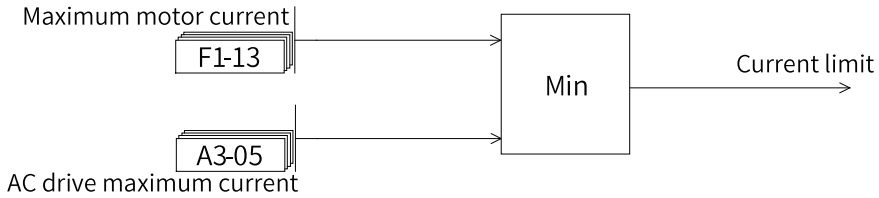


Figure 4-24 Current limit effective

Related Parameters

Param.	Name	Default	Value Range	Parameter
F1-13	Maximum motor current	1000.0%	0.0% to 1000.0%	Sets the maximum limit of the motor current, which is the per unit value based on the rated motor current.
A3-05	Maximum AC drive current	150%	0% to 600%	A3-05 Sets the maximum current of the AC drive. Output current upper limit of AC drive = maximum current of the AC drive x rated current of the AC drive. Additional information: This parameter uses the rated AC drive current as the base value in percentage. The current limit is the smaller value of F1-13 and A3-05.

Precautions

- When the maximum motor current is limited, the overload capacity of the motor may be affected and the motor torque output will be reduced.
- The current limit of the motor is valid only in vector control. In V/f control 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 to prevent excessive deviation between the set speed and the actual speed.

4.1.7 Torque Limit

Scenario

In some process applications, the motor output torque needs to be limited. In some cases, the motor torque limit needs to be adjusted to achieve torque control while the motor runs in the speed mode.

Working Principle

The torque limit can be achieved by limiting the output of the speed loop.

The following figure shows setting the torque limit.

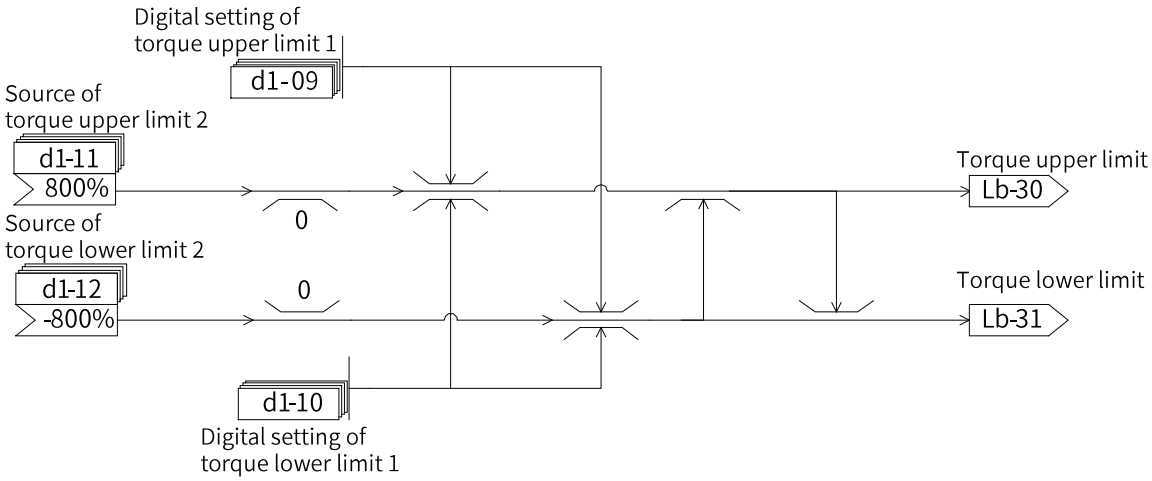


Figure 4-25 Torque limit diagram

The following figure shows how the torque limit takes effect.

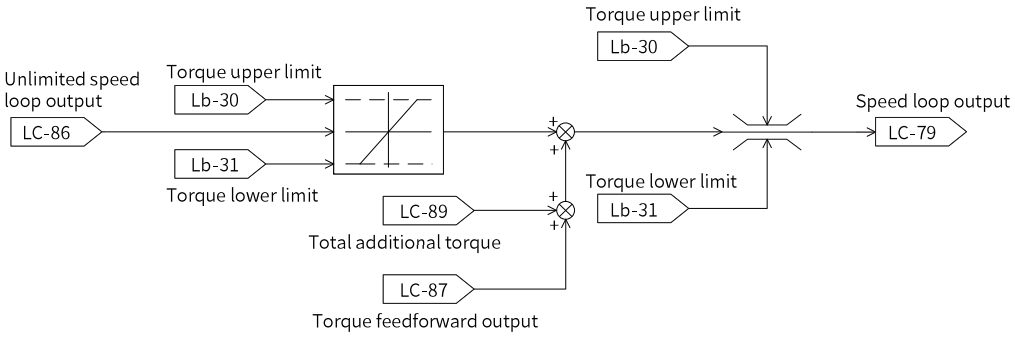


Figure 4-26 Speed loop with output torque limit

Related Parameters

Param.	Name	Default	Value Range	Parameter
d1-09	Digital setting of torque upper limit 1	180.0%	0.0% to 800.0%	This parameter limits the positive maximum output torque. It is a per-unit value based on the rated motor torque. Remarks The effective forward torque limit is the smaller value between d1-09 and d1-11.
d1-11	Source of torque upper limit 2	0	0: 800% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communica-tion 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the forward torque limit source. It is the per unit value based on the rated motor torque. Value description 0: 800%. Set the forward torque limit to 800%. 2: AI1. The forward torque limit is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The forward torque limit is set through the pulse frequency of the DI4. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 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 reverse torque limits. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. The forward torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID. The forward torque limit is set through PID. 9: Communication. The forward torque limit is set through communication. The forward frequency upper limit can be input through remote communication. 10: MD-BP-M potentiometer. The forward torque limit is set through the MD-BP-M potentiometer. Others: F connector. The reverse frequency upper limit is set through the F connector. Remarks The effective forward torque limit is the smaller value between d1-09 and d1-11.

Param.	Name	Default	Value Range	Parameter
d1-10	Digital setting of torque lower limit 1	-180.0%	-800.0% to 0.0%	This parameter limits the negative maximum output torque. It is a per-unit value based on the rated motor torque. Remarks The effective reverse torque limit is the smaller value between d1-10 and d1-12.
d1-12	Source of torque lower limit 2	1: Opposite to the source of torque upper limit 2	0: -800% 1: Opposite to the source of torque upper limit 2 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communica-tion 10: Potentiometer MD-BP-M Others: F connector	This parameter sets the reverse torque limit source. It is the per unit value based on the rated motor torque. 0: -800%. Set the reverse torque limit to -800%. 1: Opposite to torque upper limit 2. Set the reverse torque limit to the opposite value of torque upper limit 2 (d1-11). 2: AI1. The reverse torque limit is input by using current or voltage signals at the AI1 and calculated according to the preset AI curve. 5: HDI pulse. The reverse torque limit is set through the pulse frequency of the DI4. The corresponding per unit value is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 6: Multi-reference. When multi-reference is used as the reverse torque limit, combinations of different DI states correspond to different reverse torque limits. The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reverse torque limits. 7: Simple PLC. Simple PLC is a multi-speed operation command that can control the operation time and acceleration and deceleration time. The reverse torque limit is set through a multi-reference parameter. The simple PLC module sets the running time and acceleration/deceleration time for each frequency reference and supports up to 16 references. 8: PID. The reverse torque limit is set through PID. 9: Communication. The reverse torque limit is set through communication. 10: MD-BP-M potentiometer. The reverse torque limit is set the MD-BP-M potentiometer. Others: F connector. The reverse frequency upper limit is set through the F connector. Remarks The effective reverse torque limit is the smaller value between d1-10 and d1-12.

Precautions

- The motor torque limit is active only in vector control modes. It is inactive in V/f mode.
- The actual torque restriction of the motor is affected by the current limit, torque limit, and power limit. The preceding figure takes the motoring working condition as an example to illustrate the impact of the three limits on the actual torque limit. The actual torque limit is determined by the most restrictive conditions among the limits. In the figure, in order to facilitate comparison, the effective torque limit is slightly lower, and the curve of the actually effective torque limit is coincident with the curve of the minimum torque limit.

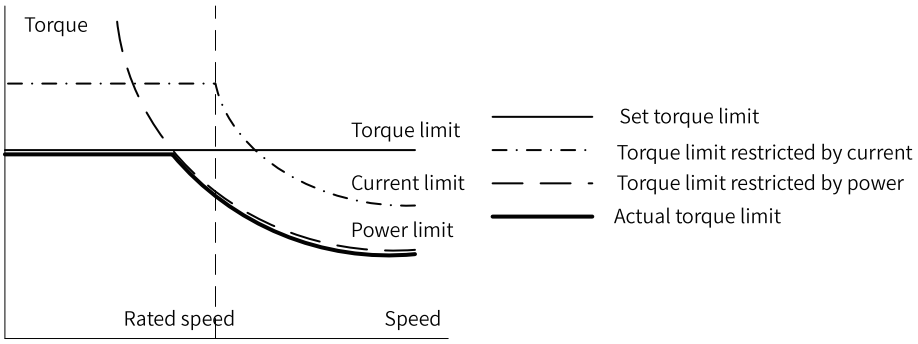


Figure 4-27 Torque limit diagram

4.1.8 Power Limit

Scenario

In SVC control, the power limit can restrict the total power output by the motor. It is suitable for process applications where the output power of the motor needs to be limited separately.

Working Principle

The power limit is internally converted to the torque limit. The output torque limit decreases as the motor speed increases 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 mode and is limited by the motoring power. When the speed direction is opposite to the torque direction, the motor is in the generating mode and is limited by the generating torque.

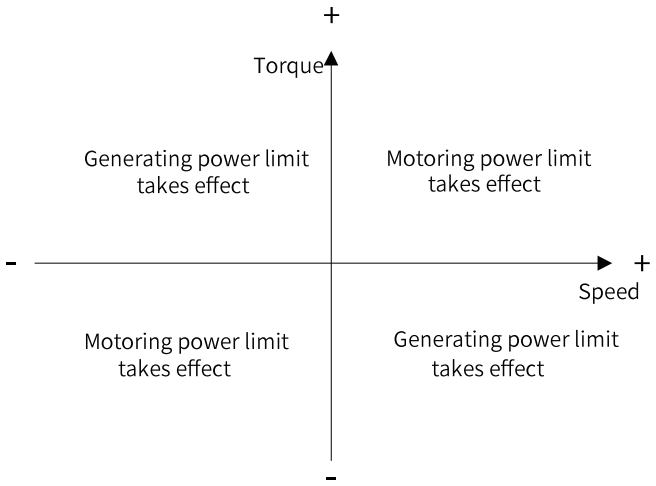


Figure 4-28 Effective range of power limits

The generating power limit is the minimum value of d1-14 (generating power limit 1) and d1-17 (generating power limit 2).

Whether d1-17 is enabled and the actual range is determined by d1-15 (generating power limit 2 setting).

For example, generating power limit 2 (d1-17) is disabled when d1-15 (generating power limit 2 setting) is set to 0.

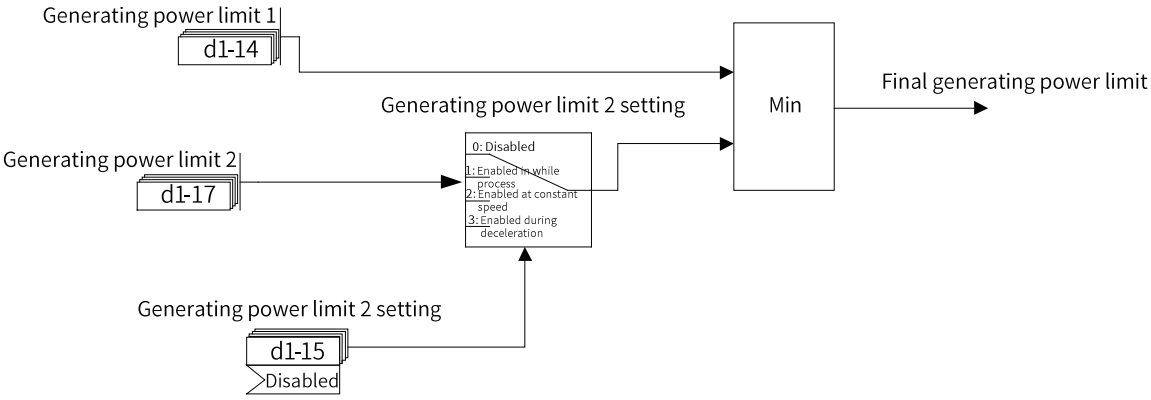


Figure 4-29 Generating power limit diagram

Related Parameters

Param.	Name	Default	Value Range	Parameter
d1-13	Motoring power limit	400.0%	0.0% to 1000.0%	Sets the motoring power limit, which is the per-unit value based on the rated motor power.
d1-14	Generating power limit 1	400.0%	0.0% to 1000.0%	Sets the generating power limit, which is the per-unit value based on the rated motor power. Additional information: The effective generating power limit is the smaller value between generating power limit 1 and generating power limit 2.
d1-15	Generating power limit 2 setting	0	0: Disabled 1: Enabled in whole process 2: Enabled at constant speed 3: Enabled during deceleration	Sets whether the motoring power limit is effective. Value description 0: Disabled. 1: Enabled in whole process 2: Enabled at constant speed 3: Enabled during deceleration Additional information: The effective generating power limit is the smaller value between generating power limit 1 and generating power limit 2.
d1-17	Generating power limit 2	20.0%	0.0% to 800.0%	Sets the generating power limit. Additional information: This parameter uses the rated motor power as the base value in percentage.

Precautions

- The motor power limit is active only in vector control modes. It is inactive in V/f mode.

4.1.9 Droop control

Scenario

In working conditions such as belt conveyor transmission, roller bed transmission, and continuous casting machines, when multiple motors drive the same load together, a slight deviation occurs between the motors even at the same speed reference due to different mechanical behaviors. In addition, the output torque is much different, and even motors may drive each other.

Droop control can be applied to all motors to enable automatic balanced load distribution between motors, requiring no communication between motors. Motors with higher speed bear higher torque. The negative feedback helps to automatically reduce speed reference and distribute torque to other motors.

The following features are available for droop control:

- Simple application, without need for communication between motor controllers.
- Multiple motors can be in stiffness or flexible connection to drive the same load.
- When multiple motors need to implement redundant running, the faulty device can be stopped while other devices can properly run.
- The adjustment range of the speed is generally not greater than the rated motor slip.
- The speed cannot be exactly followed. The actual speed has a static difference with the reference, which is proportional to the load.
- Precise load distribution cannot be ensured during the dynamic process.

Working Principle

Droop control is a control method that uses the output torque of the motor to reduce the motor speed reference by negative feedback. See the following figure.

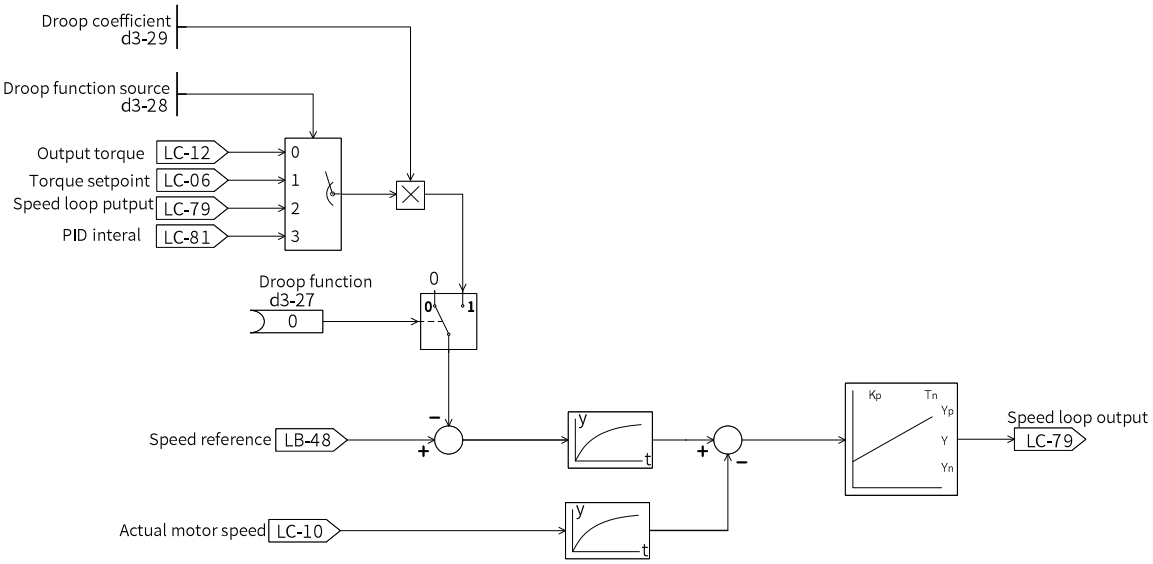


Figure 4-30 Droop control block diagram

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d3-27	Droop function	0	0: Enable 1: Disable	Set whether the droop function of speed control is enabled. Value description 0: Disable 1: Enable Additional information: When multiple motors are driving the same load, turning on this function enables load distribution among the motors. However, this will affect the speed accuracy.
d3-28	Droop source	1	0: Output torque 1: Torque reference 2: Output upon speed regulation 3: Integral component upon speed regulation	This parameter specifies the droop source. Droop speed change = Droop source x Droop coefficient x Speed reference Value description 0: Select the actual output torque of the motor as the droop source. 1: Select the final torque setpoint of the motor as the droop source. 2: Select the output of the speed loop as the droop source. 3: Select the integral item of the speed loop as the droop source. Additional information: To set V/f droop control, the value of this parameter shall be set to 0.
d3-29	Droop coefficient	0.0%	0.0% to 50.0%	Sets the droop coefficient. Additional information: Droop speed change = Droop source x Droop coefficient x Speed reference

Application Cases

The 12 motors are connected to the same rack through the gearbox (80:1). The rack is welded to the mounting leg. The host controller uses different speeds to lift the mounting leg. Due to the difference between the gearbox and the rack, some motors are connected tightly. Other motors need to run for a certain period of time to reach 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 its load is pulled in reverse direction. The motor reducer that runs under heavy load for a long time is prone to damage and the AC drive reports faults.

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 problem can be solved by using the droop function:

1. Enable droop function for all AC drives by settting d3-27 to 1.
2. Set d3-29 to the rated motor slip.

4.1.10 Current Loop

Scenario

In the SVC control mode, as the regulator of the inner loop, the current loop is used to enable the current closely follow the current reference, that is, the output of the outer loop regulator. During the dynamic process, current loop ensures that the maximum current allowed is obtained to accelerate the dynamic response.

Working Principle

The output of the speed loop PID is the input of the current loop. The output current of the AC drive is fed back negatively. The difference between the input and feedback is processed by the current loop PI controller, which adjusts the final voltage output. In this way, the current can be controlled, improving the current stability and improving the overall performance of the system.

Current loop parameters are automatically obtained after auto-tuning. The auto-tuned parameters apply to most of applications.

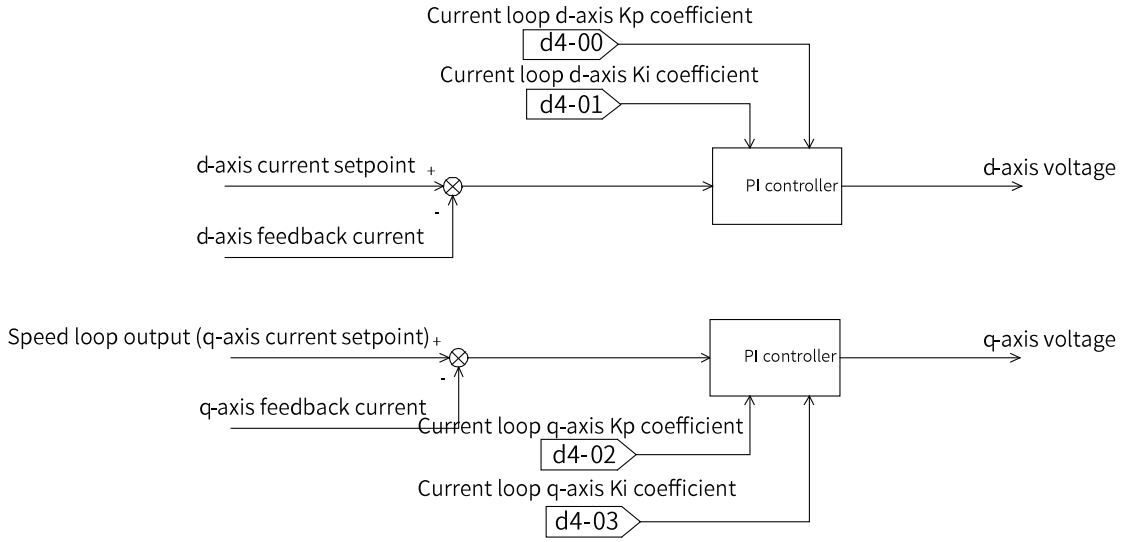


Figure 4-31 Current loop

The current loop self-adaption PI parameters are applicable to the auto-tuning of current loop parameters under heavy load.

When the current exceeds the value of d4-06 and does not exceed the value of d4-05, the actual current loop D-axis Kp coefficient and the current loop Q-axis Kp coefficient are automatically adjusted. They are calculated by self-adaption coefficient calculated linearly based on the actual current x the value of d4-00 and d4-02, respectively.

When the current exceeds the value of d4-05, the actual current loop D-axis Kp coefficient remains at d4-00 x d4-04. The actual current loop Q-axis Kp coefficient is kept at d4-02 x d4-04.

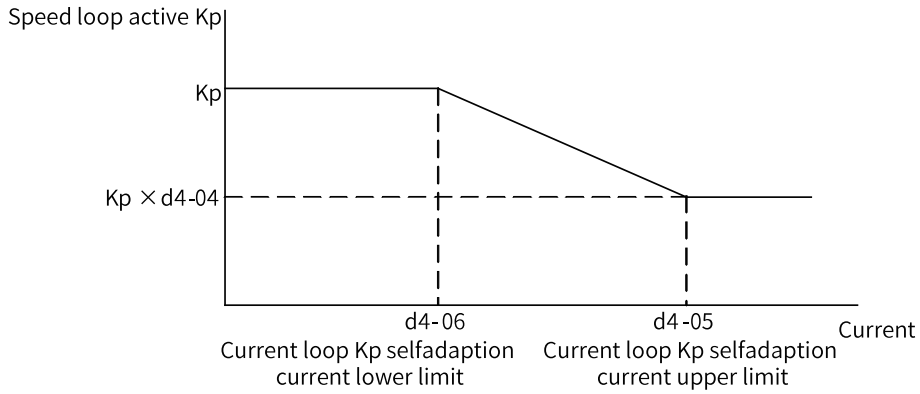


Figure 4-32 Current loop self-adapation Kp

Related Parameters

Parameter	Name	Default	Value Range	Parameter
d4-00	Current loop D-axis Kp coefficient	100%	1% to 1000%	This parameter sets the current loop D-axis Kp coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.
d4-01	Current loop D-axis Ki coefficient	100%	1% to 1000%	This parameter sets the current loop D-axis Ki coefficient. The larger the value, the faster the torque response. However, too large value may cause current oscillation.
d4-02	Current loop Q-axis Kp coefficient	100%	1% to 1000%	This parameter sets the current loop Q-axis Kp coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.
d4-03	Current loop Q-axis Ki coefficient	100%	1% to 1000%	This parameter sets the current loop Q-axis Ki coefficient. Additional information: The larger the value, the faster the torque response. However, too large value may cause current oscillation.
d4-04	Current loop Kp self-adaption upper limit coefficient	50%	1% to 100%	Sets the loop proportional self-adaptation upper limit coefficient.
d4-05	Current loop Kp self-adaption current upper limit	200%	d4-06 to 300%	Sets the upper limit of current loop proportional self-adaption current.
d4-06	Current loop Kp self-adaption current lower limit	100%	100–d4-05	Sets the lower limit of current loop proportional self-adaption current.

Instances

In heavy-load applications, current oscillation may occur due to the large current loop parameters. In this case, you can set d4-05 (Current loop Kp self-adaption current upper limit) and d4-06 (Current loop Kp self-adaption current lower limit) to limit the current loop parameters after the current exceeds d4-05. In addition, adjust the current loop attenuation level by setting d4-04 (Current loop Kp self-adaption upper limit coefficient). It helps the current loop to return to stable operation.

4.1.11 Flux control

4.1.11.1 Asynchronous Motor Field Weakening Control

Scenario

Under SVC control, the asynchronous motor field weakening control mode is triggered when the motor needs to increase speed beyond the maximum voltage output capacity or the current running speed is not supported through the reduced voltage.

Working Principle

When the motor speed increases, the motor back EMF also increases. When the motor back EMF exceeds the maximum output voltage, the AC drive loses the ability to regulate the current, and the motor will run out of control. Reducing the magnetic flux can reduce the back EMF, preventing the motor from running out of control, so that the motor speed can rise to a high level.

The maximum available voltage is calculated from the bus voltage, and a voltage margin (d5-00) is provided to ensure the current regulation capability. The maximum output voltage is calculated as follows:

$$V_{max} = \frac{\text{Bus volatge}}{\sqrt{2}} \left(100\% \right[\text{ d5-00}$$

The voltage margin for field-weakening (d5-00) can be manually adjusted when the output voltage capability is insufficient.

When the voltage reaches the maximum output voltage and the output frequency increases, the field weakening region is entered. The back EMF is reduced by setting the magnetic flux according to the curve, thus ensuring that the motor does not lose control at high speed.

As shown in the following figure, the output voltage (V_{out}) has reached the maximum output voltage (V_{max}). The frequency continues to increase and enters the field weakening region. After entering the region, the flux decreases.The output voltage (V_{out}) no longer increases.

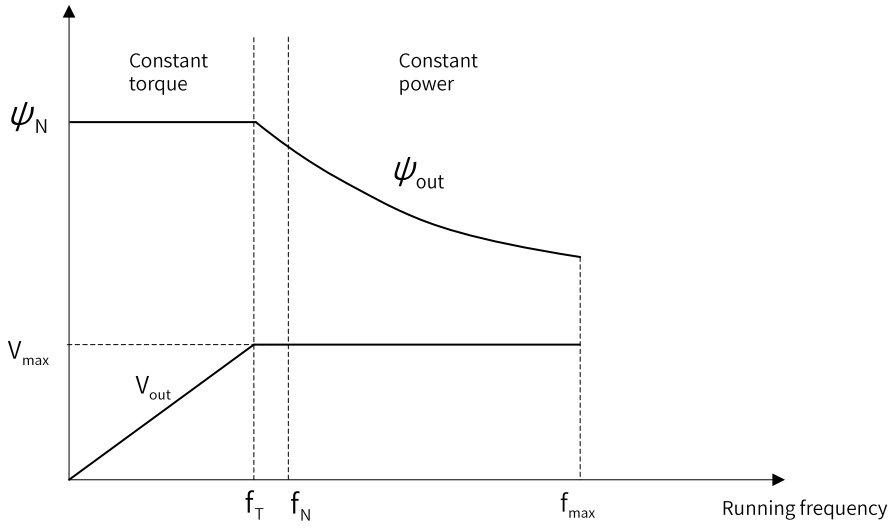


Figure 4-33 Flux frequency characteristics of the motor under voltage constraints

The following figure shows the process for obtaining the final flux setting in the field weakening phase after the maximum output voltage is obtained.

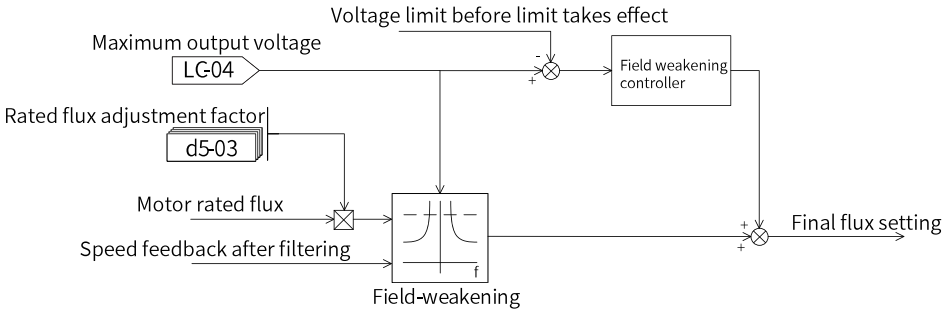


Figure 4-34 Final flux calculation flowchart

Related Parameters

Param.	Name	Default	Value Range	Parameter
d5-00	Voltage margin for field-weakening	3.0%	0.1% to 50.0%	Sets the voltage margin for field-weakening. Additional information: Decreasing the setpoint can improve voltage utilization. The current is smaller under the same load in the field weakening region. However, an excessively small setpoint will affect dynamic performance.
d5-03	Rated flux adjustment factor	100.0%	50.0% to 200.0%	Sets the flux adjustment coefficient of the asynchronous motor. Additional information: This parameter adjusts the operation flux of the asynchronous motor. Decreasing the setpoint will put the motor in under-excited state, while increasing the setpoint will put the motor in over-excited state. Rated motor flux x Rated flux adjustment coefficient = Actual motor flux applied.

Precautions

- The reserved voltage margin (d5-00) cannot be set too large; otherwise it will affect the high-speed load capacity of the motor.

4.1.11.2 Synchronous Motor Field Weakening Control

Scenario

Under SVC control, the synchronous motor field weakening control mode is triggered when the motor needs to increase speed beyond the maximum voltage output capacity or the current running speed is not supported through the reduced voltage.

Working Principle

A synchronous motor's back EMF increases with its running speed. When the back EMF exceeds the maximum voltage that can be output by the AC drive, the synchronous motor enters the field weakening control state. In the field weakening control mode, the synchronous motor increases the demagnetization current to reduce the magnetic chain of the motor stator and then to reduce the motor back EMF voltage. A higher demagnetization current means a higher output current and speed.

Related Parameters

Param.	Name	Default	Value Range	Description
d5-00	Voltage margin for field-weakening	3.0%	0.1% to 50.0%	Sets the voltage margin for field-weakening. Additional information: Decreasing the setpoint can improve voltage utilization. The current is smaller under the same load in the field weakening region. However, an excessively small setpoint will affect dynamic performance.
d5-17	Demagnetization current limit	300%	0% to 500%	This parameter is used to limit the demagnetization current of synchronous motors to prevent faults such as overload. Additional information: It is a percentage of the rated motor current.

4.1.11.3 Energy-Saving Control

Scenario

Some process applications are sensitive to energy consumption. Energy-saving control can be enabled to reduce energy consumption of the asynchronous motor at no-load and light-load running.

Working Principle

The output current is reduced by reducing the excitation current of the motor. The energy saving control function is shown in the following figure.

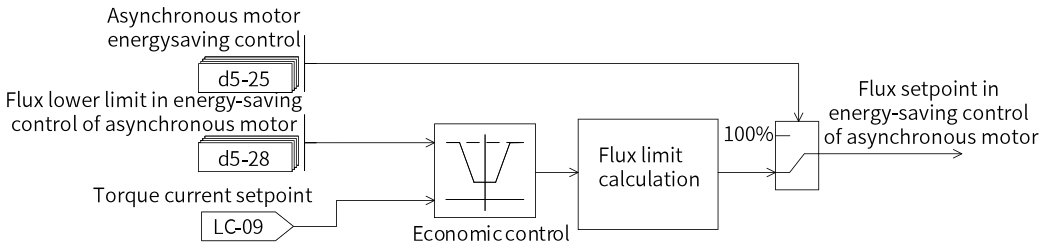


Figure 4-35 Final flux calculation of energy-saving

Related Parameters

Param.	Name	Default	Value Range	Parameter
d5-25	Asynchronous motor energy-saving control	0	0: Disable 1: Enable	This parameter sets whether to enable energy saving for the asynchronous motor in the vector control mode. Value description 0: Disable. Energy saving is disabled. 1: Enable. Energy saving is enabled. Additional information: After energy saving is enabled, the current in no-load or light-load mode can be reduced.
d5-28	Flux lower limit in energy-saving control of asynchronous motor	50.0%	10.0% to 100.0%	This parameter sets the flux lower limit in energy-saving control of the asynchronous motor. Additional information: This parameter defines the minimum flux allowed in energy-saving control. The smaller the value is, the more energy will be saved at no load. However, a small value will affect the dynamic response after the load is added.

Precautions

- The function is applicable to stable load conditions. For frequent sudden load addition and sudden unloading, it is not recommended to enable the function.

4.1.11.4 Overexcitation

Scenario

For high-inertia loads, overexcitation gain in the vector control mode can speed up the motor deceleration.

Working Principle

Increase the overexcitation current to consume the excess energy on the motor to accelerate deceleration. After enabling overexcitation, overexcitation control takes effect in the motor power generation state.

Related Parameters

Param.	Name	Default	Value Range	Description
d0-39	Overexcitation selection (vector)	0	0: Disabled 1: Enabled	This parameter sets whether the overexcitation gain is enabled in the SVC mode.
d0-40	Overexciting current (vector)	100%	0% to 150%	Defines the target current after overexcitation is activated in vector mode. Additional information: This parameter uses the rated motor current as the base value in percentage.

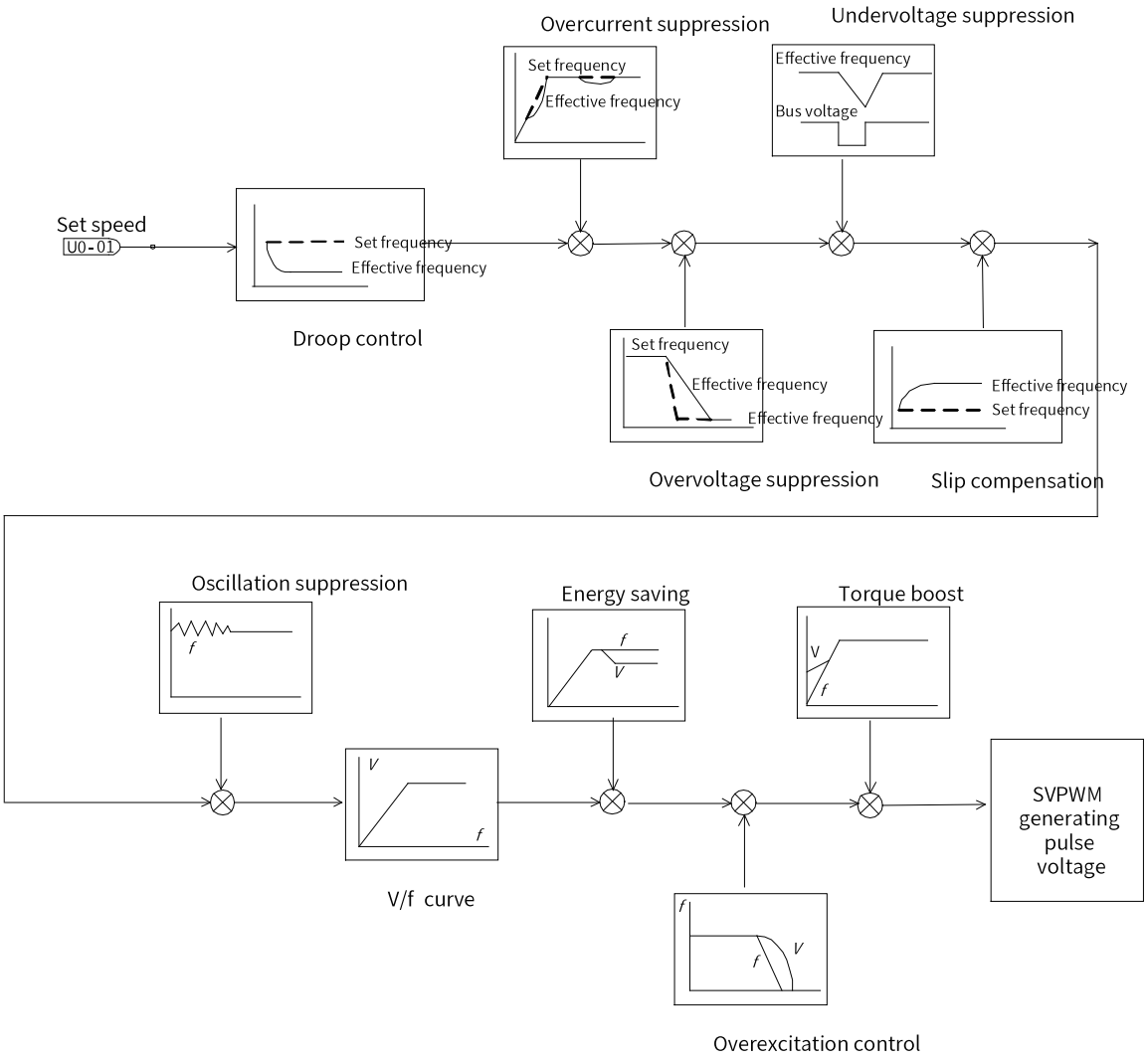
Precautions

- The higher the overexcitation current, the more obvious the effect of motor deceleration. However, overexcitation gain increases the output current of the AC drive and leads to motor wear and tear.

4.2 Asynchronous Motor V/f Control

4.2.1 Control Mode

The V/f control mode is applicable to asynchronous motor control applications. The user-defined set speed curve is controlled by the droop control and adjusts the frequency curve. After controlled by overcurrent suppression, overvoltage suppression, undervoltage suppression, and slip compensation, the curve outputs the frequency. The output frequency is processed by the V/f curve and the output voltage is obtained. Then the final voltage amplitude is obtained by energy conservation control and excitation control. After the output frequency is finally set after oscillation suppression, the voltage phase angle is obtained by integral. The final output is output to the AC drive.



4.2.2 V/f Curve Setting

Scenario

There are three modes for V/f curves:

1: Linear V/f curve When the motor runs at a 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 load such as dehydrator and centrifuge. The relationship between the voltage and frequency points can be set according to the motor characteristics.

3: Separated V/f The V/f separation mode is generally used in induction heating, inverter power supply, and torque motor control. In this mode, the output voltage of the AC drive is independent of the frequency. You can set the output frequency and output voltage.

Working Principle

1: Linear V/f curve When the motor runs at a rated frequency, a linear relationship is kept between the output voltage and the frequency.

2: Multi-point V/f curve Users can set the d2-02 to d2-10 parameters to define the V/f curve frequency and voltage points. Multi-point V/f needs to be set according to the motor characteristics. The voltage and three 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: Separated V/f The output frequency is determined by the frequency source. The output voltage is set by d2-48 (Voltage source of V/f separation). If the set separation voltage changes, you can set the voltage acceleration/deceleration time of V/f separation through d2-50 and d2-51 to prevent voltage fluctuation. You can select whether the frequency source reaches the set value at one shot or according to the acceleration/deceleration curve by d2-52 (Frequency RFG time of V/f separation).

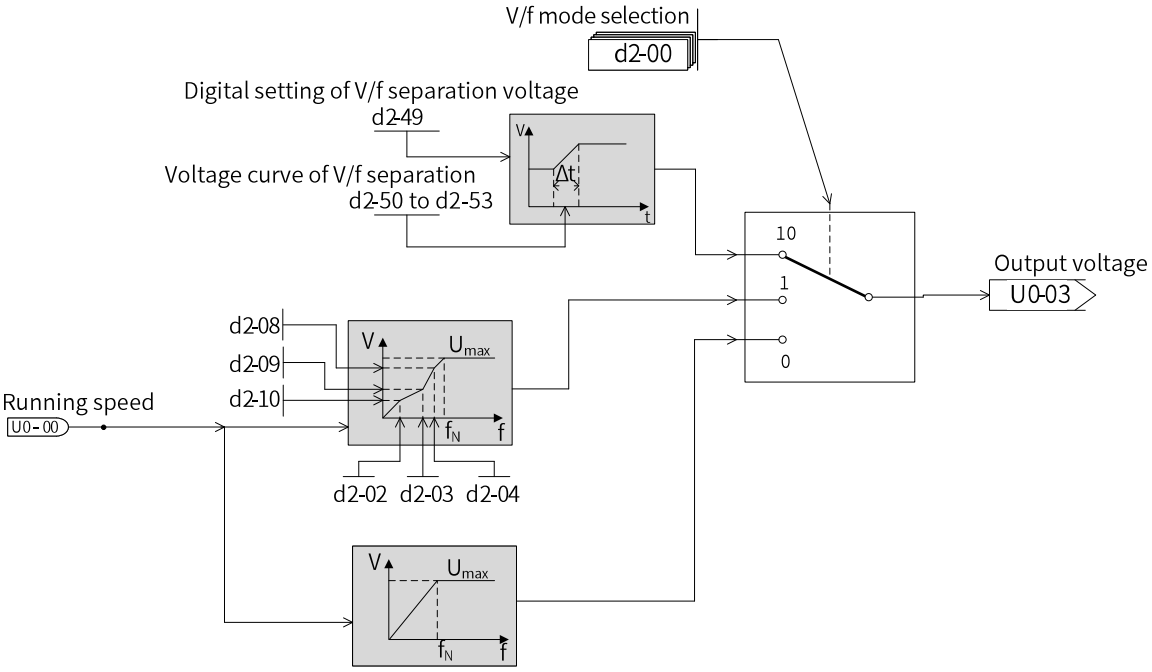


Figure 4-36 Function diagram

F_N indicates the set frequency, and U_{max} indicates the maximum output voltage

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d2-00	V/f curve type	0	0: Linear V/f curve 1: Multi-point V/f curve 10: Separated V/f	Sets the V/f curve type. Value description 0: The ratio between the output voltage and the output frequency remains constant. 1: The output voltage and output frequency conform to the set multi-point curve relationship set through d2-02 to d2-04 and d2-08 to d2-10. The output voltage and output frequency are not interrelated and specific functions can be set in d2-47 to d2-53. The output frequency is determined by the frequency source, and the output voltage is determined by the V/f separation voltage source.
d2-01	Multi-point curve source	0	0: Three-point curve	Used to select the multi-point curve source. Value description 0: The V/f curve is set by the parameters of d2-02 to d2-04 and d2-08 to d2-10.
d2-02	Frequency point 1 on a multi-point V/f curve	0.0 Hz	0.0 Hz to d2-03	This parameter defines frequency point 1 on a multi-point V/f curve.
d2-03	Frequency point 2 on a multi-point V/f curve	0.0 Hz	d2-02 to d2-04	This parameter defines frequency point 2 on a multi-point V/f curve.
d2-04	Frequency point 3 on a multi-point V/f curve	0.0 Hz	d2-03 to 600.0 Hz	This parameter defines frequency point 3 on a multi-point V/f curve.
d2-08	Voltage point 1 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V	This parameter defines voltage point 1 on a multi-point V/f curve.
d2-09	Voltage point 2 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V	This parameter defines voltage point 2 on a multi-point V/f curve.
d2-10	Voltage point 3 on a multi-point V/f curve.	0.0V	0.0 V to 1000.0 V	This parameter defines voltage point 3 on a multi-point V/f curve.
d2-47	Upper limit of V/f separation voltage	100.0%	50.0% to 200.0%	Sets the upper limit of V/f separation voltage. Additional information: This parameter uses the rated motor voltage as the base value in percentage.

Param.	Name	Default	Value Range	Descriptions
d2-48	Voltage source of V/f separation	0	0: Set by the parameter (d2-49) 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Defines the target voltage reference source in case of separated V/f. 0: Digital setting. The V/f separation voltage is set by d2-49 (voltage digital setting for V/f separation). 2: AI1. The V/f separation voltage is input by using current or voltage signals at the AI1 terminal and calculated according to the preset AI curve. 5: HDI pulse reference (DI7). The V/f separation voltage is set through the DI5. The frequency is calculated based on the curve of the relationship between the pulse frequency and running frequency. 6: Multi-reference. When multi-reference is used as the source of the V/f separation voltage, different combinations of DI terminal states correspond to different reference values. For details, see multi-reference module. 7: Simple PLC. The V/f separation voltage is set by simple PLC. For details, see the function description of simple PLC. 8: PID. The V/f separation voltage is set by PID. For details, see the PID function description. 9: Communication. The V/f separation voltage is set through communication. The running frequency is input through remote communication. The AC 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 equipment. 10: MD-BP-M potentiomete.r The V/f separation voltage is set by the MD-BP-M potentiometer. Other: F connector. Read the connector value through setting the parameter No. of a float connector. The value being read is used as the V/f separation voltage in speed control. This mode is used for expansion of common sources. (How to set the connector parameters: If the parameter is set to others, the AC drive automatically jumps to the connector selection. Click a connector and the value of the connector will be used as the source for V/f separation voltage)
d2-49	Digital setting of V/f separation voltage	0V	0 V to C4-03	Digital setting of V/f separation voltage. Additional information: Valid when the voltage source of V/f separation (d2-48) is set to 0.
d2-50	Voltage acceleration time of V/f separation	0.0s	0.0s to 1000.0s	This parameter defines the time required for the output voltage to rise from 0 to the rated motor voltage.
d2-51	Voltage deceleration time of V/f separation	0.0s	0.0s to 1000.0s	This parameter defines the time required for the output voltage to fall from the rated motor voltage to 0.

Param.	Name	Default	Value Range	Descriptions
d2-52	Frequency RFG time of V/f separation	0	0: 0 1: Preset RFG time	Sets the frequency RFG time of V/f separation. Value description 0: Frequency reference acceleration/deceleration time is forcibly set to zero. 1: Increase/decelerate according to the time set for normal operation.
d2-53	Stop mode selection of V/f separation	0	0: The frequency and the voltage decline to 0 separately. 1: Te frequency declines to 0 after the voltage declines to 0. 2: Coast to stop	Sets the stop mode selection of V/f separation. Value description 0: The frequency/voltage declines to 0 independently based on respective deceleration time. 1: The voltage declines to 0 based on the deceleration time. Then the frequency declines to 0 based on the deceleration time. 2: The voltage/frequency coasts to stop, regardless of the deceleration curve.

Precautions

- In V/f separation and multi-point V/f control, note that the ratio of V/f cannot be too large. Otherwise, overcurrent may occur; for example, voltage is given without reference to the frequency.

4.2.3 V/f Overvoltage Suppression

Scenario

If the power supply is not regeneration-enabled, when the motor is in the power generation state, the DC bus voltage rises. If overvoltage exists in the DC bus, enable V/f overvoltage suppression.

Working Principle

When the motor is in a deceleration regenerative state, if the power supply is not regeneration-enabled, energy will be fed into the bus, resulting in voltage rise and overvoltage of the bus, which is especially obvious when the motor inertia is large and the deceleration time is short. After setting F2-39 to enable the V/f overvoltage suppression function, when the bus voltage rises to the setpoint (bus overvoltage threshold defined by F2-40), the AC drive will adjust the output frequency to maintain the bus voltage stability and inhibit the voltage rise.

After the function is enabled, the actual deceleration time will be automatically lengthened. If the actual deceleration time cannot meet the requirements, d0-41 (V/f over-excitation gain) can be appropriately increased.

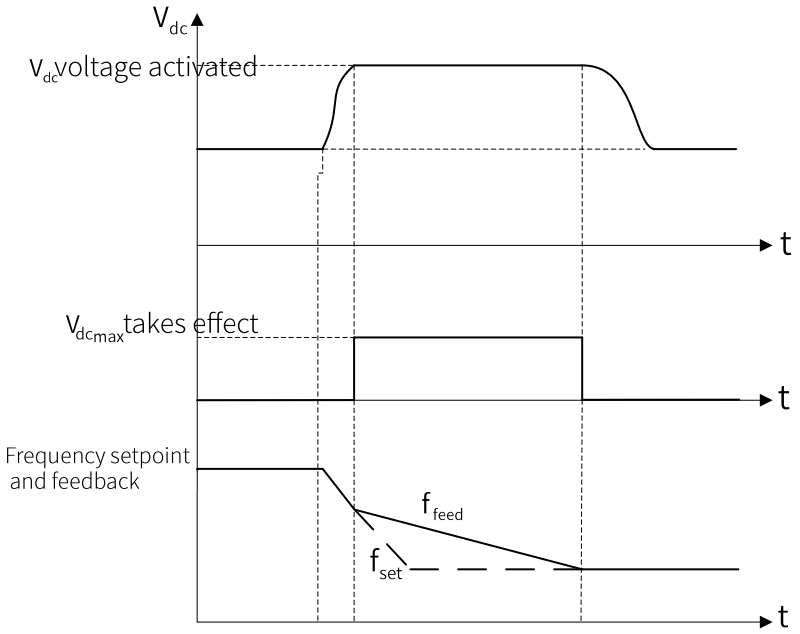


Figure 4-37 Function diagram

F_{feed} : frequency, f_{set} : set frequency

Related Parameters

Parameter Code	Name	Default	Value Range	Descriptions
d1-54 (F2-39)	Overvoltage suppression	1	0: Disable 1: Enable	Sets whether overvoltage suppression is enabled. Value description 0: Disable 1: After the overvoltage suppression function 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 setting. Additional information: When a braking resistor, braking unit, or energy feedback unit is used, set this parameter to 0. Otherwise, the deceleration time may be prolonged.
d1-55 (F2-40)	Overvoltage suppression action voltage	770.0V	330.0 V to 800.0 V	Defines the bus voltage threshold for overvoltage suppression. The actual effective value is displayed in d1-56. If the mains voltage is too high and the overvoltage suppression action voltage is set to a lower value than the bus voltage after rectification, the motor may accelerate or V/f may be overcurrent at startup.
d1-56	Overvoltage suppression actual effective action voltage	770.0V	330.0 V to 800.0 V	Displays the actual bus voltage when overvoltage suppression is active. When the bus voltage is greater than this value, the overvoltage suppression function takes effect.

Parameter Code	Name	Default	Value Range	Descriptions
d1-57	Overvoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the overvoltage suppression control loop. Additional information: The actual Kp gain is the Kp calculated by the loop x overvoltage suppression Kp adjustment coefficient. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-58	Overvoltage suppression Ki adjustment	100%	0% to 1000%	Defines the integral coefficient of the overvoltage suppression control loop. Additional information: The actual Ki gain is the Ki calculated by the loop x overvoltage suppression Ki adjustment coefficient. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.

Note

The parameter group F in the table is the mapping of parameter group d. The settings of the two groups are equivalent.

Precautions

- Use the V/f overvoltage suppression function only when the power supply lacks the regenerative capability.
- When using a braking resistor, set the braking voltage to a value less than the V/f overvoltage suppression trigger voltage or disable the V/f overvoltage suppression.
- In the case of common bus, enable the V/f overvoltage suppression function on only one drive unit, typically the drive unit with the largest inertia, and disable this function on other drive units.
- Overvoltage suppression cannot be enabled for lifting active loads. When the load drops, the motor is in the power generation state. Overvoltage suppression limits the power generation, which can prevent the motor from carrying the load effectively, leading to continuous acceleration. There is a risk of motor stall.
- If many parallel motors are connected, increase the overvoltage suppression Kp adjustment. If the motor inertia is large, decrease the overvoltage suppression Kp adjustment.

Application Cases

If the braking resistor is not applied, set F2-39/d1-54 to enable the V/f overvoltage suppression. Set F2-40/d1-55 according to the actual bus voltage. The remaining values can keep the default values. The V/f suppression can protect the AC drive and prevent the bus voltage from hitting too high if the decelerating to stop is required.

4.2.4 V/f Undervoltage Suppression

Scenario

This function is mainly applicable to unstable power grid, preventing the AC drive from undervoltage caused by short-term voltage dip and system stop. It can also be used to prevent the power failure of the grid from causing damage to processing materials due to machine coast to stop, such as yarn breaking in the textile industry.

After the bus voltage falls below the allowable value(defined by d1-65), the V/f undervoltage suppression function makes the motor enter the power generation state to compensate for energy loss and stabilize the voltage in the DC bus. When the power supply or DC bus incurs short-term power-off, undervoltage will occur if the fault is not handled in time, causing coast to stop.

Working Principle

Set d1-63 to a non-zero value to enable the undervoltage suppression function to suppress undervoltage in a short period, preventing stop upon instantaneous power-off. When the power supply or DC bus is powered off for a long time, the AC drive keeps the bus voltage stable and suppresses the voltage by adjusting the output frequency. Enable the undervoltage suppression function to compensate for the power loss on the bus by generating electricity until each motor stops reliably.

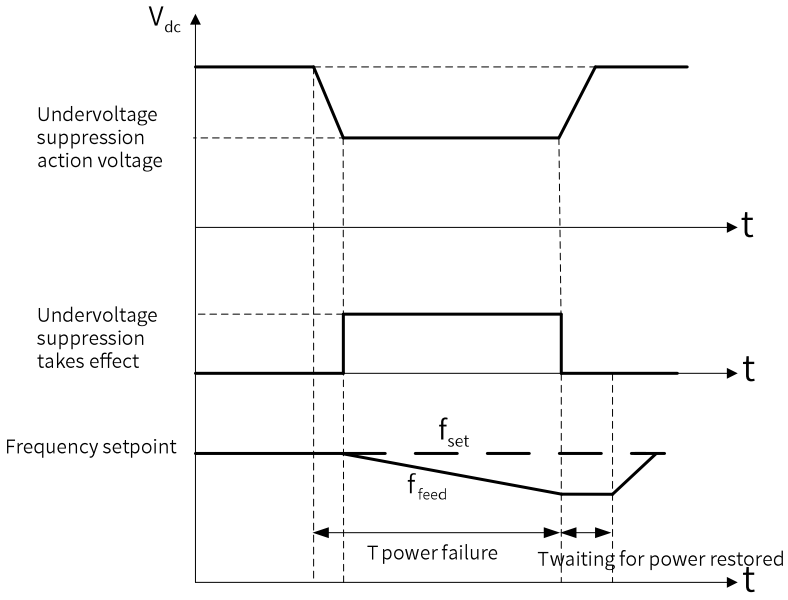


Figure 4-38 Function diagram

F_{feed} : feedback frequency, f_{set} : set frequency

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d1-63	Undervoltage action	0	0: No action 1: Undervoltage suppression. Restore to normal operation after voltage recovery. 2: Reserved	Defines the response when the bus voltage reaches the undervoltage suppression point due to power failure. Value description 0: No action. 1: Maintains the bus at the undervoltage suppression point through motor deceleration and energy feedback, keeping the motor running for a short period without stopping. If the bus voltage is restored during this period, the motor restores to the target speed according to the acceleration time. 2: Reserved
d1-64	Undervoltage suppression action voltage	430.0V	190.0 V to 500.0 V	Sets the voltage threshold for undervoltage suppression. Additional information: Defines the response when the bus voltage is lower than the value of the parameter due to power failure.
d1-65	Undervoltage suppression actual effective action voltage	430.0V	190.0 V to 500.0 V	Displays the actual voltage of the undervoltage suppression threshold Additional information: The actual action voltage is internally limited when the undervoltage suppression threshold that does not match the model is set.
d1-66	Undervoltage suppression Kp adjustment	100%	0% to 1000%	Defines the proportional coefficient of the undervoltage suppression control loop. Additional information: The actual Kp gain is the Kp calculated by the loop x overvoltage suppression Kp adjustment coefficient.. Low Kp setting will cause that the bus voltage cannot be maintained when the grid is powered off and the system may report undervoltage or overcurrent faults when the the motor is still rotating. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.
d1-67	Undervoltage suppression Ki adjustment	100%	0% to 1000%	Defines the integral coefficient of the undervoltage suppression control loop. Additional information: The actual Ki gain is the Ki calculated by the loop x overvoltage suppression Ki adjustment coefficient.. Low Ki setting will cause that the bus voltage cannot be maintained when the grid is powered off and the system may report undervoltage or overcurrent faults when the the motor is still rotating. Increasing this value improves the bus voltage control effect, but may result in output frequency fluctuations. When the output frequency fluctuates greatly, reduce this value appropriately.

Application Cases

The textile industry requires high yarn continuity. If the power grid is disconnected, the entire machine coasts to stop. All yarns are disconnected, making it difficult to restart production. Undervoltage suppression prevents the machine from rotating and breaking the yarn after power failure. When power failure occurs for a short time, the machine enters undervoltage suppression state and resumes normal production. The application configuration is as follows:

- Connect the bus of the AC drive together and use a large AC drive to power other AC drives.
- For motors with a large inertia, set d1-63 (undervoltage action) to 1.
- During power failure, the motor with undervoltage suppression is used as the master. The PLC calculates the matching speed of other motors. The motors decelerate to stop.

4.2.5 V/F Overcurrent Suppression

Scenario

Overcurrent is reported when the current exceeds the limit of the AC drive during rapid acceleration/deceleration or when the load is too heavy. The overcurrent suppression function can suppress current exceeding the overcurrent threshold.

Working Principle

After the overcurrent suppression function is enabled, if the output current of the AC drive reaches the motor overcurrent suppression threshold during motor current rising, the output frequency of the AC drive changes to reduce motor slip. This reduces the motor output current. After the current drops below the overcurrent suppression threshold, the frequency starts to restore to the target frequency. The actual acceleration time will be extended automatically during rapid acceleration, and the deceleration time will be prolonged during rapid deceleration. The motor output frequency drops when a sudden heavy load occurs during steady operation.

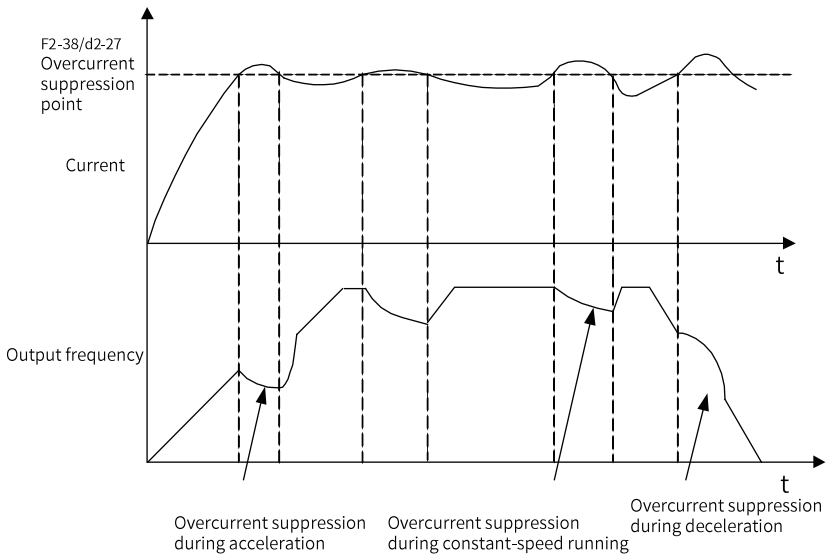


Figure 4-39 Function diagram

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
d2-26 (F2-37)	Overcurrent suppression	1	0: Enable 1: Disable	Sets whether overcurrent suppression is enabled. Value description 0: Disable 1: Enable Additional information: When the AC drive output current reaches the threshold set by d2-27, the AC drive slows down the acceleration or reduces the operation frequency to prevent continuous current rising, thus suppressing the overcurrent faults.
d2-27 (F2-38)	Overcurrent suppression threshold	200%	80% to 300%	This parameter specifies the threshold current that triggers overcurrent suppression. Additional information: This parameter uses the rated motor current as the base value in percentage. The actually effective overcurrent suppression point is determined by this parameter or A3-05 (AC drive maximum current), whichever is smaller. Too large setting may lead to overcurrent.
d2-28	Overcurrent suppression Kp	100%	1% to 500%	Defines the Kp for frequency adjustment when overcurrent suppression is active. Additional information: A larger value of this parameter means faster frequency adjustment and better acceleration following effect, but also more prone to oscillation. The actual Kp gain is the Kp calculated by the loop x overvoltage suppression Kp adjustment coefficient..
d2-29	Overcurrent Suppression Ki	100%	10% to 1000%	Defines the Ki for frequency adjustment when overcurrent suppression is active. Additional information: A larger value of this parameter means faster frequency adjustment and better acceleration following effect, but also more prone to oscillation. The actual Ki gain is the Ki calculated by the loop x overvoltage suppression Ki adjustment coefficient..

Note

The motor parameters in group F2 in the table are the mapping of motor parameters in group d2. The settings of the two groups are equivalent.

Precautions

- The overcurrent suppression allows for a large current. When the load is large, the motor decelerates. When the output frequency is below 5 Hz, the AC drive is prone to low-frequency derating, which causes the AC drive to report overload. If overload is easily reported during

overcurrent suppression at low speed, check whether the load is abnormal. Otherwise, the AC drive model with a larger capacity shall be selected.

Application Cases

Set F2-37/d2-26 (Overcurrent suppression) to 1 (enable) and set F2-38/d2-27 (Overcurrent suppression threshold) according to the current in the normal operating conditions on the customer site. Ensure that the current suppression threshold is higher than the current under normal operating conditions. The remaining values are set by default.

4.2.6 V/f Oscillation Suppression

Scenario

During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.

Working Principle

You can set d2-22 (V/f oscillation suppression) to enable oscillation suppression to improve the control effect. d2-23, which is the V/f oscillation suppression gain, should be as small as possible to reduce its influence on normal operation, provided that the oscillation can be effectively suppressed. When the oscillation is obvious, it is necessary to increase the gain. The greater the gain, the more obvious the suppression effect.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d2-22	V/f oscillation suppression	1	0: Disable 1: Enable	Sets whether V/f oscillation suppression is enabled. Value description 0: V/f oscillation suppression is disabled. 1: During motor operation, mechanical resonance causes system oscillation. Enable oscillation suppression for a better control effect.
d2-23	V/f oscillation suppression gain	100%	0% to 400%	Sets the V/f oscillation suppression gain. Additional information: This parameter adjusts the intensity of V/f oscillation suppression. A larger value of this parameter means greater compensation, but setting it too large may result in overcompensation that can cause oscillation.

Precautions

When the oscillation suppression function 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 Cases

Motor oscillation caused by mechanical structure can be reduced by setting d2-22 (V/f oscillation suppression) to enable.

Observe the actual oscillation of the motor during normal operation.

4.2.7 V/f Torque Boost

Scenario

When the motor adopts V/f control, the voltage drop on the stator resistor will lead to small motor output torque, and even poor load capacity of the motor at low speed. The torque boost function can be used to compensate the voltage loss on the stator resistor, improving the load capacity of the motor at a low speed. If the torque boost is not enabled in the V/f heavy-load startup, overload faults may occur.

Working Principle

Setting d2-16 to enable this function and select the torque boost mode.

In the case of manual torque boost, the voltage can be compensated by torque boost set by d2-14. When the load is heavy and the starting torque of the motor is insufficient, the value of d2-14 can be increased. However, if the setting is too large, it is easy to cause overheating of the motor and overcurrent of the AC drive. d2-15 sets the cut-off 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 AC drive automatically calculates the voltage compensation amount according to the motor parameters, so there is no need to set E3-14 and E3-16. Note that before using this function, be sure to perform motor auto-tuning to ensure the accuracy of motor parameters.

When the automatic and manual torque boost is selected, you can adjust the manual boost amount through d2-14 and d2-15. If the manual boost amount is too small, the automatic torque boost calculates and compensates the voltage.

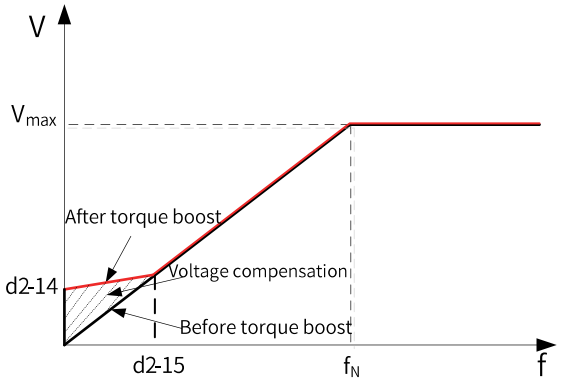


Figure 4-40 Function diagram

F_N indicates the set frequency, and V_{max} indicates the maximum output voltage

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
d2-14	Manual torque boost amount	3.0%	0.0% to 100.0%	Sets the manual torque boost amount. Additional information: This parameter defines the voltage boost amount at zero speed in V/f mode. Increasing this voltage can improve the load capacity at low speed, but setting it too large may easily result in overcurrent, overload, or other problems. After the output frequency is increased to the cut-off frequency of torque boost (d2-15), the boost voltage is linearly reduced to 0.
d2-15	Cut-off frequency of torque boost	100%	0.0% to 400.0%	Sets the cut-off frequency of torque boost. When the operation frequency exceeds this cut-off frequency, torque boost is disabled.
d2-16	Torque boost mode	2	0: Manual boost 1: Automatic boost 2: Manual boost + automatic boost	Used to select the torque mode. Value description 0: The boost amount at zero speed is defined by d2-14. After the speed increases, the manual boost amount is reduced linearly until the cut-off frequency decreases to 0. 1: The boost voltage is calculated automatically based on motor parameters. In this mode, it is recommended to perform auto-tuning for better effects. 2: The final effective boost amount is the sum of the manual boost amount plus the automatic boost amount.

Application Cases

After the motor starts and fails to run normally due to heavy load, increases d2-14 (Manual torque boost amount) when the motor stops. Increase the value until it can be started successfully.

4.2.8 V/f Slip Compensation

Scenario

V/f slip compensation can compensate the decrease of speed of an asynchronous motor when the load increases, so that the motor speed can basically remain unchanged when the load changes. Slip compensation improves V/f control speed accuracy.

Working Principle

Set d2-41 to enable the slip compensation. Set d2-42 to adjust slip compensation gain. When the compensation coefficient is 100%, the motor bears a rated load, and the compensation frequency is the rated motor slip. When the compensation coefficient is set to 0, the slip compensation function is disabled. When adjusting the V/f slip compensation gain, confirm that the motor speed under the rated load is the same as the target motor speed. If they are different, slightly adjust the parameter.

d2-43 can set the V/f slip compensation filter time. The smaller the setting, the faster the response speed of slip compensation, but a too small value will also cause oscillation or instability in the dynamic process of the motor.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d2-41	Slip compensation mode	0	0: Disable 1: Enable	Sets the slip compensation mode. Value description 0: No slip compensation 1: Enable compensation mode. Additional information: Due to slip inherent to asynchronous motors, there can be speed errors in V/f mode during with-load operation. After slip compensation is enabled, the frequency can be compensated based on the load size to improve the accuracy of speed.
d2-42	Slip compensation gain	100.0%	0.0% to 200.0%	This parameter adjusts the frequency in slip compensation.
d2-43	Slip compensation filter time	0.5s	0.1s to 10.0s	Sets the slip compensation filter time. Additional information: Longer filter time means a slower and smoother dynamic process of slip compensation.

Precautions

- V/f slip compensation improves dynamic accuracy, but brings slower dynamic response. Vector control should be used for high-dynamic response applications.

Application Cases

In textile applications, the asynchronous motor runs stably in V/f control mode. The heavier the load, the more the motor's output speed deviates from the set speed, with the actual motor speed lower than the set speed. In the actual process, the speed must be as accurate as possible to match the motor of different mechanisms.

Set d2-41 to 1 (enable) to improve the speed accuracy. The speed accuracy during actual running can meet the process requirements. If the slip compensation process is too fast, increase d2-43 (slip compensation filter time).

4.2.9 V/f Energy-Saving Control

Scenario

Energy-saving control is applicable to applications where the motor load does not change. It can be also used in light-load applications to reduce output current automatically to achieve energy conservation. It can be used in applications where the load changes slowly, such as fans, water pumps, and air compressors.

Working Principle

After the d2-35 is set to enable the energy-saving function, when the motor runs with low load, the AC drive continuously reduces the output voltage to lower exciting current, reducing energy consumption.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d2-35	Energy-saving in V/f control mode	0	0: Disable 1: Enable	Sets whether energy-saving in V/f control mode is enabled. Value description 0: Disable 1: Energy-saving control can reduce output current and energy consumption of the asynchronous motor when it runs with no load or light load.
d2-36	Cut-off frequency of V/f energy-saving control	30%	20% to 100%	Sets the cut-off frequency of V/f energy-saving control. Additional information: Energy-saving control can be enabled only when the operation frequency is greater than this cut-off frequency.

Application Cases

In light-load applications, if you want to reduce the output power, you can enable d2-35 and set the cut-off frequency (defined by d2-36) to the value lower than the normal operating frequency.

4.2.10 V/f Droop Control

Scenario

When multiple motors drive the same load together, a slight deviation occurs between the motors even at the same speed reference due to different mechanical behaviors. In addition, the output torque is much different, and even motors may drive each other. It is widely used in working conditions such as belt conveyor transmission, roller bed transmission, and continuous casting machines. The application features simple application and no communication between the motor controllers. Multiple motors can drag the same load with rigid or flexible connections. When multiple motors run in redundant mode, it is convenient to stop faulty equipment while keep others running normally.

Working Principle

Droop control is a control method that uses the output torque of the motor to reduce the motor speed reference by negative feedback. Droop control features good stability and simple application though low control accuracy. Droop control can be applied to all motors to enable automatic balanced load distribution between motors, requiring no communication between motors. Motors with higher speed bear higher torque. The negative feedback helps to automatically reduce speed reference and distribute torque to other motors.

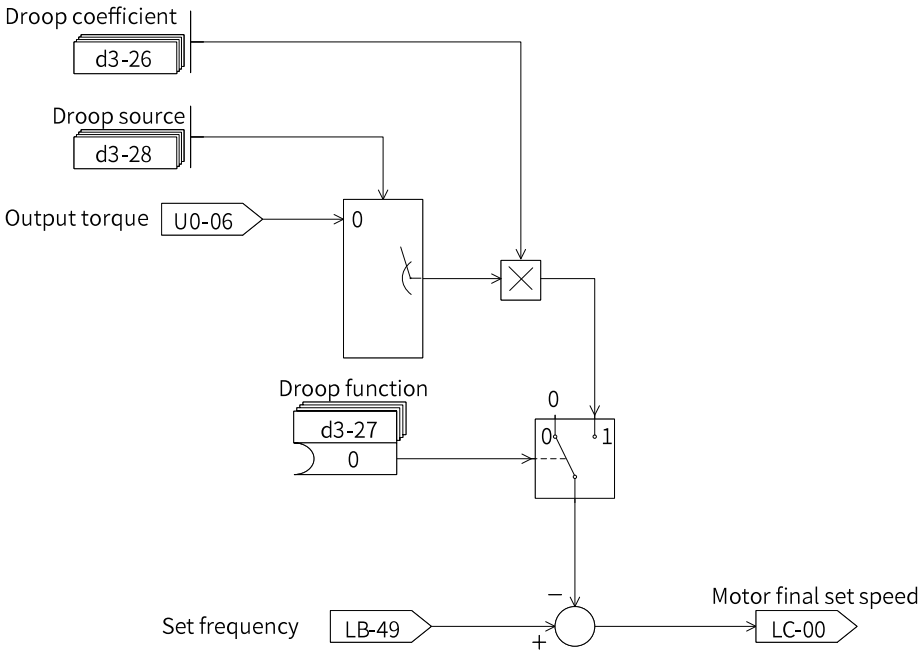


Figure 4-41 Function diagram

Related Parameters

Param.	Name	Default	Value Range	Descriptions
d3-27	Droop function	0	0: Enable 1: Disable	Set whether the droop function of speed control is enabled. Value description 0: Disable 1: Enable Additional information: When multiple motors are driving the same load, turning on this function enables load distribution among the motors. However, this will affect the speed accuracy.
d3-28	Droop source	1	0: Output torque 1: Torque reference 2: Output upon speed regulation 3: Integral compo-nent upon speed regulation	This parameter specifies the droop source. Droop speed change = Droop source x Droop coefficient x Speed reference 0: Select the actual output torque of the motor as the droop source. 1: Select the final torque setpoint of the motor as the droop source. 2: Select the output of the speed loop as the droop source. 3: Select the integral item of the speed loop as the droop source. Additional information: To set V/f droop control, the value of this parameter shall be set to 0.
d3-29	Droop coefficient	0.0	0.0% to 50.0%	Sets the droop coefficient. Additional information: Droop speed change = Droop source x Droop coefficient x Speed reference Large droop coefficient may lead to obvious droop effect, but the speed accuracy will be affected and speed oscillation will occur.

Precautions

- The adjustment range of the speed is generally not greater than the rated motor slip.
- The speed cannot be exactly followed. The actual speed has a static difference with the reference, which is proportional to the load.
- Precise load distribution cannot be ensured during the dynamic process.

Application Cases

When multiple motors are connected with a belt, to ensure the load balance of the motor and does not result in the generation of one motor, set the droop coefficient. Adjust the droop speed change to the rated slip.

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. It is recommended to use the droop function by setting d3-27 to 1, and d3-29 = [(Rated frequency x 60 ÷ pole pair number) - Rated speed] ÷ Rated speed.

4.2.11 V/f Overexcitation Gain

Scenario

During rapid 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.

Working Principle

Set overexcitation gain through d0-41 when the motor is decelerating and the bus voltage is approaching the overvoltage threshold in asynchronous motor V/f control mode. When entering the overexcitation state, the AC drive increases the output voltage to increase the motor exciting current. This aims to intensify the loss and consequently reduce the motor deceleration time. The higher the overexcitation gain, the better the suppression effect will be.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
F2-36 (d0-41)	Overexcitation gain (V/f)	90%	0% to 200%	Sets the overexcitation gain in the V/f control mode of the motor. Additional information: This parameter is effective when the motor is decelerating and the bus voltage is approaching the overvoltage threshold in asynchronous motor V/f control mode. When entering the overexcitation state, the AC drive increases the output voltage to increase the motor exciting current. This aims to intensify the loss and consequently reduce the motor deceleration time. The larger the setting, the stronger the excitation effect. However, the larger setting may cause overcurrent. The motor parameters in group F2 in the table are the mapping of motor parameters in group d0. The settings of the two groups are equivalent.

Application Cases

A large number of mechanisms on the ceramic tile production line need to quick start/stop. During deceleration, the bus voltage will rise and overvoltage suppression will be triggered, which will prolong the deceleration time. This will have a significant impact on the process of fast start/stop equipment. Increasing d0-41 properly can consume bus voltage faster. It can increase the deceleration time significantly.

4.3 Basic Control Parameters

4.3.1 Auto-Tuning

Scenario

Auto-tuning is the process by which the AC drive obtains its and the parameters of the controlled motor. Auto-tuning must be performed in the SVC mode. Otherwise, the motor will not operate normally. It is also recommended to perform parameter auto-tuning in the V/f control mode. If parameters are accurate, better control performance can be achieved for flying start, overcurrent stall suppression, and torque boost.

Working Principle

When the user sets the auto-tuning type and starts the AC drive, the AC drive enters the parameter auto-tuning state. Based on the motor type and parameters on the nameplate, the voltage and current signal is auto-tuned. Then the auto-tuning parameters is updated to the motor parameter group. After auto-tuning is completed, the AC drive exits the auto-tuning state to the stop state.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
C2-00	Motor parameter auto-tuning mode	0	0: No operation 1: Static partial auto-tuning of asynchro-nous motor 2: No-load dynamic auto-tuning of asynchro-nous motor 3: Static complete auto-tuning of asynchro-nous motor 4: Inertia auto-tuning 5: Dead zone auto-tuning 11: With-load auto-tuning for synchronous motor 12: No-load dynamic auto-tuning of synchronous motor 13: Static partial auto-tuning of synchronous motor 14: UV gain deviation auto-tuning	Sets the motor auto-tuning mode. Value description 0: No auto-tuning. 1: Static partial auto-tuning of asynchronous motor. It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Some motor parameters are auto-tuned. Other parameters use default values. 2: No-load dynamic auto-tuning of asynchronous motor. It applies to scenarios where the motor can rotate at high speed without the load. It supports auto-tuning of all motor parameters under no-load and pure inertia load states. 3: Static complete auto-tuning of asynchronous motor It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Some motor parameters are auto-tuned. The auto-tuning precision is better than that when C2-00 is set to 1. 4: Inertia auto-tuning. This mode is applicable to scenarios requiring high-speed operation. Auto-tuning can be performed without load or with light load (below 80% of the rated load) or pure inertia load. Auto-tuning inertia ratio parameters. 5: Dead zone auto-tuning. This mode is used to tune the non-linear characteristics of the drive, thus improving the voltage output precision and operation efficiency. 11: Scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. Some motor parameters are auto-tuned. Other parameters use default values. 12: No-load dynamic auto-tuning of synchronous motor. It applies to scenarios where the motor can rotate at high speed without the load. All motor parameters can be tuned. 13: Static partial auto-tuning of synchronous motor. It applies to scenarios where the motor cannot be disconnected from the load and dynamic complete auto-tuning is not allowed. Some motor parameters are auto-tuned. Other parameters use default values. 14: UV gain deviation auto-tuning. The sampling deviation between output phase currents is auto-tuned. Specific auto-tuning parameters also depends on the setting of C2-01. Additional information: Dynamic auto-tuning and inertia auto-tuning are suitable for occasions where the motor can rotate without load. If little load torque is output after the motor rotates, the scenario will be regarded as no load even through the motor does not completely disconnect from the load mechanism. Static auto-tuning is suitable for situations where the motor cannot rotate.

Parameter description:

For asynchronous motors, C2-00 can be selected as 1, 2, and 3. For synchronous motors, C2-00 can be selected as 11, 12, and 13. The following scenarios apply to each auto-tuning mode:

C2-00 = 1: Static partial auto-tuning of asynchronous motors The motor is static during auto-tuning. It is applicable to motors with load, no rotation, or limited rotation travel. Only the parameters of the motor are auto-tuned. The mutual inductance and no-load current are estimated values which may deviate from the actual values, as shown in the following table.

C2-00 = 2: Dynamic auto-tuning for asynchronous motor The motor rotates during auto-tuning. It is applicable to no-load motors. The auto-tuning parameters are the most complete and accurate.

C2-00 = 3: Static complete auto-tuning of asynchronous motor The motor is static during auto-tuning. Compared with static partial auto-tuning, the auto-tuning parameters are more complete though with lower accuracy than dynamic auto-tuning.

C2-00 = 11: With-load auto-tuning for synchronous motor In SVC and V/f control mode, the effect is the same as C2-00 = 13.

C2-00 = 12: No-load dynamic auto-tuning of synchronous motor The motor rotates during auto-tuning. It is applicable to no-load motors. The auto-tuning parameters are the most complete and accurate.

C2-00 = 13: Static partial auto-tuning of synchronous motor The motor is static during auto-tuning. It is applicable to applications with a load, no rotation, or limited rotation travel, but the accuracy is slightly lower than dynamic auto-tuning.

Param.	Name	C2-00 = 1	C2-00 = 2	C2-00 = 3	C2-00 = 11	C2-00 = 12	C2-00 = 13
C4-12	Synchronous motor back EMF	-	-	-	-	✓	-
C4-20	Stator resistance	✓	✓	✓	✓	✓	✓
C4-22	Asynchronous motor rotor resistance	✓	✓	✓	-	-	-
C4-24	Leakage inductance of asynchronous motor stator	✓	✓	✓	-	-	-
C4-26	Leakage inductance of asynchronous motor rotor	✓	✓	✓	-	-	-
C4-28	Asynchronous motor mutual inductance	√[1]	✓	✓	-	-	-
C4-30	No-load current of asynchronous motor	√[1]	✓	✓	-	-	-
C4-32	Synchronous motor D-axis inductance	-	-	-	✓	✓	✓
C4-34	Synchronous motor Q-axis inductance	-	-	-	✓	✓	✓
C4-62	Inertia ratio	-	✓	-	-	✓	-
C4-63	Electromechanical time constant	-	✓	-	-	✓	-
C4-64	System rotation inertia	-	✓	-	-	✓	-
C5-02 to C5-05	Current coefficient of mutual inductance curve	-	✓	✓	-	-	-
C5-06 to C5-09	Flux coefficient of mutual inductance curve	-	✓	✓	-	-	-

Param.	Name	C2-00 = 1	C2-00 = 2	C2-00 = 3	C2-00 = 11	C2-00 = 12	C2-00 = 13
C5-32 to C5-55	Q-axis inductance on DQ axis inductance curve	-	-	-	✓	✓	✓
d3-02	Speed loop Kp in SVC mode	-	✓	-	-	✓	-
d3-03	Speed loop Ti in SVC mode	-	✓	-	-	✓	-
d3-07	Zero speed Kp correction factor	-	✓	-	-	✓	-
d3-08	Zero speed Ti correction factor	-	✓	-	-	✓	-
d3-10	Low speed Kp correction factor	-	✓	-	-	✓	-
d3-11	Low speed Ti correction factor	-	✓	-	–	✓	-
d3-13	High speed Kp correction factor	-	✓	-	-	✓	-
d3-14	High speed Ti correction factor	-	✓	-	-	✓	-
A3-13	U/V current sampling coefficient	✓	✓	✓	✓	✓	✓
A3-30	AC drive transistor voltage drop	✓	✓	✓	✓	✓	✓
A3-31 to A3-38	Dead zone curve current	✓	✓	✓	✓	✓	✓
A3-39 to A3-46	Dead zone curve time	✓	✓	✓	✓	✓	✓

Precautions

- The parameters marked [1] are not true auto-tuning results. They are estimated based on experience and cannot be completely 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.
- After the motor runs, friction or low load torque can be considered as no load. For example, the motor carries an empty drum or inertia disk. You can select dynamic parameter auto-tuning for better effect. The motor and the load are not required to be disconnected.
- The auto-tuning parameters set by the motor manufacturer may deviate from the actual auto-tuning parameters. The actual auto-tuning parameters shall prevail.

4.3.2 Parameter Calculation

Scenario

The parameter calculation function can be used in situations when auto-tuning cannot be performed or when the requirements on the parameter accuracy is not high, such as V/f control mode. This function calculates and updates some parameters based on the motor nameplate-based parameters and the built-in experience algorithm.

To use the parameter calculation, set the nameplate-based parameters, including C4-00 to C4-09, enable parameter calculation (C2-19 = 1), and then confirm nameplate-based parameter calculation (C2-20 = 1). The parameter calculation is completed.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
C2-19	Parameter calculation	0	0: Disable 1: Motor nameplate-based parameter calculation	This parameter sets whether to enable the nameplate-based parameter calculation. Value description 0: Disable 1: Motor nameplate-based parameter calculation.
C2-20	Confirmation of nameplate-based parameter calculation	0	0: Disabled 1: Enable	This parameter sets whether to confirm the nameplate-based parameter calculation. Value description 0: Disable 1: Enable Additional information: This parameter specifies whether to confirm motor nameplate-based parameter calculation. Confirmed calculation results are updated and written into the basic parameter group of the motor.

The parameters updated by calculation are as follows:

Parameter	Name	Parameters updated by calculation
C4-12	Synchronous motor back EMF	✓
C4-20	Stator resistance	✓
C4-22	Asynchronous motor rotor resistance	✓
C4-24	Leakage inductance of asynchronous motor stator	✓
C4-26	Leakage inductance of asynchronous motor rotor	✓
C4-28	Asynchronous motor mutual inductance	✓
C4-30	No-load current of asynchronous motor	✓
C4-32	d axis inductance of synchronous motor	✓
C4-34	q axis inductance of synchronous motor	✓

Precautions

- The parameter calculation is based on the built-in experience algorithm. It provides a relative parameter as a reference instead of accurate parameters.
- The parameters updated are current active motor parameter groups. The current active motor parameter groups are set and viewed through parameters b0-00 and b0-01.

4.3.3 Carrier Frequency and Wave Generation Control

The carrier frequency of the AC drive is set by A5-01 (Set carrier frequency). In addition to being limited by A5-01 (Set carrier frequency) and A5-00 (Maximum carrier frequency), the carrier frequency is controlled by functions such as "Carrier frequency adjustment with synchronous frequency" and "Random PWM". For details, see description of A5-09 to A5-12.

Param.	Name	Default	Value Range	Descriptions
A5-00	Maximum carrier frequency	16.0 kHz	0.0 kHz to 24.0 kHz	Displays the maximum carrier frequency that the AC drive can take effect. Additional information: It is related to the motor control mode and model hardware.
A5-01	Set carrier frequency	4.0 kHz	0.8 kHz to 20.0 kHz	Sets the carrier frequency of the AC drive. It is used to adjust the carrier frequency of the AC drive, helping to reduce the motor noise, avoiding the resonance of the mechanical system, and reducing the leakage current to the earth and interference generated by the AC drive. It helps reduce the motor noise, avoid the resonance of the mechanical system, and reduce the leakage current to the earth and interference generated by the AC drive. Additional information: The higher the setting, the lower the motor noise and the lower the current ripple. However, a higher carrier frequency will derate the AC drive, making it more prone to overload. When the carrier frequency is low, high harmonics of the output current and power loss, as well as temperature rise of the motor increase.
A5-02	Active carrier frequency	4.0 kHz	0.8 kHz to 20.0 kHz	Displays the carrier frequency currently in effect. Additional information: The carrier frequency of the AC drive is also affected by the carrier frequency adjustment with synchronous frequency and random PWM.
A5-09	Hysteresis for adjusting carrier frequency with synchronous frequency	3.0 Hz	0.0 Hz to 100.0 Hz	Sets the hysteresis for adjusting carrier frequency with synchronous frequency. Additional information: After carrier frequency adjustment with synchronous frequency is enabled (bit 1 of A5-08 (PWM command word)), when the output frequency is lower than the setting of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than (A5-10 + A5-09), the effective carrier frequency will reach the carrier frequency reference.

Param.	Name	Default	Value Range	Descriptions
A5-10	Start frequency for adjusting carrier frequency with synchronous frequency	5.0 Hz	0.0 Hz to 600.0 Hz	Sets the start frequency for adjusting carrier frequency with synchronous frequency. Additional information: After carrier frequency adjustment with synchronous frequency is enabled (bit 1 of A5-08 (PWM command word)), when the output frequency is lower than the setting of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than (A5-10 + A5-09), the effective carrier frequency will reach the carrier frequency reference.
A5-11	Random PWM depth	0	0 to 10	Sets the random PWM depth. Additional information: 1. This parameter is effective only for asynchronous motors in V/f mode. 2. This function can turn the sharp electromagnetic noise of the motor caused by the carrier frequency into a relatively soft "rustling" sound. Setting this parameter to 0 disables this function. A larger value means better noise improvement.
A5-12	Carrier frequency upper limit at low speed (V/f)	6.0 kHz	0.8 kHz to 20.0 kHz	Sets the low-speed carrier frequency limit in V/f mode. Additional information: 1. Valid for V/f mode. 2. After carrier frequency adjustment with synchronous frequency is enabled (bit 1 of A5-08 (PWM command word)), when the output frequency is lower than the setting of A5-10, the carrier frequency will be limited by A5-12 or A5-13. When the output frequency is higher than (A5-10 + A5-09), the effective carrier frequency will reach the carrier frequency reference.

Adjusting the carrier frequency will affect the parameters in the following table.

Carrier frequency	Low → High
Motor noise	Large → Small
Output current waveform	Bad → Good
Motor temperature rise	High → Low
AC drive temperature rise	Low → High
Leakage current	Small → Large
External radiation interference	Small → Large

The default carrier frequency varies with the AC drive power. If you need to modify the carrier frequency, note that if the set carrier frequency is higher than the default value, it will lead to an increase in temperature rise of the AC drive heatsink. In this case, you need to de-rate the AC drive. Otherwise, the AC drive may overheat and alarm.

4.3.4 Overmodulation

Scenarios

In applications with high demands for the output current and energy efficiency of the AC drive, such as fans and water pumps, 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 region.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
A5-06	Overmodulation coefficient	103.0%	0.0% to 110.0%	Sets the overmodulation coefficient. Used in conjunction with the bus voltage filter time to improve the performance of the motor in the field weakening region. Additional information: Increasing the voltage overmodulation coefficient can enhance the voltage output capacity and effectively improve the load carrying capacity of the motor in the flux weakening region. However, this can increase the output current distortion.

Precautions

- The larger the overmodulation coefficient, the greater the output voltage distortion and current fluctuation. Large fluctuation will result in wave-by-wave current limit, overcurrent, and other faults. Therefore, the negative effect of increased fluctuation must be considered when the overmodulation coefficient is increased.
- The output voltage reverses a voltage margin of 3% to meet the dynamic current response. Therefore, the 103% overmodulation coefficient 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%. Generally, the effect can be better at around 105%. Otherwise, large harmonic current will be generated, resulting in a decrease in system efficiency.
- The conversion relationship between the effective value of the maximum output line voltage and the bus voltage of the AC drive is as follows:

$$U_{max} = \frac{U_{dc}}{1.414} \times [A5\text{-}06] \times (1 - [D5\text{-}00])$$

4.3.5 Braking Resistor Control

Scenario

In applications with energy feedback, particularly during quick deceleration with heavy inertia load or load lifting operations like hoisting, connect the braking unit to manage the excess energy fed back to the bus to avoid overvoltage. For applications requiring good speed following performance during quick deceleration, installing a braking resistor is highly recommended. If the speed following

requirement is not so critical, consider activating the excitation and overvoltage suppression features to protect the bus from overvoltage during deceleration.

Working Principle

When the bus voltage is higher than the active action voltage of the braking unit during AC drive operation, the braking unit works and the energy is dissipated through the braking resistor. When the bus is lower than the braking unit action voltage, the braking unit stops operating.

Related Parameters

The action voltage of the braking unit is set in A4-00. The actual effective voltage is displayed in A4-01. The parameter A4-02 (Braking duty cycle) can be used to adjust the power of the braking unit.

Param.	Name	Default	Value Range	Descriptions
A4-00	Braking unit action voltage	760.0V	300.0 V to 820.0 V	This parameter specifies the bus voltage threshold to open the braking transistor. The actually effective value is displayed in A4-01. When the motor has regenerative energy charging the bus to high voltage that exceeds this threshold, the braking transistor acts to release the bus energy through the external braking resistor to prevent overvoltage. Additional information: The braking transistor will not act when the AC drive is in the stopped state. Models equipped with braking units include the 2.2 kW (380 V), 4.0 kW (380 V), 5.5 kW (380 V), 1.5 kW (220 V), and 2.2 kW (220 V) models.
A4-01	Active braking unit action voltage	760.0V	300.0 V to 820.0 V	This parameter displays the actually effective action voltage of the braking unit, which is set in A4-00.
A4-02	Braking duty cycle	100%	0% to 100%	This parameter sets the braking duty cycle. Additional information: This parameter specifies the duty cycle of the braking unit. The braking unit is disabled when this parameter is set to 0, and normally open when this parameter is set to 100%.

Precautions

- Connect one end of the braking resistor to the BR terminal and the other end to the positive bus (+). Then verify the resistance between the bus terminal and the BR with a multimeter.
- Ensure that the braking resistor terminals are securely connected and with proper power. Failure to comply may result in an increase in the temperature of the terminals, potentially leading to extreme cases such as fire.
- If bus overvoltage occurs during regeneration even with the braking resistor connected, it may indicate that the braking unit does not have sufficient power. In such cases, replace the braking unit with a higher power within the recommended range You can also reduce the action voltage of the braking unit properly, and apply braking in advance to cope with the rapid deceleration. For the selection of the braking resistor, see *MD600 Series Compact AC Drive Hardware Guide*.

- Be mindful of the grid voltage range when setting the braking voltage. High grid voltage can result in high bus voltage. If the braking unit's action voltage is set below the normal bus voltage, the braking unit may operate continuously during AC drive operation, risking damage Therefore, the action voltage of the braking unit should be 20 V higher than the normal bus voltage to ensure safety.
- When the braking unit is connected and the overvoltage suppression function is activated, set the value of A4-00 below the d1-56 parameter (Actual overvoltage suppression action voltage).
- For large inertia loads, if the speed loop integral time is too short during vector control, the bus voltage may fluctuate excessively when load changes, leading to overheating of the braking resistor. To mitigate this, increase the speed loop integral time (F2-03) to 2 seconds to reduce bus voltage fluctuations.

4.3.6 Random PWM

Scenario

When driving a motor, the AC drive often generates sharp noise from switching frequencies. In noise-sensitive applications, you can enable the random PWM function to improve the user experience.

Working Principle

After random PWM is enabled, the carrier frequency actually in effect changes randomly near the set carrier frequency. This function can turn the sharp noise of the fixed frequency into a relatively soft "rustling" sound.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
A5-11	Random PWM depth	0	0 to 10	Sets the random PWM depth. Remarks 1. This parameter is effective only for asynchronous motors in V/f mode. 2. This function can turn the sharp electromagnetic noise of the motor caused by the carrier frequency into a relatively soft "rustling" sound. Setting this parameter to 0 disables this function. A larger value means better noise improvement.

Precautions

- Larger random PWM depth brings stronger noise improvement. However, this may impact current harmonics negatively. Therefore, it is recommended to increase the value gradually from the default value during actual commissioning.
- For carrier ratios below 10 (the ratio of carrier frequency to output frequency), it is recommended to disable the random PWM function. When the carrier frequency is too low and random PWM is activated, the control frequency will be insufficient, leading to fluctuations in motor speed.
- This parameter is effective only for asynchronous motors in V/f mode.

4.3.7 Slip compensation

Slip compensation can compensate the decrease of speed of an asynchronous motor when the load increases, so that the motor speed can basically remain unchanged when the load changes. When this function is enabled by d2-41, the frequency can be compensated based on the load size to improve the speed accuracy.

Param.	Name	Default	Value Range	Descriptions
d2-41	Slip compensation mode	0	0: Disable 1: Enable	Sets the slip compensation mode. Value description 0: No slip compensation 1: Enable compensation mode. Additional information: Due to slip inherent to asynchronous motors, there can be speed errors in V/f mode during with-load operation. After slip compensation is enabled, the frequency can be compensated based on the load size to improve the accuracy of speed.
d2-42	Slip compensation gain	100%	0% to 200%	This parameter adjusts the frequency in slip compensation.
d2-43	Slip compensation filter time	0.5s	0.1s to 10s	Sets the slip compensation filter time. Remarks Longer filter time means a slower and smoother dynamic process of slip compensation.

4.3.8 Shorting Motor Stator Control

Scenario

The shorting motor stator is a type of braking control applicable to synchronous motors. It is also known as active short circuit (ASC). For example, when a load with gravitational potential energy is hoisted, a certain braking torque is generated through shorting motor stator to prevent the load from overspeed. In the applications such as fan and water pump, the shorting motor stator function also prevents the motor from rotating due to inertia.

Working Principle

When the motor rotates, the three phases of the winding of the synchronous motor are short-circuited in the shorting motor stator state of the AC drive, inducing a current within the windings. Then the braking torque is generated. Therefore, the higher the motor speed, the greater the braking torque.

The process of shorting motor stator is as shown in the following figure.

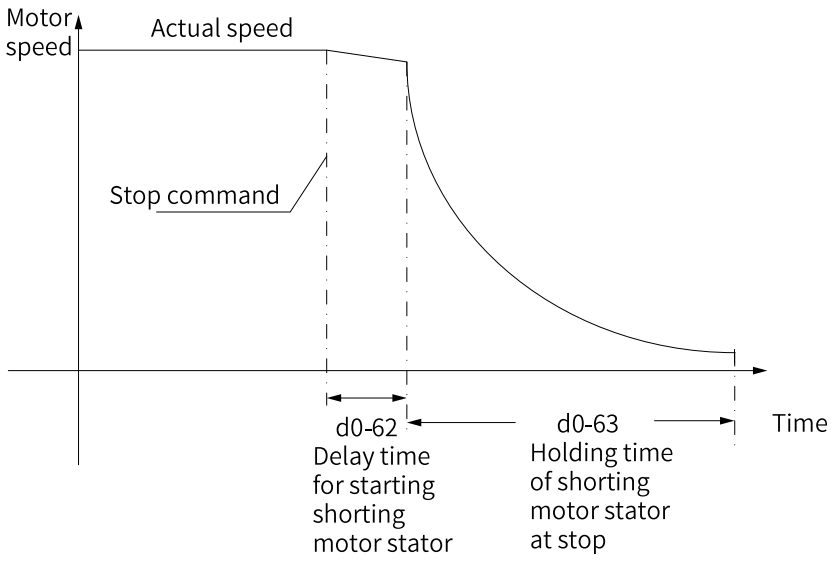


Figure 4-42 Shorting motor stator

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
d0-61	Shorting motor stator	0	0: Disable 1: Enable Other: B connector	Sets whether the shorting stator function is enabled. Value description 0: The function is disabled. 1: The function is enabled. Others: B connector Whether the function is enabled depends on the state of B connector. Additional information: The function is disabled for coast-to-stop mode, and takes effect when the motor decelerates to stop, stops at maximum capability, and stops quickly.
d0-62	Delay time for starting shorting motor stator	0.0 ms	0.0 ms to 5000.0 ms	Shorting motor stator starts after this delay time during shutdown.
d0-63	Holding time of shorting motor stator at stop	10.0s	0.1s to 3600.0s	Sets the holding time of shorting motor stator at shutdown. Additional information: After entering the shorting motor stator, the motor exits after the hold time elapses. The maximum setpoint indicates the active short circuit control is always active.

Precautions

When the motor speed is high, the motor energy returns back to the bus, causing the bus voltage to rise. When the bus reaches a high value, the AC drive stops the shorting motor stator to prevent overvoltage and the motor loses the braking torque that is caused by shorting motor stator. Therefore, it is recommended to use a braking resistor.

4.3.9 Self-Check

Scenario

Self-check is a function that automatically checks the abnormality of the AC drive. The self-check function includes three items: IGBT shoot through self-check, short circuit to ground self-check, and output phase loss self-check. It is recommended that self-check be performed when the motor and AC drive is used for the first time to check whether internal wiring and external wiring are correct. When the system is short-circuited to ground, inter-phase short-circuited, phase loss, or various hardware faults, the self-check reports the corresponding faults and guides the user to perform specific inspection.

Self-check can be started in three ways: manual self-check, pre-running self-check, and power-on self-check. The manual self-check is triggered manually by C2-04. The pre-running self-check automatically performs a self-check after each start command is given and then runs again. The power-on self-check automatically performs a self-check after each power-on is completed.

Related Parameters

Pre-running self-check configuration

Param.	Name	Default	Value Range	Descriptions
C2-03	Pre-start self-test configuration	0x0000	Bit 0: IGBT shoot through self-check 0: Disable 1: Enable Bit 1: Short circuit to ground self-check 0: Disable 1: Enable Bit 2: Phase loss self-check 0: Disable 1: Enable Bit 3 to bit 15: Reserved	Sets the pre-running self-check configuration. Value description Bit 0: The AC drive performs the IGBT shoot through self-check before start. Bit 1: The AC drive performs the self-check on short circuit to ground before start. Bit 2: The AC drive performs the phase loss self-check before start.

Power-on self-check configuration

Param.	Name	Default	Value Range	Descriptions
C2-06	Self-check upon power-on	0x000A	Bit 0: IGBT shoot through self-check upon power-on 0: Disable 1: Enable Bit 1: Self-check on short circuit to ground upon power-on 0: Disable 1: Enable Bit 2: Phase loss self-check upon power-on 0: Disable 1: Enable Bit 3: Inter-phase short circuit self-check upon power-on 0: Disable 1: Enable Bit 4 to bit 15: Reserved	This parameter sets the self-check upon power-on. Value description Bit 0: IGBT shoot through self-check upon power-on. The drive performs IGBT shoot through self-check upon power-on. Bit 1: Self-check on short circuit to ground upon power-on. The drive performs the self-check on short circuit to ground upon power-on. Bit2: Phase loss self-check upon power-on. The drive performs the phase loss self-check upon power-on. Bit 3: Inter-phase short circuit self-check upon power-on. The drive performs the inter-phase short circuit self-check upon power-on.

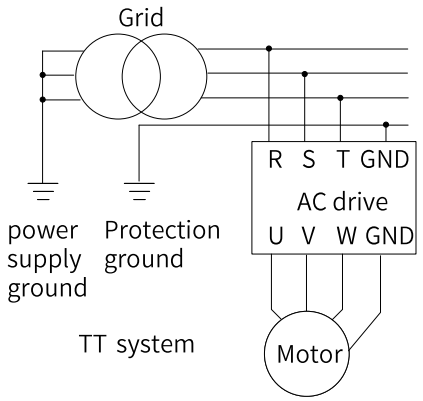
Manual self-check configuration

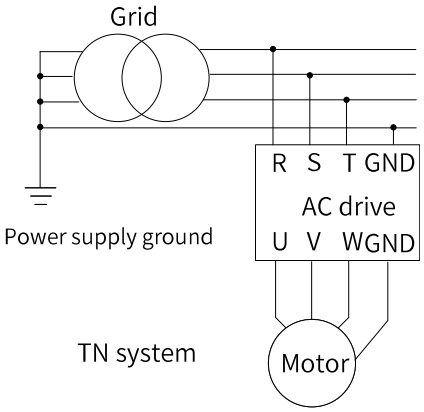
The start of manual self-check is similar to parameter auto-tuning. The CHEC flashing is displayed on the operating panel after self-check is selected. The self-check is completed within 100 ms and the system enters the switch-on inhibition state. If no fault is reported, the self-check is normal.

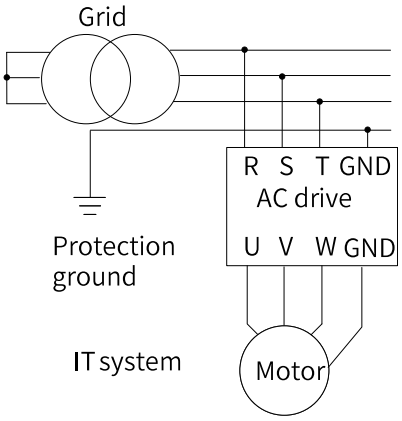
Param.	Name	Default	Value Range	Descriptions
C2-04	Single self-check	0	0: No command 1: Ready for self-check	This parameter sets the single self-check command. Value description 0: No command 1: Ready for self-check Additional information: Single static self-check does not cover the encoder and the motor does not rotate during the self-check process.
C2-05	Single self-check setting	0x0007	Bit 0: IGBT shoot through self-check 0: Disable 1: Enable Bit 1: Short circuit to ground self-check 0: Disable 1: Enable Bit 2: Phase loss self-check 0: Disable 1: Enable Bit 3 to bit 15: Reserved	This parameter sets the self-check items. Value description Bit 0: IGBT shoot through self-check before start. The AC drive performs the IGBT shoot through self-check in the offline state. Bit 1: Self-check on short circuit to ground before start. The AC drive performs the self-check on short circuit to ground in the offline state. Bit 2: Phase loss self-check before start. The AC drive performs the phase loss self-check in the offline state.

Precautions

- During self-check, the AC drive will generate waves. Therefore, ensure that the self-check, especially the power-on self-check, is performed without the risk of electric shock.
- The time consumed during the self-check is within 100 ms. For the applications with strict requirements on startup time, perform the self-check carefully. Otherwise, slow start will occur.
- Do not start self-check when the motor is rotating. If self-check is started when the motor still has back EMF, a false fault may be reported such as short circuit to ground.
- When using the self-check function, ensure that the rated motor current is greater than 0.2 times the rated AC drive current. If the motor power is much lower than the AC drive power, the self-check may fail. In this case, self-check is not recommended.
- When the motor cable reaches several hundred meters, a small AC drive (Below 30 kW) has a large grounding capacitor. A relatively large leakage current to the ground will occur during self-check compared to the rated current of the AC drive. The self-check may result in false faults. In this case, self-check is not recommended.
- When the grid is an IT system, short circuit to ground cannot be detected during self-check. To enable this function, install an insulation monitor to the IT system. The following figures show different types of grids:


Grid
R S T GND
AC drive
U V W GND
power supply ground
Protection ground
TT system
Motor


Grid
R S T GND
AC drive
U V WGND
Power supply ground
TN system
Motor


Grid
R S T GND
AC drive
U V W GND
Protection ground
IT system
Motor

5 Function Applications

5.1 Frequency Function

5.1.1 Multi-reference

Description

If multi-reference is selected as the frequency reference source, frequency references are input through different state combinations of the DIs corresponding to different set frequencies.

Instances

Table 5–1 Using multi-reference as the frequency reference source

Procedure	Parameter	Description
Step 1: Select multi-reference as the frequency reference source.	F0-29	F0-29 = 6
Step 2: Determine the number of multi-references.	/	A total of 16 multi-references are supported, which requires four DIs. The relationship between the number of multi-references and the number of DIs is as follows: 2 multi-references: One DI (K1) 3-4 multi-references: Two DIs (K1 and K2) 5-8 multi-references: Three DIs (K1, K2, and K3) 9-16 multi-references: Four DIs (K1, K2, K3, and K4)
Step 3: Set the multi-reference function for the DI through parameters in group b8.	b8-03	0: Invalid
		1: Valid
		2: Terminal input function
		3 to 7: Corresponds to DI1 to DI5
		Others: B connector
	b8-04	0: Invalid
		1: Valid
		2: Terminal input function
		3 to 7: Corresponds to DI1 to DI5
		Others: B connector
	b8-05	0: Invalid
		1: Valid
		2: Terminal input function
		3 to 7: Corresponds to DI1 to DI5
		Others: B connector
	b8-06	0: Invalid
		1: Valid
		3 to 7: Corresponds to DI1 to DI5
		Others: B connector

Procedure	Parameter	Description
Step 4: Set the frequency for each multi-reference. [Note]	b8-09 to b8-24	The frequency corresponding to each speed reference is set to a percentage value. 100% corresponds to the per-unit base value of frequency (A2-04).
	C4-06	If the frequency reference source is set multi-reference, the value 100% of FC-00 to FC-15 corresponds to the value of C4-06 (Motor rated frequency).

Note

[Note] The four multi-reference terminals can provide 16 state combinations, corresponding to 16 reference values, as listed in the following table.

Table 5–2 State combinations of the four multi-reference terminals

K4	K3	K2	K1	Reference	It corresponds to the percentage of the per-unit base value of frequency (A2-04).
OFF	OFF	OFF	OFF	Multi-reference 0	b8-09
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
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

5.1.2 Frequency Detection (FDT)

Description

This function sets the detection value of the output frequency as well as the hysteresis value upon output cancellation. When the running frequency is higher than the frequency detection value, the DO terminal is assigned with function 3: Frequency detection FDT1 output or function 25: Frequency detection FDT2 output, and the DO outputs the ON signal. When the running frequency is lower than the detection hysteresis value, the DO ON signal output is canceled. The following figure shows the frequency detection function.

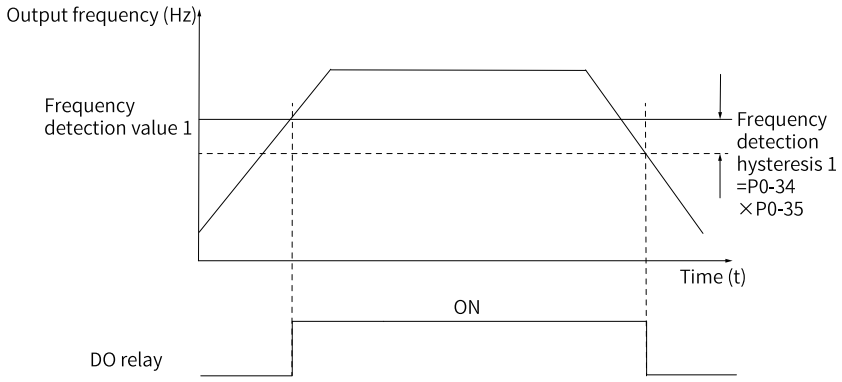


Figure 5-1 Parameters related to frequency detection

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-34	Frequency detection value (FDT1)	50.00 Hz	0.00 Hz to A2-17	Sets the running frequency detection value 1 of the AC drive. Additional information: When the running frequency of the AC drive is higher than or equal to the frequency detection value (FDT1), the DO outputs an active signal. When the running frequency of the AC drive is lower than the result (frequency detection value - frequency detection value x hysteresis coefficient), the DO outputs an inactive signal.
P0-35	Frequency detection hysteresis (FDT1)	5.00%	0.0% to 100.0%	Sets the running frequency detection hysteresis coefficient of the AC drive, which is the percentage of the frequency detection value (FDT1). Additional information: When the running frequency of the AC drive is higher than or equal to the frequency detection value (FDT1), the DO outputs an active signal. When the running frequency of the AC drive is lower than the result (frequency detection value - frequency detection value x hysteresis coefficient), the DO outputs an inactive signal.

Param.	Name	Default	Value Range	Descriptions
P0-36	Frequency detection value (FDT2)	50.00 Hz	0.00 Hz to A2-17	Sets the running frequency detection value 2 of the AC drive. Additional information: When the running frequency of the AC drive is higher than or equal to the frequency detection value (FDT2), the DO outputs an active signal When the running frequency of the AC drive is lower than the result (frequency detection value - frequency detection value x hysteresis coefficient), the DO outputs an inactive signal.
P0-37	Frequency detection hysteresis (FDT2)	5.00%	0.0% to 100.0%	Sets the running frequency detection hysteresis value of the AC drive, which is the percentage of the frequency detection value (FDT2). Additional information: When the running frequency of the AC drive is higher than or equal to the frequency detection value (FDT2), the DO outputs an active signal When the running frequency of the AC drive is lower than the result (frequency detection value - frequency detection value x hysteresis coefficient), the DO outputs an inactive signal.

5.1.3 Jump Frequency

Description

The AC drive can avoid the mechanical resonance point of the load through the jump frequency. The AC drive supports four jump frequencies. If the four frequencies are set to 0, the frequency jump function is disabled.

Set whether the jump frequency is active during acceleration/deceleration by P0-05 (Jump frequency during acceleration/deceleration). When it is disabled, the AC drive continues to run at the running frequency when the running frequency is near the jump frequency during acceleration and deceleration.

When it is enabled, the AC drive jumps over the jump frequency when the running frequency is near the jump frequency during acceleration and deceleration. The jump range is twice the value of P0-10 (jump frequency amplitude). The following figure shows how the jump frequency works.

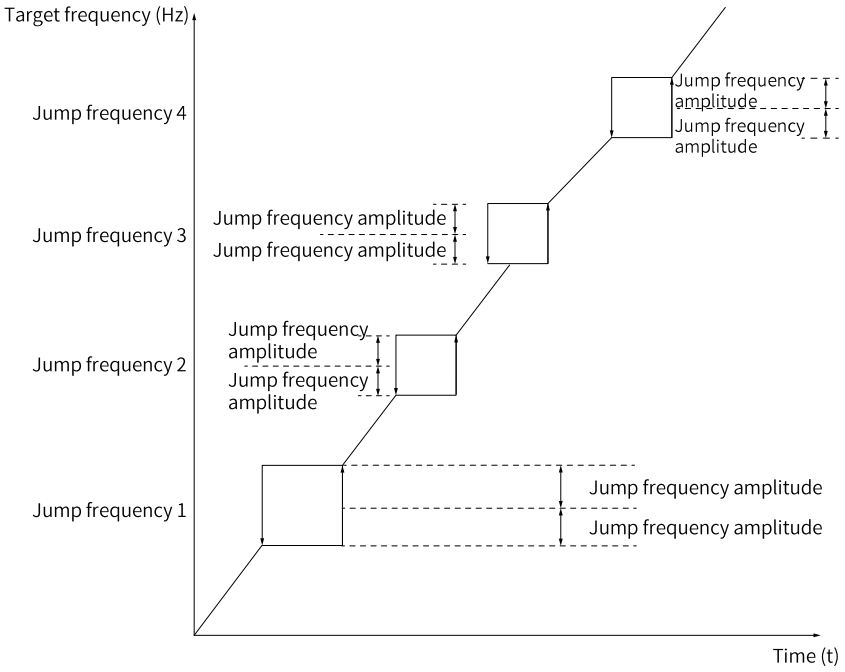


Figure 5-2 Jump frequency

As shown in the preceding figure, when the running frequency approaches the value (jump frequency minus P0-10) during acceleration, the AC drive runs at the current frequency for a period and then jumps over the jump frequency. The jump range is twice the value of P0-10 (jump frequency amplitude). Then the AC drive continues to run at the frequency (the jump frequency plus P0-10).

When the running frequency decelerates to the value (jump frequency plus P0-10) during deceleration, the AC drive runs at the current frequency for a period and then jumps over the jump frequency. The jump range is twice the value of P0-10 (jump frequency amplitude). Then the AC drive continues to run at the frequency (the jump minus P0-10).

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-05	Jump frequency during acceleration/ deceleration	0	0: Enable 1: Disable	This parameter is used to enable or disable the jump frequency function during acceleration/deceleration. Value description 0: During acceleration/deceleration, when the running frequency reaches the jump frequency, the AC drive continues to run at the running frequency. 1: During acceleration/deceleration, the AC drive jumps over the jump frequency when the running frequency reaches the jump frequency during acceleration and deceleration. The jump range is twice the value of P0-10 (jump frequency amplitude).
P0-06	Jump frequency 1	0.0 Hz	0.0 Hz to 800.0 Hz	Set the first jump frequency to be used with P0-10. Additional information: 1. When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2. If this parameter is set to 0, the first jump frequency is disabled. 3. During acceleration/deceleration, the actual running frequency normally passes the jump frequency range, and no jump occurs.
P0-07	Jump frequency 2	0.0 Hz	0.0 Hz to 800.0 Hz	Set the second jump frequency to be used with P0-10. Additional information: 1. When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2. If this parameter is set to 0, the second jump frequency is disabled. 3. During acceleration/deceleration, the actual running frequency normally passes the jump frequency range, and no jump occurs.
P0-08	Jump frequency 3	0.0 Hz	0.0 Hz to 800.0 Hz	Set the third jump frequency to be used with P0-10. Additional information: 1. When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2. If this parameter is set to 0, the third jump frequency is disabled. 3. During acceleration/deceleration, the actual running frequency normally passes the jump frequency range, and no jump occurs.

Param.	Name	Default	Value Range	Descriptions
P0-09	Jump frequency 4	0.0 Hz	0.0 Hz to 800.0 Hz	Set the fourth jump frequency to be used with P0-10. Additional information: 1. When the set frequency is within the jump frequency range, the actual running frequency is at the edge of the jump frequency range (lower limit or upper limit of the range) to avoid the mechanical resonance point of the load. 2. If this parameter is set to 0, the fourth jump frequency is disabled. 3. During acceleration/deceleration, the actual running frequency normally passes the jump frequency range, and no jump occurs.
P0-10	Jump frequency amplitude	0.0 Hz	0.0 Hz to 5.0 Hz	The jump frequency amplitude is set to determine the effective range of the jump frequency . Additional information: 1. If the running frequency jumps over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency plus the jump frequency amplitude (upper limit of the range). 2. If the running frequency does not jump over the jump frequency, when the frequency is set to the jump frequency again, the frequency jumps over the value that is jump frequency minus the jump frequency amplitude (lower limit of the range).

5.2 Current Detection

5.2.1 Zero Current Detection

Description

The DO is assigned with function 34 (Zero current status) and outputs an active signal when the output current of the AC drive remains at or below the zero current detection level (P0-47) for a period greater than the value of P0-48 (zero current detection delay time).

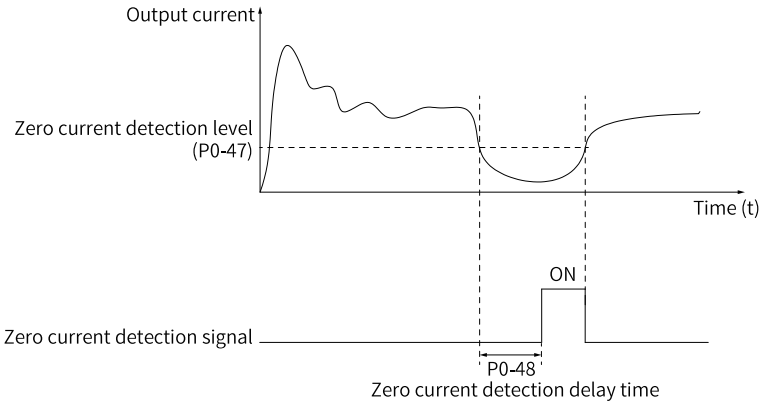


Figure 5-3 Zero current detection

Related parameter

Table 5–3 Parameters about zero current detection

Param.	Name	Default	Value Range	Descriptions
P0-47	Zero current detection level	5.00%	0.0% to 300.0% (reference current)	Set the zero current detection value of the output current of the AC drive to the percentage of the rated motor current. Additional information: When the output current of the AC drive has been less than or equal to the zero current detection level for a period longer than the zero current detection delay time, the DO terminal outputs an "active" signal.
P0-48	Zero current detection delay time	0.10s	0.01s to 600.00s	Defines the delay time for zero current detection of the output current of the AC drive. Additional information: When the output current of the AC drive has been less than or equal to the zero current detection level for a period longer than the zero current detection delay time, the DO terminal outputs an "active" signal.

5.2.2 Output Current Overlimit

Description

When the output current of the AC drive remains above the output current overlimit threshold (P0-49) for a period longer than the value of P0-50 (output current overlimit detection delay), the DO assigned with function 36 (output current overlimit) outputs an active signal.

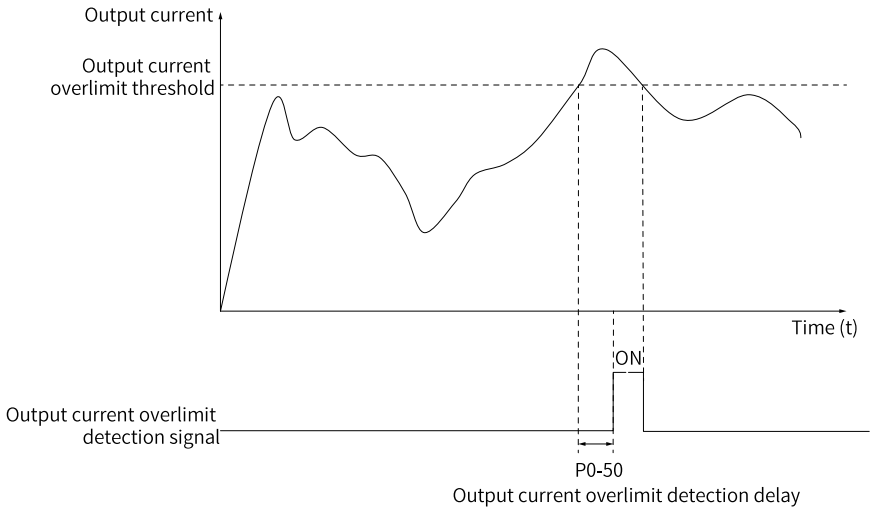


Figure 5-4 Output current overlimit threshold

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-49	Output current overlimit threshold	200.0%	0.0% to 300.0% (reference current)	Defines the output current overlimit threshold of the AC drive, which is the percentage of the rated motor current. Additional information: When the output current of the AC drive has been greater than the output overcurrent threshold for a period longer than the output overcurrent detection delay, the DO terminal outputs an "active" signal.
P0-50	Output current overlimit detection delay	0.00s	0.00s to 600.00s	Sets the output current overlimit detection delay time. Additional information: When the output current of the AC drive has been greater than the output overcurrent threshold for a period longer than the output overcurrent detection delay, the DO terminal outputs an "active" signal.

5.2.3 Current Detection Value

Description

The DO terminal is assigned with function 28/29: current 1/2 reached and outputs the active signal when the output current of the AC drive is within the range of "current detection value 1 ± current detection width 1 x reference current". The AC drive provides two groups of current detection value and current detection widths, as shown below.

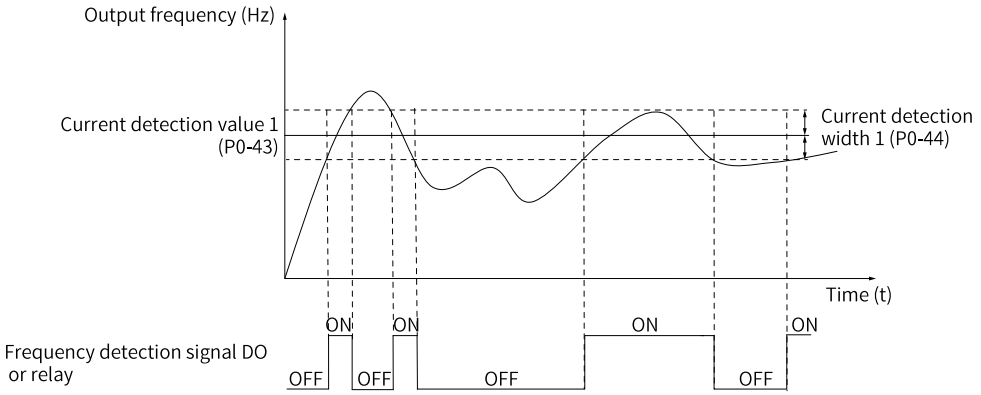


Figure 5-5 Detection current time sequence

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-43	Current detection value 1	100.0%	0.0% to 300.0% Reference current	Defines current detection value 1 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is within the range from current detection value 1 - current detection width 1 x rated motor current to current detection value 1 + current detection width 1 x rated motor current, the DO outputs an active signal.
P0-44	Current detection width 1	0.0%	0.0% to 300.0% Reference current	Defines current detection width 1 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is within the range from current detection value 1 - current detection width 1 x rated motor current to current detection value 1 + current detection width 1 x rated motor current, the DO outputs an active signal.
P0-45	Detection current 2	100.0%	0.0% to 300.0% Reference current	Defines current detection value 2 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is within the range from current detection value 2 - current detection width 2 x rated motor current to current detection value 2+ current detection width 2 x rated motor current, the DO outputs an active signal.
P0-46	Detection current amplitude 2	0.00%	0.0% to 300.0% Reference current	Defines current detection width 2 of the output current of the AC drive: the percentage of the rated motor current. Additional information: When the output current of the AC drive is within the range from current detection value 2 - current detection width 2 x rated motor current to current detection value 2+ current detection width 2 x rated motor current, the DO outputs an active signal.

5.3 Fan Control

Description

The fan control is used to control the running mode of the cooling fan, or to switch the forward and reverse running of the fan.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
A4-11	General mode of fan control	0	0: Working (forward running when the heatsink temperature is higher than 42°C at stop state) when AC drive is running 1: Working continuously (forward running) 2: Working (forward/ reverse running when the heatsink temperature is higher than 42°C at stop state) when AC drive is running 3: Working continuously (forward/ reverse running) 4: Manufacturer-defined mode 1 5: Manufacturer-defined mode 2	Set the general mode of fan operation. Value description: 0: Except for undervoltage state, the fan runs when the AC drive is running. When the AC drive stops, the fan runs if the heatsink temperature is higher than 42°C, and does not run if the heatsink temperature is lower than 40°C. 1: Except for undervoltage state, the fan runs continuously. 2: Except for undervoltage state, the fan runs when the AC drive is running. When the AC drive stops, the fan runs if the heatsink temperature is higher than 42°C, and does not run if the heatsink temperature is lower than 40°C. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 3: Working continuously (forward/reverse running). Except for undervoltage state, the fan runs continuously. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 4: Manufacturer-defined mode 1. It is not recommended to set this mode. 5: Manufacturer-defined mode 2. It is not recommended to set this mode.
U0-49	Set fan speed	0rpm	0 rpm to 65535 rpm	Displays the set speed of the fan when it is running. The unit is rpm.
U0-50	Actual fan speed	0rpm	-32768 rpm to +32767 rpm	Displays the real-time speed of the fan. The unit is rpm.
U0-52	Fan initialization flag	0	0 to 65535	Displays whether the initialization of the fan is complete.

5.4 Output Power Correction

Description

When the output power (U0-05) is not equal to expected value, perform linear correction on the output power via this parameter.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-64	Output power correction coefficient	100.0%	0.0% to 200.0%	Defines the linear correction coefficient of the output power (U0-05). Additional information: This function is mainly used when the output power (U0-05) cannot match the expected value.

5.5 User-Defined Parameters

Description

Group AE consists of user-defined parameters (AE-00 to AE-31). Users can define up to 32 commonly used parameters for easier check and modification.

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) = P0.06, the user-defined parameter 0 is P0-06 (jump frequency 1). The value of AE-00 in the commissioning software is 0x6006, which is the communication address of P0-06 (jump frequency 1).

If F0.00 is displayed on the operating panel (0xF000 displayed in the commissioning software), the corresponding user-defined parameter is empty. In the user-defined parameter mode, the displayed parameters are defined by AE-00 to AE-31, and the sequence is consistent with that in group AE. The parameter is skipped if F0-00 is displayed.

The communication addresses and the mapping addresses of Group AE parameters are shown in the following table. The addresses 0x2F00 to 0x2F1F are the communication addresses of the parameters AE-00 (user-defined parameter 0) to AE-31 (user-defined parameter 31). You can set common parameters to user-defined parameters through these addresses. Similarly, 0xAE00 to 0xAE1F are the mapping addresses of user-defined parameters set in AE-00 (user-defined parameter 0) to AE-31 (user-defined parameter 31). You can read and write the user-defined parameters set through 0xAE00 to 0xAE1F.

For example, set AE-00 (user-defined parameter 0) to U0.00 through the operating panel to set U0-00 (running frequency) to user-defined parameter 0. You can read the value of U0-00 through the mapping address 0xAE00 of user-defined parameter 0. Then set AE-01 (user-defined parameter 1) = U0.07 and AE-02 (user-defined parameter 2) = U0.09. In this case, read the values of three consecutive parameters from 0xAE00 to 0xAE02 to obtain the running frequency (U0-00), DI input status (U0-07), and AI1 voltage (U0-09).

Parameter	Name	Communication Address	Mapping Address of User-Defined Parameters
AE-00	User-defined parameter 0	0x2F00	0xAE00
AE-01	User-defined parameter 1	0x2F01	0xAE01
AE-02	User-defined parameter 2	0x2F02	0xAE02
AE-03	User-defined parameter 3	0x2F03	0xAE03
AE-04	User-defined parameter 4	0x2F04	0xAE04
AE-05	User-defined parameter 5	0x2F05	0xAE05
AE-06	User-defined parameter 6	0x2F06	0xAE06
AE-07	User-defined parameter 7	0x2F07	0xAE07
AE-08	User-defined parameter 8	0x2F08	0xAE08
AE-09	User-defined parameter 9	0x2F09	0xAE09
AE-10	User-defined parameter 10	0x2F0A	0xAE0A
AE-11	User-defined parameter 11	0x2F0B	0xAE0B
AE-12	User-defined parameter 12	0x2F0C	0xAE0C
AE-13	User-defined parameter 13	0x2F0D	0xAE0D
AE-14	User-defined parameter 14	0x2F0E	0xAE0E
AE-15	User-defined parameter 15	0x2F0F	0xAE0F
AE-16	User-defined parameter 16	0x2F10	0xAE10
AE-17	User-defined parameter 17	0x2F11	0xAE11
AE-18	User-defined parameter 18	0x2F12	0xAE12
AE-19	User-defined parameter 19	0x2F13	0xAE13
AE-20	User-defined parameter 20	0x2F14	0xAE14
AE-21	User-defined parameter 21	0x2F15	0xAE15
AE-22	User-defined parameter 22	0x2F16	0xAE16
AE-23	User-defined parameter 23	0x2F17	0xAE17
AE-24	User-defined parameter 24	0x2F18	0xAE18

Parameter	Name	Communication Address	Mapping Address of User-Defined Parameters
AE-25	User-defined parameter 25	0x2F19	0xAE19
AE-26	User-defined parameter 26	0x2F1A	0xAE1A
AE-27	User-defined parameter 27	0x2F1B	0xAE1B
AE-28	User-defined parameter 28	0x2F1C	0xAE1C
AE-29	User-defined parameter 29	0x2F1D	0xAE1D
AE-30	User-defined parameter 30	0x2F1E	0xAE1E
AE-31	User-defined parameter 31	0x2F1F	0xAE1F

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
A0-72	Display of individual-ized parameters	111	Ones place: User mode selection 0: Hide user mode 1: Show user mode Tens place: Calibration mode selection 0: Hide calibration mode 1: Show calibration mode Hundreds place: Error menu selection 0: Hide error menu 1: Display error menu Thousands place: Reserved Ten thousands place: Reserved	This parameter is used to determine whether the user-defined parameter menu, user-modified parameter menu, and error menu are displayed on the operating panel. Value description The ones place of this parameter is used to set whether the user-defined parameter menu is displayed. 0: The user-defined parameter menu is hidden. 1: The user-defined parameter menu is displayed. The tens place of this parameter is used to set whether the user-modified parameter menu is displayed. 0: The user-modified parameter menu is hidden. 1: The user-modified parameter is displayed. The hundreds place of this parameter is used to set whether the error menu is displayed. 0: The error menu is hidden. 1: The error menu is displayed.
AE-00	User-defined parameter 0	F0-00	F0-00 to FF-xx A0-00 to AF-xx b0-xx to bF-xx C0-xx to CF-xx D0-xx to dF-xx E0-xx to EF-xx H0-xx to HF-xx n0-xx to nF-xx 00-xx to oF-xx P0-xx to PF-xx L0-xx to LF-xx U0-xx to U3-xx	Set user-defined parameters. AE-00 to AE-31 support setting a total of 32 user-defined parameters. Additional information: This group is user-defined. You can select the required parameters from the parameter list and add them to group AE, which facilitates view and modification. You can switch to the -USER menu by long-pressing the Back key.
AE-01 to AE-31	User-defined parameters 1 to 31	Same as AE-00	Same as AE-00	Same as AE-00

5.6 AC Drive Automatically Stops

Description

The timer starts from 0 upon startup of the AC drive. When the timing duration (P0-15) expires, the AC drive automatically stops, and the DO assigned with function 30 (timing duration reached) and outputs an active signal. The remaining timing duration can be viewed through U2-25.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P0-13	Timing function	0	0: Disable 1: Enable	Set whether the timed operation of the AC drive is active. Value description 0: Disable 1: Enable. The timer starts upon startup of the AC drive. When the set timing duration is reached, the AC drive stops automatically and meanwhile the corresponding multi-function DO outputs ON signal. Additional information: The timing duration is set by P0-14 and P0-15, and the time unit is min. The AC drive starts timing from 0 each time it starts up and the remaining timing duration can be viewed in U0-20.
P0-14	Timed operation time source	0	0: P0-15 1: AI1 Others: F connector	Defines the source of the timed operation time. Value description 0: Depended by P0-15. 1: Depended by AI1 input voltage and P0-15. Others: Depended by the value of F connector and the setting result of P0-15. Additional information: When this parameter is set to 1 and 2, the timed operation time = AI voltage ÷ 10 V x P0-15, and 100% of the analog input range corresponds to P0-15.
P0-15	Timed operation time	0.0 min	0.0 min to 6500.0 min	Set the local digital value of the timed operation time.

5.7 Hibernation and Wakeup of the AC Drive

Description

Hibernation enables you to set any time period within 24 hours, during which the AC drive stops running and hibernates.

Wakeup is a process that the AC drive wakes up from the hibernation state and starts to run.

To use the hibernation and wakeup functions, set the wakeup frequency, hibernation frequency, and hibernation duration. Generally, set the wakeup frequency (P0-22) equal to or greater than the

hibernation frequency (P0-24). The hibernation and wakeup function is disabled if both the wakeup frequency and hibernation frequency are set to 0.0 Hz.

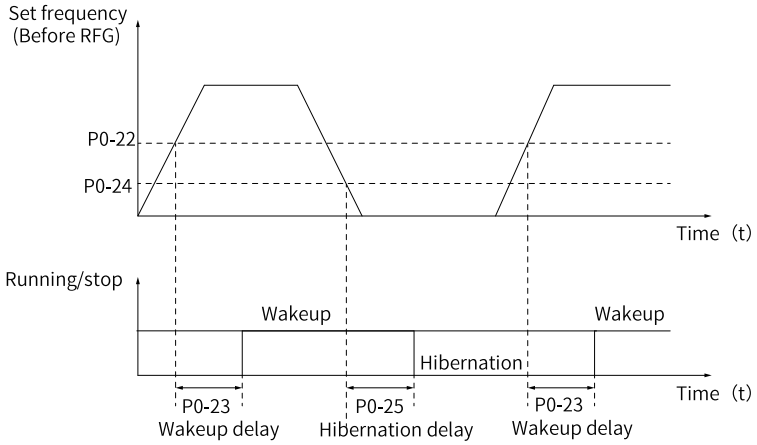


Figure 5-6 Hibernation and wakeup settings

Note

When sleep 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

Parameter	Name	Default	Value Range	Descriptions
P0-22	Wakeup frequency	0.00 Hz	P0-24 to A2-17	Sets the wakeup frequency of the AC drive to exit the hibernation state. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
P0-23	Wakeup delay	0.0s	0.0s to 6500.0s	Defines the wakeup delay time of the AC drive. Additional information: If the AC drive is hibernating and the current RUN command is active, when the frequency reference is greater than or equal to the wakeup frequency (P0-22), the AC drive starts directly after the wakeup delay (P0-23).
L4-64	Hibernation enable flag	0	0 to 65535	Displays whether hibernation is active. Value description 0: Disabled. 1: Enable

Parameter	Name	Default	Value Range	Descriptions
P0-24	Hibernation frequency	0.00 Hz	0.00 Hz to P0-22	Set the hibernating frequency of the AC drive. The AC drive enters the hibernation state when the frequency reference in the running state is lower than the hibernating frequency. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.
P0-25	Hibernation delay	0.0s	0.0s to 6500.0s	Defines the hibernation delay of the AC drive. Additional information: If the AC drive is running, when the frequency reference is less than or equal to the hibernating frequency (P0-24), after the hibernating delay (P0-25), the AC drive starts to hibernate and decelerates to stop.

5.8 Multi-Reference

Description

As shown in the figure, the product supports up to 16 multi-reference input, which can be selected through multi-reference selection parameters (b8-03 to b8-06) or DI terminal function selection.

The input source of multi-reference 0 is selected by b8-08. When b8-08 is set to 0, the input value of multi-reference 0 is set by b8-09 (Multi-reference 0). The multi-reference 1 to 15 is set by b8-10 to b8-24.

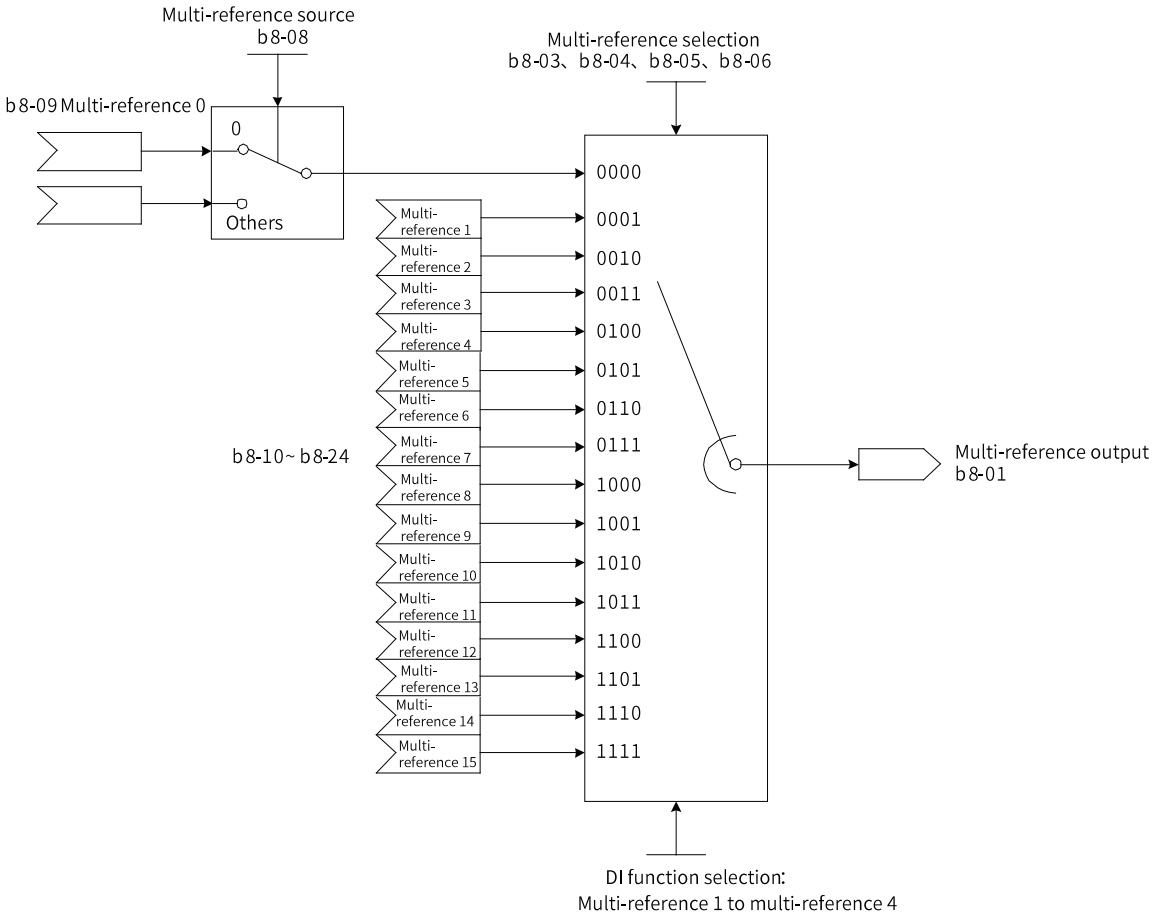


Figure 5-7 Multi-reference module

You can select 16 multi-references by setting b8-03 (Multi-reference selection bit 0) to b8-06 (Multi-reference selection bit 3). The relationship between the parameter setting and the corresponding multi-reference is shown in the following table. The effective multi-reference is viewed in b8-00 (Currently effective multi-reference X) and b8-01 (Currently valid multi-reference output).

When setting parameters b8-03 to b8-06, if the value displays the connector parameters (L4-48 to L4-52) of the DI terminal and cannot be modified, the DI function is assigned to multi-reference selection. In this case, the bitx value is determined by the corresponding DI state.

b8-06	b8-05	b8-04	b8-03	Reference	Parameter
0	0	0	0	Multi-reference 0	b8-09 (b8-08=0)
0	0	0	1	Multi-reference 1	b8‑10
0	0	1	0	Multi-reference 2	b8‑11
0	0	1	1	Multi-reference 3	b8‑12
0	1	0	0	Multi-reference 4	b8‑13
0	1	0	1	Multi-reference 5	b8‑14
0	1	1	0	Multi-reference 6	b8‑15
0	1	1	1	Multi-reference 7	b8‑16
1	0	0	0	Multi-reference 8	b8‑17
1	0	0	1	Multi-reference 9	b8‑18
1	0	1	0	Multi-reference 10	b8‑19
1	0	1	1	Multi-reference 11	b8‑20
1	1	0	0	Multi-reference 12	b8‑21
1	1	0	1	Multi-reference 13	b8‑22

b8-06	b8-05	b8-04	b8-03	Reference	Parameter
1	1	1	0	Multi-reference 14	b8‑23
1	1	1	1	Multi-reference 15	b8‑24

Unit selection and range setting

This product supports multi-reference unit switchover. You can set the unit of multi-reference 0 to multi-reference 15 by b8-02 (Multi-reference unit selection). If there is no special requirement, the default unit of multi-reference is % (100% = rated motor frequency).

Note

When b8-02 (Multi-reference unit selection) is not 0, the multi-reference 0 setting mode only supports 0 (Set by the parameter (b8-09)), and the setting is inactive from other sources.

Param.	Name	Default	Value Range	Descriptions
b8-02	Multi-reference unit selection	0	0: % (100% corresponds to the rated motor frequency) 1: % (100% corresponds to the maximum motor frequency) 2: User-defined (100% = b8-41) 3: Hz 4: rpm	This parameter sets the multi-reference unit. Value description 0: % (100% = rated motor frequency). The base value is the rated motor frequency. 100% corresponds to A2-04 (Per unit frequency base value). 1: % (100% = maximum motor frequency). The base value is the maximum motor frequency. 100% corresponds to A2-17 (Maximum motor frequency). 2: User-defined (100% = b8-41). The user-defined unit applies. The digital setting of the base value is set by b8-41 (User-defined base value). 3: Hz. You can directly set the target frequency. 4: rpm. You can directly set the target speed.

1. When b8-02 is set to 0, the multi-reference unit is %, and 100% corresponds to A2-04 (per-unit base value of frequency).
2. When b8-02 is set to 1, the multi-reference unit is %, and 100% corresponds to A2-17 (Effective maximum motor frequency).
3. When b8-02 is set to 2, the multi-reference unit and the base value is defined by the user, and the base value is set by b8-41 (User-defined base value). If the base value is 50.0, and multi-reference 1 is set to 200.0, the actual effective output value of multi-reference 1 is 400% (200.0 ÷ 50.0 x 100%).

Param.	Name	Default	Value Range	Descriptions
b8-41	User-defined base value	100.0	0.0 to 6553.0	This parameter sets the user-defined base value of multi-reference. It is value only when b8-02 is set to 4 (User-defined). Additional information: If the base value is 100.0, and multi-reference 1 is set to 200.0, the actual effective output value of multi-reference 1 is 200% (200.0/100.0 x 100%).

4. When b8-02 is set to 3, the multi-reference unit is Hz, and the multi-reference output is the frequency reference.
5. When b8-02 is set to 4, the multi-reference unit rpm, and the multi-reference output is speed reference.

If you need to limit the input range of multi-references, you can set the upper and lower limits of multi-references through b8-42 (Multi-reference upper limit threshold) and b8-43 (Multi-reference lower limit threshold). Values outside the set range cannot be written to multi-references 0 to 15.

Param.	Name	Default	Value Range	Descriptions
b8-42	Multi-reference upper limit threshold	3000.0	0.0 to 3000.0	This parameter set the upper limit threshold of the multi-reference. Additional information: You can set this parameter when you need to limit the upper and lower limits of the written multi-reference. For example, if b8-42 is set to 100.0, you cannot write a value greater than 100.0 to b8-09 (Multi-reference 0) to b8-24 (Multi-reference 15).
b8-43	Multi-reference lower limit threshold	-3000.0	-3000.0 to 0.0	This parameter set the lower limit threshold of the multi-reference. Additional information: You can set this parameter when you need to limit the upper and lower limits of the written multi-reference. For example, if b8-42 is set to -100.0, you cannot write a value smaller than -100.0 to b8-09 (Multi-reference 0) to b8-24 (Multi-reference 15).

Related Parameters

Param.	Name	Default	Value Range	Descriptions
b8-00	Currently effective multi-reference X	0	-	This parameter displays the currently effective multi-reference No.
b8-01	Currently valid multi-reference output	0.0	-	This parameter displays the value of the currently effective multi-reference.
b8-02	Multi-reference unit selection	0	0: % (100% corresponds to the rated motor frequency) 1: % (100% corresponds to the maximum motor frequency) 2: User-defined (100% = b8-41) 3: Hz 4: rpm	This parameter sets the multi-reference unit. Value description 0: % (100% = rated motor frequency). The base value is the rated motor frequency. 100% corresponds to A2-04 (Per unit frequency base value). 1: % (100% = maximum motor frequency). The base value is the maximum motor frequency. 100% corresponds to A2-17 (Maximum motor frequency). 2: User-defined (100% = b8-41). The user-defined unit applies. The digital setting of the base value is set by b8-41 (User-defined base value). 3: Hz. The unit is Hz. You can directly set the target frequency. 4: rpm. You can directly set the target speed.

Param.	Name	Default	Value Range	Descriptions
b8-03	Multi-reference selection bit 0	0	0: 0 1:1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	A total of 16 multi-reference values are supported based on the combination of multi-reference selection bit0, bit0, bit2, and bit3. Value description 0: The value of multi-reference bit0 is 0. 1: The value of multi-reference bit0 is 1. 3 to 7: DI1 to DI5 - Depends on the terminal state of the DI. Other: B connector - Depends on other B connectors. Additional information: A total of 16 multi-reference can be supported through binary combination of b8-03, b8-04, b8-05, and b8-06. For example, if bit0 is 1, bit1 is 1, bit2 is 0, and bit3 is 1, the multi-reference 11 (0x1011) is selected. After the DI terminal is assigned with function 12 (Multi-reference terminal 1), the value of b8-03 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
b8-04	Multi-reference bit 1			
b8-05	Multi-reference bit 2			
b8-06	Multi-reference bit 3			

Param.	Name	Default	Value Range	Descriptions
b8-08	Multi-reference 0 setting mode	0	0: Set by the parameter (b8-09) 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse 5: PID 6: Digital setting of main frequency (b5-01/b6-01 Others: F connector	It defines the source of multi-reference 0. Value description 0: Set by the parameter (b8-09) - The value of multi-reference 0 is set by b8-09. 1: AI1. The multi-reference 0 is input by current or voltage signal through the AI1. The multi-reference 0 is calculated according to the preset AI curve. 2: Reserved 3: MD-BP-M potentiometer. The multi-reference 0 is set by the MD-BP-M potentiometer. 4: HDI pulse. The multi-reference 0 is set through the pulse frequency of the DI4. The multi-reference 0 is calculated based on the curve of the relationship between the pulse frequency and the set frequency. 5: PID - PID output is selected as the source of multi-reference 0. 6: Digital setting of the main frequency (b5-01/b6-01). Multi-reference 0 is set by the digital setting of the main frequency (b5-01/b6-01). The multi-reference 0 is calculated based on the set frequency. Others: F connector. A parameter is set for a floating-point connector, and the value of the connector is read as the main frequency. This mode is used for expansion of common sources. Note: When the value of b8-02 (Multi-reference unit selection) is not 0, b8-08 (Multi-reference 0 setting mode) can be set only to 0. Other options of b8-08 are invalid.

Param.	Name	Default	Value Range	Descriptions
b8-09	Multi-reference 0	0.0	b8-42 to b8-43	The source of multi-reference 0 is selected by b8-08, and the other multi-references are set by other parameters. Additional information: 1. The AC drive provides four multi-reference terminals, b8-03 to b8-06. They provide 16 state combinations, corresponding to 16 frequency references. 2. This parameter defines the frequency reference for each speed when the frequency reference source is set to multi-reference. Parameters b8-09 to b8-24 correspond to a total of 16 frequency references for speeds 0 to 15. A frequency reference is calculated as a percentage of the rated frequency rather than as a numerical frequency value. 100% corresponds to the rated motor frequency. 3. When the multi-reference is used as the frequency source, the set frequency is limited by C4-10 (Maximum motor frequency) and d1-03 (Digital setting of positive upper frequency). To set the multi-reference value to exceed 100%, modify these two limit parameters first. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. 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 of the rated value.
b8-10	Multi-reference 1			
b8-11	Multi-reference 2			
b8-12	Multi-reference 3			
b8-13	Multi-reference 4			
b8-14	Multi-reference 5			
b8-15	Multi-reference 6			
b8-16	Multi-reference 7			
b8-17	Multi-reference 8			
b8-18	Multi-reference 9			
b8-19	Multi-reference 10			
b8-20	Multi-reference 11			
b8-21	Multi-reference 12			
b8-22	Multi-reference 13			
b8-23	Multi-reference 14			
b8-24	Multi-reference 15			
b8-41	User-defined base value	100.0	0.1 to 6553.0	This parameter sets the user-defined base value of multi-reference. It is value only when b8-02 is set to 4 (User-defined). Additional information: If the base value is 100.0, and multi-reference 1 is set to 200.0, the actual effective output value of multi-reference 1 is 200% (200.0 ÷ 100.0 x 100%).

Param.	Name	Default	Value Range	Descriptions
b8-42	Multi-reference upper limit threshold	3000.0	0.0 to 3000.0	This parameter set the upper limit threshold of the multi-reference. Additional information: You can set this parameter when you need to limit the upper and lower limits of the written multi-reference. For example, if b8-42 is set to 100.0, you cannot write a value greater than 100.0 to b8-09 (Multi-reference 0) to b8-24 (Multi-reference 15).
b8-43	Multi-reference lower limit threshold	-3000.0	-3000.0 to 0.0	This parameter set the lower limit threshold of the multi-reference. Additional information: You can set this parameter when you need to limit the upper and lower limits of the written multi-reference. For example, if b8-42 is set to -100.0, you cannot write a value smaller than -100.0 to b8-09 (Multi-reference 0) to b8-24 (Multi-reference 15).

5.9 Simple PLC Function

Description

The simple PLC module performs a simple combination of multi-references based on the setting of each running time. When the simple PLC is used as the main frequency or auxiliary frequency source, the acceleration/deceleration time of multi-reference 0 to 15 set by simple PLC takes effect during running.

When using the simple PLC module, you need to manually enable the simple PLC module. In addition you need to configure the multi-reference 0 to 15 (the running frequency of the simple PLC is set by the multi-reference 0 to 15), the running time, acceleration/deceleration time, and running mode. Then configure the simple PLC calculation enablement source. When simple PLC calculation is enabled, the simple PLC module starts running according to the set running time and mode.

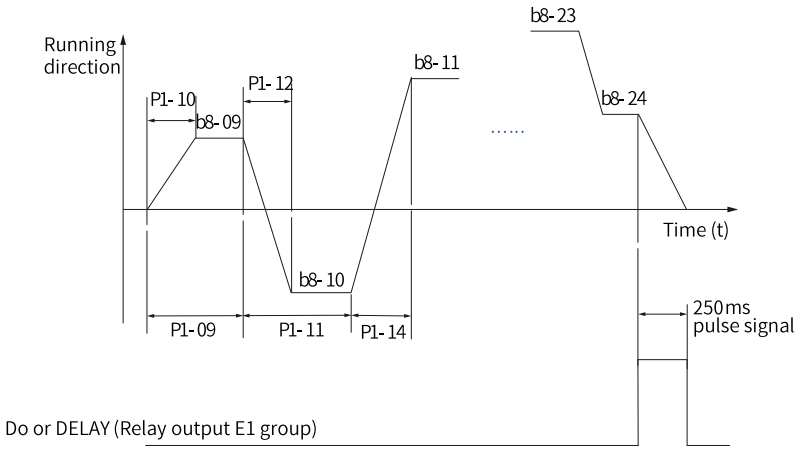


Figure 5-8 Simple PLC

The simple PLC running mode (defined by P1-02) includes:

- 0: Keep multi-reference 0 output after running for one cycle Keep multi-reference 0 output after running for one cycle and 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.
- 1: Keep final values after running for one cycle Keep final values after running for one cycle and 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: 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 the simple PLC module runs for one cycle, the output per-unit value obtained in the PLC step is 0. In this case, 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.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P1-03	Simple PLC function selection	0	0 to 11	Sets the simple PLC function. Value description Ones: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC is retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time. Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved

Simple PLC function selection (defined by P1-03) is used to configure PLC retention upon power failure and calculation enablement. When the tens place of the calculation enablement is set to 0, the current STEP is retained and the calculation is disabled, and is recalculated when the calculation is enabled. When the value is set to 1, the current STEP is retained and the calculation is disabled, and continue when the calculation is enabled. The ones place is used to configure whether the current running phase and running time are memorized at power-off. If PLC retention upon power failure is required, both the ones place and tens place need to be configured to 1.

PLC retention upon power failure indicates that the AC drive memorizes the PLC running phase and running frequency before power failure and will continue to run from the memorized values after it is powered on again. If "Non-retentive upon power failure" is selected, the AC drive restarts the PLC

process after it is powered on again. PLC retentive upon stop indicates that the AC drive memorizes the PLC running phase and running frequency upon stop and will continue to run from the memorized values after it operates again. If "Non-retentive upon stop" is selected, the AC drive restarts the PLC process after it operates again.

Param.	Name	Default	Value Range	Descriptions
P1-00	Simple PLC module	0: Disable	0: Disable 1: Enable	This parameter is used to enable or disable the simple PLC module. Value description 0: Disable If the simple PLC module is disabled, the output 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 simple PLC step, are all cleared. 1: Enable The simple PLC module is enabled, but whether the PLC module is calculated and output is normal depends on P1-01.
P1-01	Simple PLC calculation enablement source	L1-26 Motor running flag	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Sets the simple PLC calculation enablement source. Value description 0: Simple PLC calculation function is disabled. 1: Simple PLC calculation function is enabled. 3 to 7: DI1 to DI5 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI5 terminals. Others: Connector B Whether simple PLC calculation is enabled depends on the status of the selected connector B. Additional information: 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 Range	Descriptions
P1-02	Simple PLC running 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 for one cycle 3: Output 0 after running for one cycle	Sets the running mode of the simple PLC. Value description 0: Multi-reference 0 value is output after single-cycle running of the simple PLC module. 1: The final values are output after single-cycle running of the simple PLC module. 2: The simple PLC starts running again from the first stage after completing a cycle. 3: After simple PLC runs for a cycle, the output per-unit value obtained in the simple PLC step is 0. Additional information: 1. If this parameter is set to 0, 1, and 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 selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens position: Calculation enablement configuration 0: Current STEP retained when disabled, and recalculated when enabled 1: Current STEP retained when disabled, and continue when enabled Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Sets the simple PLC function. Value description Ones: Retention selection upon power failure 0: The current STEP and the current STEP running time of the simple PLC is not retentive upon power failure. 1: The current STEP and the current STEP running time of the simple PLC is retentive upon power failure. Tens position: Calculation enablement configuration 0: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from STEP0 and recalculates the running time. 1: If P1-01 is disabled, keeps the current STEP; if P1-01 is enabled, runs from the current STEP and the current running time.

Param.	Name	Default	Value Range	Descriptions
P1-04	Simple PLC status reset	0: Invalid	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	Simple PLC status reset Value description 0: The simple PLC status reset is disabled, and the simple PLC operates according to the setting. 1: The simple PLC status reset is enabled. The simple PLC module is restored to the initial state: Simple PLC running phase is 0, and the simple PLC output is the setpoint of the multi-reference 0 of P1-09. 3 to 7: DI1 to DI5 - Whether simple PLC calculation is enabled depends on the input state of DI1 to DI5 terminals. Others: Connector B Whether the simple PLC status reset is enabled depends on the status of the selected connector B. Additional information: After the DI terminal is assigned with function 23 (Simple PLC status reset), the value of P1-04 is automatically switched to the corresponding DI terminal connector parameter (the commissioning software displays L4-48 to L4-52 and the operating panel displays 1448 to 1452).
P1-05	Current step of PLC	0	0 to 65535	This parameter displays the current STEP of the simple PLC.
P1-06	Current STEP running time in hours of the simple PLC	0	0 to 65535	This parameter displays the current STEP running time in hours of the simple PLC.
P1-07	Current STEP running time in seconds of the simple PLC	0.0 to 3599.9	0.0	This parameter displays the current STEP running time in seconds of the simple PLC.
P1-08	PLC operating time unit	0: s (second)	0: s (second) 1: h (hour)	Sets the time unit of simple PLC operation. Value description 0: Set the unit of simple PLC running time to second. 1: Set the unit of simple PLC running time to hour.
P1-09	Running time of multi-reference 0 set by simple PLC	0.0	0.0s (h) to 6553.5s (h)	Sets the running time of multi-reference 0 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. Additional information: It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.

Param.	Name	Default	Value Range	Descriptions
P1-10	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0	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)	Sets the acceleration/deceleration time of multi-reference 0 set by simple PLC. Value description 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC. 0: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/ deceleration time of multi-reference 0 set by simple PLC.
P1-11	Running time of multi-reference 1 set by simple PLC	0.0	0.0s (h) to 6553.5s (h)	Sets the running time of multi-reference 1 set by simple PLC, which is the sum of acceleration or deceleration time and operating time at constant speed and target frequency. Additional information: It is recommended that the running time of multi-reference i set by simple PLC should be set higher than the acceleration/deceleration time.

Param.	Name	Default	Value Range	Descriptions
P1-12	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0	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)	Sets the acceleration/deceleration time of multi-reference 1 set by simple PLC. Value description 0: Select the acceleration/deceleration time of ramp 1 (b7-04/b7-05) as the acceleration/ deceleration time of multi-reference 1 set by simple PLC. 1: Select the acceleration/deceleration time of ramp 2 (b7-10/b7-11) as the acceleration/ deceleration time of multi-reference 1 set by simple PLC. 1: Select the acceleration/deceleration time of ramp 3 (b7-16/b7-17) as the acceleration/ deceleration time of multi-reference 1 set by simple PLC. 1: Select the acceleration/deceleration time of ramp 4 (b7-22/b7-23) as the acceleration/ deceleration time of multi-reference 1 set by simple PLC.
P1-13 to P1-40	Running time and acceleration/ deceleration time of multi-reference 2 to 15 set by simple PLC	Same as P1-09 and P1-10	Same as P1-09 and P1-10	Same as P1-09 and P1-10

5.10 PID Process Control

Description

PID control is a common method of process control. By performing proportional, integral, and derivative operations on the difference between the feedback signal and the target signal of the controlled variable, and adjusting the output of the AC drive, a closed-loop system is formed to stabilize the controlled variable at the target level. For example, the PID-controlled output is used as the running 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.

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A greater Kp value means faster deviation reduction but causes oscillation, especially in the case of long hysteresis. A smaller Kp value means lower probability of oscillation but leads to slow adjustment. (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, when regulating frequency, 100% indicates A2-04 (Per-unit base value of frequency).
- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the adjustment intensity. (When the deviation between PID feedback and

PID reference is 100.0%, the integral regulator performs continuous regulation within the time. The regulation amount reaches the maximum range.) For example, when regulating frequency, 100% indicates A2-04 (Per-unit base value of frequency).

- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. (Differential time indicates the time within which the feedback change reaches 100.0%. The regulation amount reaches the maximum range.) For example, when regulating frequency, 100% indicates A2-04 (Per-unit base value of frequency). When adjusting PID parameters, the differential time Td is not modified to prevent oscillation.

Instances

1. Set P2-02 to select the target PID reference source. If P2-02 is set to 0, set P2-03. The value 100% of this parameter corresponds to the maximum value of PID feedback.

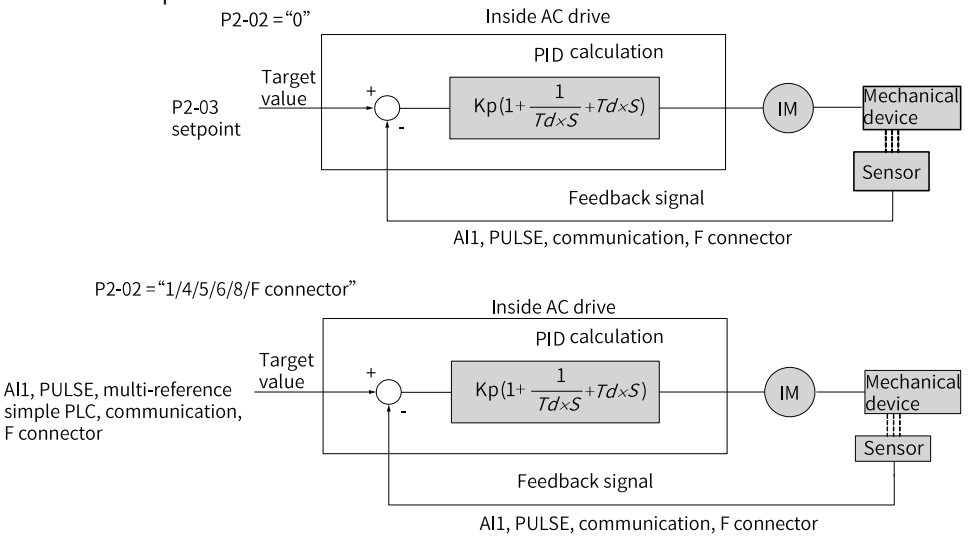


Figure 5-9 Principle of general PID control

2. Set P2-04 to select the PID feedback source.
3. Set P2-01 to select the PID action direction.

   The following figure shows the logic of general PID control parameter configuration.

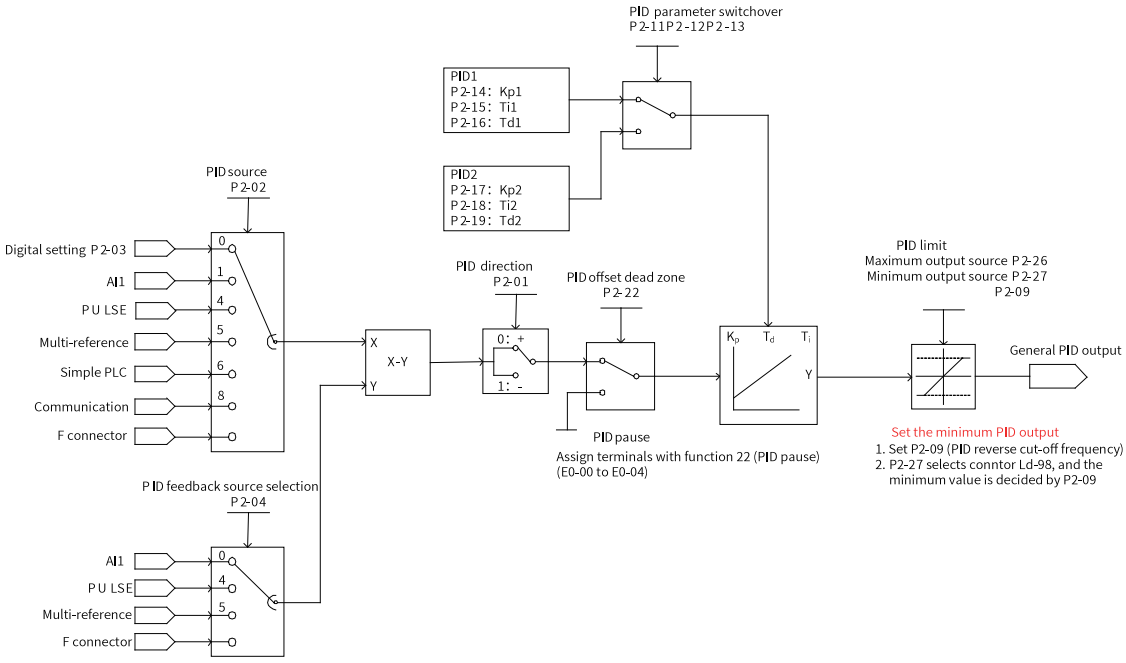


Figure 5-10 Parameter settings for general PID control

4. Select PID reference or connector LC-36 [General PID output] as the control source.

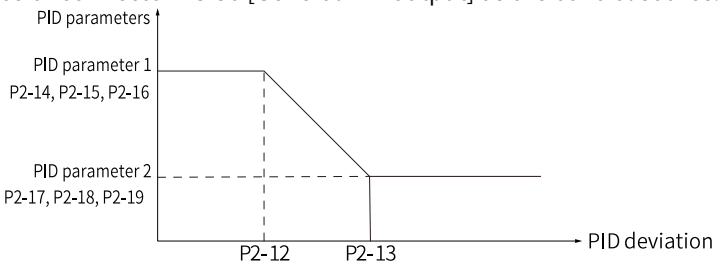


Figure 5-11 PID parameter switchover

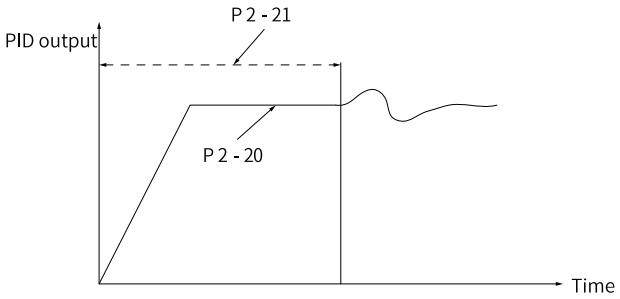


Figure 5-12 PID initial value function

5. Set P2-00 to 1 to enable PID.

Upper and lower limits of PID output

You can set the maximum and minimum values of the PID output by setting P2-26 and P2-27. For example, when the main frequency source is PID and A2-04 is 50 Hz, set P2-09 to 2 Hz, set P2-27 to Ld98, and P2-26 to 0 to achieve PID output range of -4.0% to 100.0%. Accordingly, the frequency reference range of the selected channel is -4% to 100%.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P2-00	Process PID	0	0: Disable 1: Enable Others: B connector	Sets whether PID is enabled 0: Disable PID operation is not performed and the output is cleared. 1: Enable PID operation is performed based on parameters. Others: B connector Whether to enable the PID function is determined by a parameter in the bit connector.
P2-01	PID action direction	0	0: Forward 1: Reverse Others: B connector	Sets the PID action direction. 0: Positive When the feedback value is lower than the PID reference, the output frequency of the AC drive increases. 1: Negative When the feedback value is lower than the PID reference, the output frequency of the AC drive decreases. Others: B connector Select the parameter in the bit connector to control PID direction. (The value 0 represents positive action and 1 represents negative action.)
P2-02	PID reference source	0	0: PID digital setting 1: AI1 3: Potentiometer MD-BP-M 4: HDI pulse 5: Multi-reference 6: Simple PLC 8: Communica-tion Others: F connector	This parameter specifies the PID reference source. Value description 0: PID digital setting The PID target reference is the value of P2-03 (PID digital setting). 1: AI1 The PID target reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer The PID reference source is set by the MD-BP-M potentiometer. 4: HDI pulse The PID target reference is the per-unit value of the HDI curve corresponding to the DI4 pulse frequency input. 5: Multi-reference The PID target reference is the per-unit value after multi-reference calculation. 6: Simple PLC The PID target reference is the per-unit value after simple PLC calculation. 8: Communication The PID reference is set by remote communication (1000H). Others: F connector The parameter in float connector is used as the PID target reference value. Additional information: When P2-00 is set to 5 (multi-reference), b8-08 (multi-reference 0 setting mode) cannot be set to 5 (PID reference).
P2-03	PID reference	50.0%	0.0% to 800.0%	When P2-02 (PID reference source) is set to 0, this parameter shall be set.

Parameter	Name	Default	Value Range	Descriptions
P2-04	PID feedback source	0	0: AI1 3: Potentiometer MD-BP-M 4: HDI setting 5: Communica-tion Others: F connector	It is used to select the PID feedback channel. Value description 0: AI1 The PID feedback reference is the per-unit value of the AI curve corresponding to AI1 voltage. 3: MD-BP-M potentiometer The PID reference source is set by the MD-BP-M potentiometer. 4: HDI pulse The PID Feedback reference is the per-unit value of the HDI curve corresponding to the HDI pulse frequency input. 5: Communication The PID reference is set by remote communication (1000H). Others: F connector The parameter in float connector is used as the PID feedback reference value.
P2-05	PID reference and feedback range	1000	0 to 65535	Defines the PID and feedback ranges. Additional information: This parameter is used for display of the PID reference and feedback, which are dimensionless. For example, if the parameter is set to 1000, the PID setting (0% to 100%) and the feedback value (0% to 1000) corresponds to 0 to 1000 of U0-15 and U0-16 linearly.
P2-06	PID reference change time	0.00s	0.00s to 650.00s	This parameter defines the time required for the PID reference to change from 0.0% to 100.0%.
P2-07	PID feedback filter time	0.00s	0.00s to 60.00s	Sets the PID feedback filter time. Additional information: This parameter defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but lowers the responsiveness of the process closed-loop system.
P2-08	PID output filter time	0.00s	0.00s to 60.00s	Defines the filter time of PID output. Additional information: The filter enhances smooth output but lowers the responsiveness of the process closed-loop system.
P2-09	PID reverse cut-off frequency	2.00 Hz	0.00 Hz to A2-17	Sets the PID reverse cut-off frequency. Additional information: 1. When the frequency source is pure PID, the PID cut-off frequency in the reverse direction is the minimum PID output value. 2. When the frequency source is main frequency + PID, P2-09 acts on the main frequency + PID and outputs the minimum frequency value after "main frequency + PID" operation. 3. PID reverse cut-off frequency is invalid when it is set to 0. Note: To use this function, the minimum PID output source (Ld-98) must be set.

Parameter	Name	Default	Value Range	Descriptions
P2-11	PID parameter switchover condition	0	0: No switchover, default PID parameter 1 1: Switchover by DI 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency	Set the switchover mode of the two groups of PID parameters. Value description 0: No switchover No switchover is performed. 1: Switched by DI To enable switchover through a DI terminal, assign the DI with function 43 (PID parameter switchover). If the DI is invalid, group 1 (P2-14 to P2-16) is selected. If the DI is valid, group 2 (P2-17 to P2-19) is selected. 2: Automatic switchover based on deviation If the absolute value of the deviation between the setting and the feedback is less than P2-12 (PID parameter switchover deviation 1), PID selects parameter group 1. If the absolute value of the deviation between the setting and the feedback is greater than P2-13 (PID parameter switchover deviation 2), PID selects parameter group 2. When the absolute value of the deviation between the setting and feedback is between P2-12 (PID parameter switchover deviation 1) and P2-13 (PID parameter switchover deviation 2), the PID parameters are linear interpolation values of the two sets of PID parameters. 3: Automatic switchover based on running frequency Linear interpolation between 0 Hz and the maximum motor frequency is performed based on the running frequency of the AC drive (0 Hz corresponds to the first group of PID parameters and the maximum frequency corresponds to the second group of PID parameters).
P2-12	PID parameter switchover deviation 1	20.0%	0.0% to P2-13	Defines the minimum deviation when PID parameters are automatically switched based on the deviation. The value 100% corresponds to the maximum deviation between the reference and feedback. The setting range is 0.0% to P2-13 (PID parameter switchover deviation 2). Additional information: They are valid when P2-11 is set to 2.
P2-13	PID parameter switchover deviation 2	80.0%	P2-12 to 800.0%	Defines the maximum deviation when PID parameters are automatically switched based on the deviation. The value 100% corresponds to the maximum deviation between the reference and feedback. The setting range is P2-12 (PID parameter switchover deviation 1) to 800.0%. Additional information: They are valid when P2-11 is set to 2.
P2-14	PID parameter 1 proportional gain Kp1	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the first group of parameters in PID control. Additional information: This parameter defines the proportional gain Kp in PID control. The deviation reduction speed depends on the proportional coefficient Kp. A larger Kp value indicates faster deviation reduction but higher possibility of oscillation. A smaller Kp value indicates lower possibility of oscillation but slower deviation reduction.

Parameter	Name	Default	Value Range	Descriptions
P2-15	PID parameter 1 integral time Ti1	2.00s	0.01s to 10.00s	Indicates the integral time Ti of the first group of parameters in PID control. Additional information: Indicates the integral time Ti in PID control. It decides the integral regulating intensity. The shorter the integral time, the greater the adjustment intensity will be.
P2-16	PID parameter 1 derivative time Td1	0.000s	0.000s to 10.000s	Defines the derivative time Td of the first group of parameters in PID control. Additional information: This parameter defines the derivative time Td in PID control. It decides the regulating intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity.
P2-17	PID parameter 2 proportional gain Kp2	20.0	0.0 to 1000.0	Defines the proportional gain Kp of the second group of parameters in PID control. Additional information: See P2-14.
P2-18	PID parameter 2 integral time Ti2	2.00s	0.01s to 10.00s	Indicates the integral time Ti of the second group of parameters in PID control. Additional information: See P2-15.
P2-19	PID parameter 2 derivative time Td2	0.000s	0.000s to 10.000s	Defines the derivative time Td of the second group of parameters in PID control. Additional information: See P2-16.
P2-20	PID initial value	0.00%	0.0% to 800.0%	Defines the initial output value when PID calculation starts. Additional information: The PID starts the closed-loop regulation operation only after the PID has output the PID initial value for a period longer than the active time of PID initial value.
P2-21	Active time of PID initial value	0.00s	0.00s to 650.00s	Sets the active time of PID initial value. Additional information: See P2-20.
P2-22	PID deviation dead zone	0.0%	0.0% to 800.0%	Defines the minimum deviation of PID adjustment, that is, the deviation dead zone. Additional information: When the deviation is within the PID deviation limit, no adjustment is required. This parameter helps balance the accuracy and stability of the system output.
P2-23	PID differential limit	0.10%	0.00% to 600.00%	Parameter P2-23 defines the PID derivative output range. Additional information: In PID control, the derivative may easily cause system oscillation. Therefore, the PID derivative action is restricted to a small range.

Parameter	Name	Default	Value Range	Descriptions
P2-26	Source of maximum output	0	0: 100.0% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to 100%. 2: AI1 - The maximum PID output value is limited to the value of the AI1curve in the per-unit system. 5: HDI pulse The maximum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference The maximum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC The maximum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID The maximum PID output value is limited to the per-unit value of the current PID output. 9: Communication The maximum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M The maximum PID output value is set by the MD-BP-M potentiometer. Other: F connector The maximum PID output value is limited to the value of the selected floating-point connector.
P2-27	Source of minimum output	0	0: -100.0% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 9: Communication 10: Potentiometer MD-BP-M Others: 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 limited to -100%. 2: AI1 The minimum PID output value is limited to the value of the AI1 curve in the per-unit system. 5: HDI pulse The minimum PID output value is limited to the value of the HDI curve in the per-unit system. 6: Multi-reference The minimum PID output value is limited to the per-unit value after multi-reference calculation. 7: Simple PLC The minimum PID output value is limited to the per-unit value after simple PLC calculation. 8: PID The minimum PID output value is limited to the per-unit value of the current PID output. 9: Communication The minimum PID output value is limited to communication reference (1000H). 10: Potentiometer MD-BP-M The minimum PID output value is set by the MD-BP-M potentiometer. Other: F connector The minimum PID output value is limited to the value of the selected floating-point connector.

Parameter	Name	Default	Value Range	Descriptions
P2-28	Forced output value	0	0: 0% 2: AI1 5: HDI pulse 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	Sets the forced PID output value. Value description 0: 0% The forced PID output value is 0. 2: AI1 The forced PID output value is the value of the AI1 curve in the per-unit system. 4: Reserved 5: HDI pulse setting The forced PID output value is the value of the HDI curve in the per-unit system. 6: Multi-reference The forced PID output value is the per-unit value after multi-reference calculation. 7: Simple PLC The forced PID output value is the per-unit value after simple PLC calculation. 8: PID The forced PID output value is current PID output. 9: Communication The forced PID output value is the communication reference (1000H). 10: Potentiometer MD-BP-M The forced PID output value is set by the MD-BP-M potentiometer. Other: F connector The forced PID output value is the value of the selected floating-point connector. Additional information: When forced output value is enabled, PID output is retained at the selected value.
P2-29	Forced assignment of PID output enable	0	0: Disable 1: Enable Others: B connector	Sets whether the forced assignment of PID output is enabled. Value description 0: The forced assignment of PID output is disabled. 1: The forced assignment of PID output is enabled. Others: Connector B Whether forced assignment of PID output is enabled depends on the status of the selected connector B.
P2-30	PID feedback loss detection upper limit	100.0%	0.0% to 800.0%	Defines the upper limit of PID feedback loss. Additional information: 1. This parameter is used to determine whether the PID feedback is lost. 2. When the PID feedback has been greater than the value of this parameter for a period longer than the PID feedback loss detection time, the AC drive reports E031.1. 3. Setting this parameter to 800.0% disables feedback loss detection.
P2-31	PID feedback loss detection lower limit	0.0%	0.0% to 800.0%	Defines the lower limit of PID feedback loss. Additional information: 1. This parameter is used to determine whether the PID feedback is lost. 2. When the PID feedback has been lower than the value of this parameter for a period longer than the PID feedback loss detection time, the AC drive reports E031.1. 3. When this parameter is set to 0, PID feedback loss detection is disabled.

Parameter	Name	Default	Value Range	Descriptions
P2-32	PID feedback loss detection time	0.0s	0.0s to 20.0s	Sets the detection time of PID feedback loss Additional information: See P2-30 and P2-31.
P2-33	Selection of PID operation at stop	0	0: Disabled 1: Enabled Others: B connector	Defines whether the PID operation is performed at stop. Value description 0: No operation at stop When the motor is not running, PID operation is not performed and the output is cleared. 1: Operation at stop When the motor is not running, PID operation is still performed and the output changes based on the feedback and reference. Others: Connector B Whether the PID operation is performed at stop depends on the status of the selected connector B.
P2-34	PID integral	10	Ones position: Integral pause/ separation 0: Inactive 1: Active Tens position: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation 1: Stop integral operation Hundreds position: Reserved Thousands position: Reserved Ten thousands position: Reserved	Defines the properties of PID integral operation. Value description Ones position: Integral pause/separation. 0: The integral pause is inactive no matter whether the multi-functional DI (assigned with PID pause/PID integral pause) is active. 1: PID integral operation stops when the DI assigned with the PID integral pause function (for example, function 22) is active. In this case, only PID proportional and derivative actions are active. Tens position: Whether to stop integral operation when the output reaches the limit 0: Continue integral operation The PID continues integral operation after the PID operation output reaches the maximum or minimum value. 1: Stop integral operation After the PID operation output reaches the maximum or minimum value, PID stops the integral operation. Additional information: When this position is set to 1, PID integral operation stops, which may help reduce the PID overshoot.

PID Adjustment Methods

This section describes general rules for PID parameter adjustment, which can be used as reference for adjusting closed-loop control PID parameters (P2-14 to P2-16, and P2-17 to P2-19) and speed loop PI parameters (d3-02 and d3-03).

- In case of slow response, increase Kp.

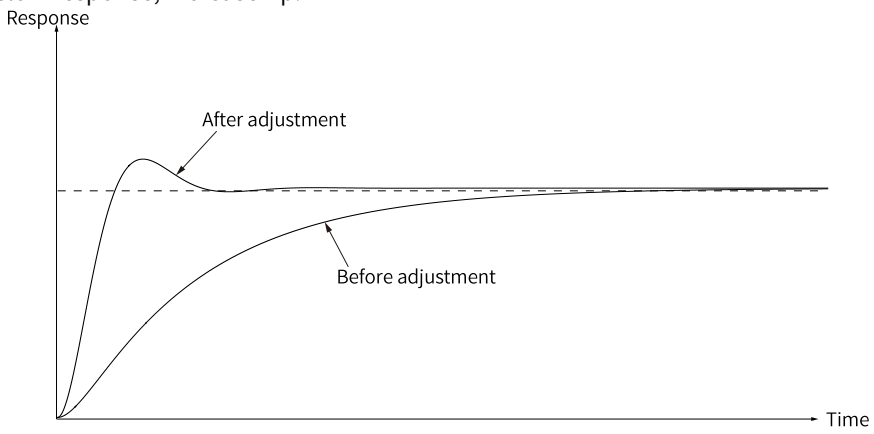


Figure 5-13 Response-time trend after increasing Kp

- In case of frequent vibration, reduce Kp

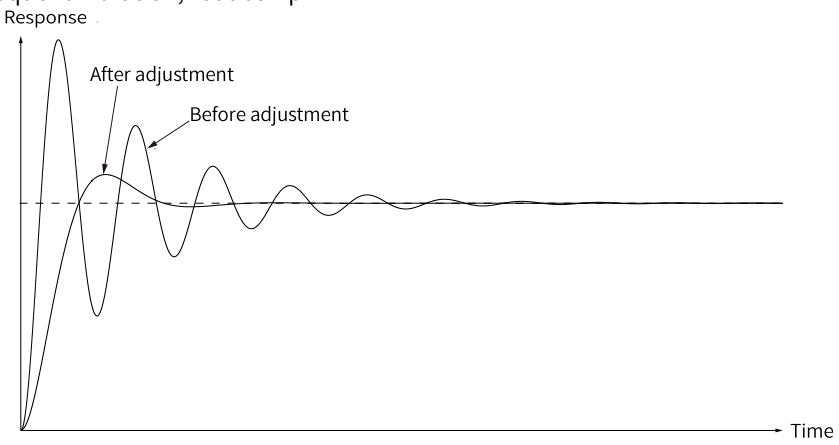


Figure 5-14 Response-time trend after decreasing Kp

- In case of large overshoot and slow fluctuation, increase Ti.

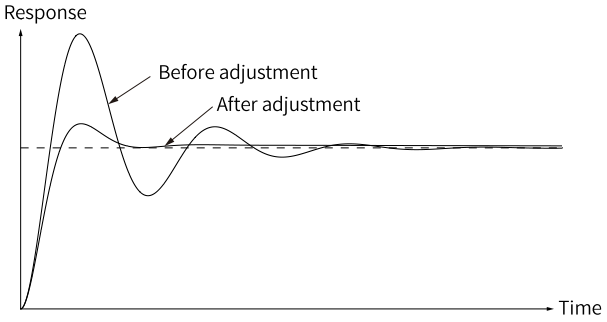


Figure 5-15 Response-time trend after increasing Ti

- In case of large static difference and slow response at load fluctuation, increase Kp or decrease Ti.

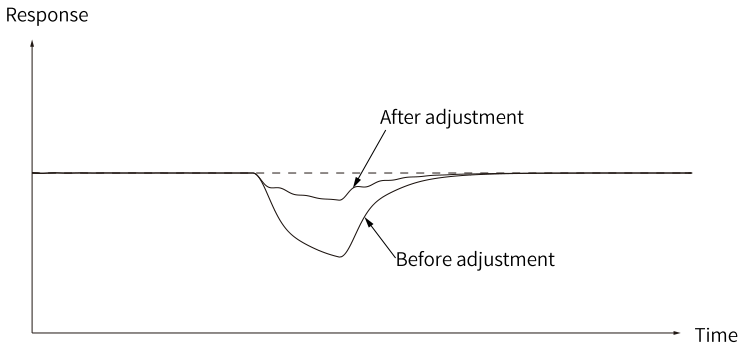


Figure 5-16 Response-time trend after increasing Kp at load fluctuation

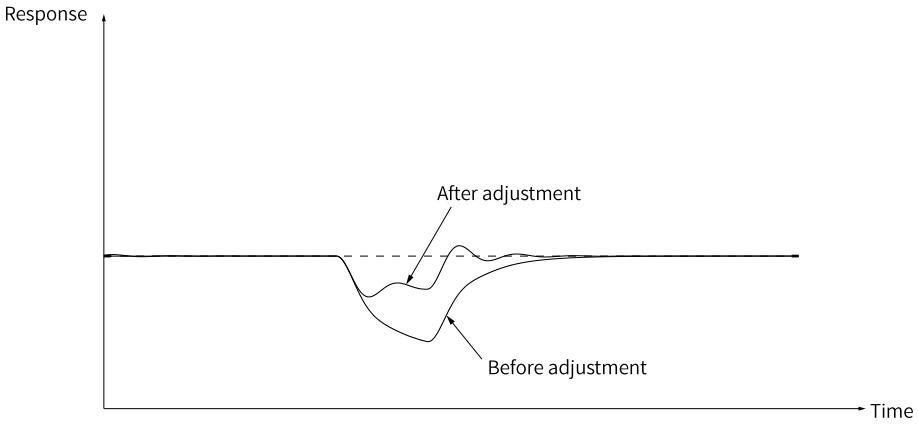


Figure 5-17 Response-time trend after decreasing Ti at load fluctuation

- If the derivative time Td is set properly, the system stability can be improved. Note that if the derivative time Td is too long, interference and vibration may be caused.

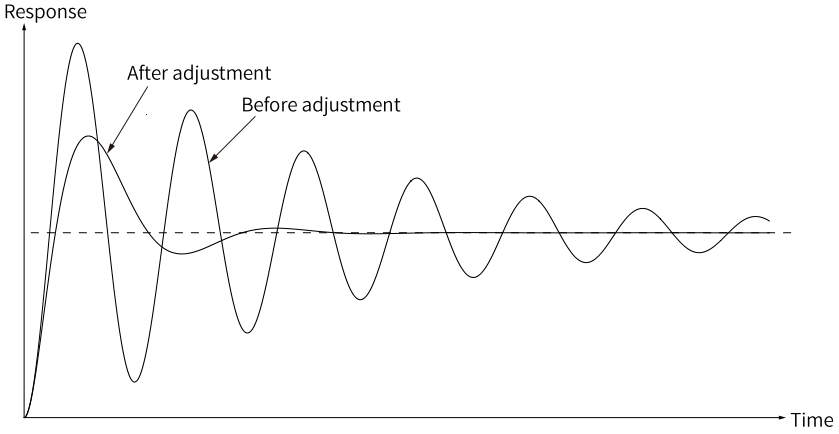


Figure 5-18 Response-time trend after setting the Td

5.11 Load Monitoring

Description

The load monitoring module monitors input signals (such as output current, output torque, and output power) related to the AC drive output speed. It can monitor both underload and overload. Underload monitoring can detect load loss due to reasons such as conveyor belt breaking or mechanical shaft

breaking. Overload monitoring can detect whether the drive load is blocked due to reasons such as motor stall.

During load monitoring, the current speed/monitoring signal is compared with the speed/overload or speed/underload threshold set by the user. If the current speed exceeds the threshold set by the user, a fault or an alarm is reported based on the setpoint of P0-66/P0-68/P0-69 after a delay time set by P0-85/P0-86.

The conditions for activating the load monitoring module include:

- P0-66 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.
- Under the same speed point of the load monitoring curve, the overload threshold is greater than the underload threshold.

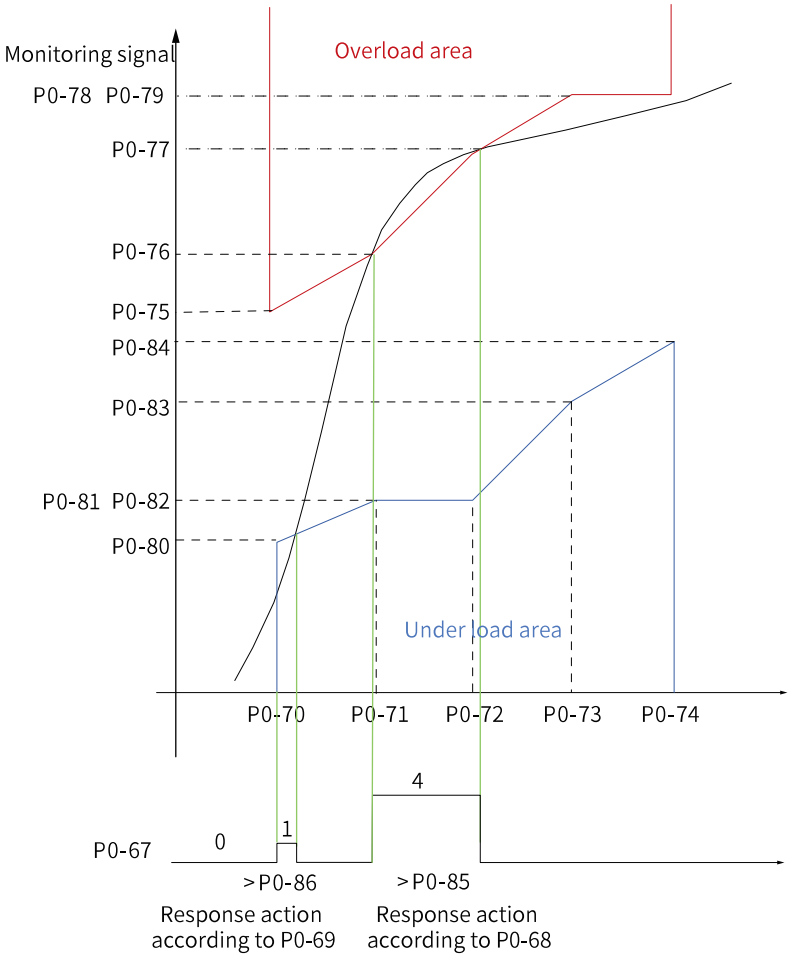


Figure 5-19 Load monitoring and response

Related Parameters

Param.	Name	Default	Value Range	Descriptions
P0-66	Load monitoring signal selection	0	0: Monitoring not enabled 1: Monitor output current 2: Monitor output torque 3: Monitor output power Others: F connector	Set the monitoring signal, including output current, torque, or power, or selecting from the connector.
P0-67	Load monitoring signal status	0	0 to 65535	Indicates the monitoring signal state. Value description 0: The monitoring signal is within the set area. 1: The monitoring signal is above the set area (overload). 4: The monitoring signal is below the normal area (load loss).
P0-68	Load monitoring overload action	0	0: No warning/no fault 1: Warning 2: Fault 3: Warning/fault	Sets the response action after monitoring overload. Value description 0: No warning/no fault. Ignore since no warning/ fault is reported. 1: Warning. Overload warning E046.2 is reported when the monitoring signal is higher than the set overload curve for a period longer than the value of P0-85. 2: Fault. Overload fault E046.1 is reported when the monitoring signal is higher than the set overload curve for a period longer than the value of P0-85. 3: Warning/fault. Overload warning E046.2 is reported when the monitoring signal is higher than the set overload curve for a period longer than half the value of P0-85 or E046.1 is reported when the period equals to or is higher than P0-85.

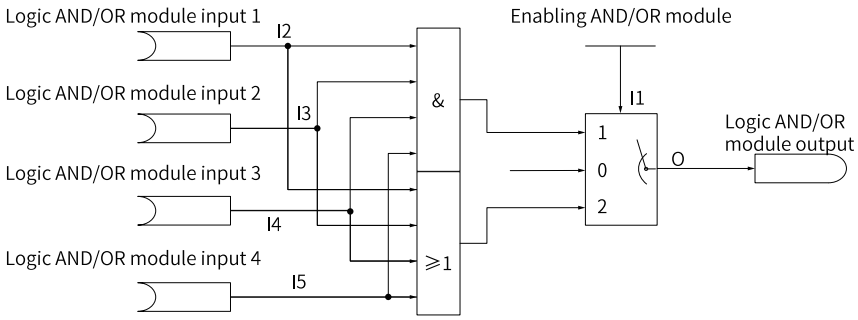
Param.	Name	Default	Value Range	Descriptions
P0-69	Load monitoring load loss action	0	0: No warning/no fault 1: Warning 2: Fault 3: Warning/fault	Sets the response action after monitoring load loss. Value description 0: No warning/no fault. Ignore since no warning/ fault is reported. 1: Warning. Load loss warning E046.4 is reported when the monitoring signal is lower than the set overload curve for a period longer than the value of P0-86. 2: Fault. Load loss fault E046.3 is reported when the monitoring signal is lower than the set overload curve for a period longer than the value of P0-86. 3: Warning/fault. Load loss warning E046.4 is reported when the monitoring signal is lower than the set overload curve for a period longer than half the value of P0-86 or E046.3 is reported when the period equals to or is higher than P0-86.
P0-70	Load monitoring abscissa point 1	0.0%	0.0% to 600.0%	This parameter sets the speed point on the x-coordinate for load monitoring. The speed point is valid symmetrically on the negative half of the x-coordinate.
P0-71	Load monitoring abscissa point 2	0.0%	0.0% to 600.0%	
P0-72	Load monitoring abscissa point 3	0.0%	0.0% to 600.0%	
P0-73	Load monitoring abscissa point 4	0.0%	0.0% to 600.0%	
P0-74	Load monitoring abscissa point 5	0.0%	0.0% to 600.0%	
P0-75	Load monitoring curve upper limit 1	0.0%	0.0% to 400.0%	This parameter sets the overload point on the load curve.
P0-76	Load monitoring curve upper limit 2	0.0%	0.0% to 400.0%	
P0-77	Load monitoring curve upper limit 3	0.0%	0.0% to 400.0%	
P0-78	Load monitoring curve upper limit 4	0.0%	0.0% to 400.0%	
P0-79	Load monitoring curve upper limit 5	0.0%	0.0% to 400.0%	
P0-80	Load monitoring curve lower limit 1	0.0%	0.0% to 400.0%	This parameter sets the load lost point on the load curve.
P0-81	Load monitoring curve lower limit 2	0.0%	0.0% to 400.0%	
P0-82	Load monitoring curve lower limit 3	0.0%	0.0% to 400.0%	
P0-83	Load monitoring curve lower limit 4	0.0%	0.0% to 400.0%	
P0-84	Load monitoring curve lower limit 5	0.0%	0.0% to 400.0%	

Param.	Name	Default	Value Range	Descriptions
P0-85	Permissible overload time	20.0s	0.0s to 6553.5s	This parameter specifies the delay in the response action set by P0-68 after the monitoring signal enters overload state.
P0-86	Permissible load loss time	20.0s	0.0s to 6553.5s	This parameter specifies the delay in the response action set by P0-69 after the monitoring signal enters overload state.

5.12 Logic Operation

Logic AND/OR Module (A to B)

Diagram



Operation

When I1 for enabling logic AND/OR module is set to 0, the module is inactive, and the output (O) is 0.

When I1 for enabling logic AND/OR module is set to 1, the logic AND module is valid and the output (O) is I2 & I3 & I4 & I5.

Only when I2, I3, I4, and I5 are all true, the output (O) will be true; Otherwise, the output (O) is false. See the following table for the truth values.

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 I1 for enabling logic AND/OR module is set to 2, logic OR is valid and the output (O) is I2 | I3 | I4 | I5.

Only when I2, I3, I4 and I5 are false, the output (O) is false; otherwise, the output (O) is true. 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

Input I1: 0: module disabled; 1: logic AND module; 2: logic OR module

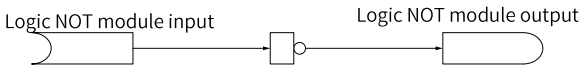
Input I2, I3, I4, and I5: 0, 1, DI input, and bit connector input

Output (O): Bit connector

Logic AND/OR Module	Input					Output
	I1	I2	I3	I4	I5	O
A	o6-00	o6-01	o6-02	o6-03	o6-04	L3-36
B	o6-05	o6-06	o6-07	o6-08	o6-09	L3-37

Logic NOT Module (A to B)

Diagram



Operation

- When the input (I) is set to 0, the module is disabled and the output is 0
  O = 0
- When the input (I) is not 0, the output is opposite to the input I.
  O = $\overline{I}$

See the following table for the truth values.

Input	Output
I	O
0	1
1	0

Connection

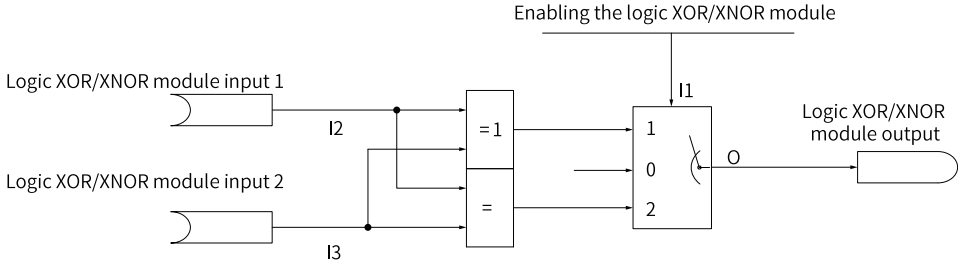
Input I: 0, 1, DI input, and bit connector input

Output (O): Bit connector

Logic NOT Module	Input	Output
	I	O
A	o6-80	L3-52
B	o6-81	L3-53

Logic XOR/XNOR Module (A to B)

Diagram



Operation

- When I2 for enabling the logic XOR/XNOR module is set to 0, the module is disabled, and the output (O) is 0.
- When I2 for enabling the logic XOR/XNOR module is set to 1, the module is enabled.

$$O=(\overline{I1}\&I2)|(I1\&\overline{I2})$$

When I2 and I3 are the same, the output (O) is 0. When I2 and 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 I1 for enabling the logic XOR/XNOR module is set to 2, the logic XNOR module is enabled.

$$O=(I2\&I3)|(\overline{I2}\&\overline{I3})$$

When I2 and I3 are the same, the output (O) is 1. When I2 and 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

Input I2: 0: module disabled; 1: logic XOR module; 2: logic XNOR module

Input I3 and I4: 0, 1, DI input, and bit connector input

Output (O): Bit connector

Logic XOR/XNOR Module	Input			Output
	I2	I3	I4	O
A	o7-00	o7-01	o7-02	L3-68
B	o7-03	o7-04	o7-05	L3-69

5.13 AI Automatic Adjustment Curve

Description

Different from the manually corrected curve, the voltage of the correction point can be filled in automatically to the AI automatically corrected curve. Parameters involved is E2-68 as shown in the table below.

Parameter	Name	Default	Value Range	Descriptions
E2-38	AI curve selection	0x111	Ones place: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens place: Reserved 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds place: MD-BP-M potentiometer curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Thousands place: Reserved	Defines the input/output curve of AI1 and MD-BP-M potentiometers. Value description Ones place: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens place: Reserved 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds place: MD-BP-M potentiometer curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67)

Parameter	Name	Default	Value Range	Descriptions
E2-68	AI automatic adjustment curve	0	Ones: Point selection (for setting) 0: Disable 1: Point 1 2: Point 2 3: Point 3 4: Point 4 Tens: AI channel selection (for setting) 0: Disable 1. Select AI1. Hundreds: AI automatic adjustment curve (for setting) 0: Disable 1: Enable Thousands: X-point curve (for display) 0: Enabling or channel is not selected 2: Two-point curve 4: Four-point curve Ten thousands: Reserved	Set the automatic AI curve correction function. Value description Ones: Sets the point on the curve of the current operation. 0: Disable 1: Select the first point of the correction curve. 2: Select the second point of the correction curve. 3: Select the third point of the correction curve. 4: Select the fourth point of the correction curve. Tens position: Sets which AI channel is corrected. 0: Disable 1: Select AI1 correction as the current action. Hundreds position: Set whether automatic curve correction is enabled. 0: Automatic curve correction disabled 1: Automatic curve correction is enabled. Thousands: Sets the curve type. 0: Enabling or channel is not selected 2: Select the two-point curve. 4: Select the four-point curve. Ten thousands position: Reserved

The curve selection of the AI automatic adjustment curve is coupled to E2-38. If E2-38 selects two-point curve 1, curve 2, or curve 3, E2-68 can only fill in the automatic adjustment of the first and second points. If E2-38 selects four-point curve 4 or curve 5, E2-68 can fill in the automatic adjustment of the first, second, third, and four the point.

Instances

Fill in the measured two-point curve with the automatic corrected curve, with a minimum voltage of 3.3 V and a maximum voltage of 7.5 V. Do as follows.

1. Set the curve of E2-38 to curve 1 or curve 2 or curve 3 (E2-38 = 1 to 3).
2. Set the functions of E2-68 as follows:

   a. Point selection: Point 1.
   b. AI channel selection: Select AI1.
   c. AI automatic adjustment curve: Enable.
   d. X-point curve: Two-point curve.
   e. Adjust the minimum voltage to 3.3 V. After stabilizing, pause for at least 200 ms to proceed to the next step.

f. Point selection: Disable. 3.3 V is recorded at the first point of the two-point curve.
g. Point selection: Point 2.
h. Adjust the maximum voltage to 7.5 V. After stabilizing, pause for at least 200 ms to proceed to the next step.
i. Point selection: Disable. 7.5 V is recorded at the second point of the two-point curve.

After the preceding steps, the two-point curve is 0% for 3.3 V and 100% for 7.5 V by default. You can adjust the voltage of the two-point curve according to the value that is filled automatically.

6 Fault and Protection

6.1 Startup Protection

Description

Set P0-21 to 1 to enable the startup protection of the AC drive. This helps to avoid unexpected motor running. Startup protection can be used in the following scenarios:

- If the running command is valid when the AC drive is powered on (for example, an input terminal is ON before power-on), the AC drive does not respond to the command. The AC drive responds only after the running command is canceled and becomes valid again.
- If the running command is valid when the AC drive fault is reset, the AC drive does not respond to the running command. The startup protection can be disabled only after the running command is canceled. The AC drive starts to run when the running command is valid again.

Related Parameters

Parameter	Name	Default	Value Range	Descriptions
P0-21	Startup protection	1	0: Disable 1: Enable	Defines whether the startup protection is enabled for safety. Value description 0: Disable 1: Enable Additional information: If it is set to 1, the AC drive does not respond to the run command valid upon AC drive power-on (for example, an input terminal is ON before power-on). The AC drive responds only after the run command is canceled and becomes valid again. In addition, the AC drive does not respond to the run command valid upon fault reset of the AC drive. The run protection can be disabled only after the run command has been cancelled.

Note

This parameter is invalid when the fault is reset and is always protected.

6.2 Automatic Reset upon Fault

Description

When H3-00 (Automatic fault reset) is set to 1 (Enable), and the value of H3-01 (Number of automatic fault reset times) is set to a value greater than 0, the automatic fault reset function takes effect. When the AC drive reports a fault, the AC drive waits for H3-02 (Time interval between automatic fault reset) before performing automatic fault reset to exit the fault state.

When the value displayed in H3-05 (Accumulative number of fault resets) is equal to the value set in H3-01 (Number of automatic fault reset times), the number of automatic fault reset times is exhausted. When the AC drive reports a fault, it does not perform automatic fault reset. The fault can only be reset manually.

In this case, set H3-06 (Auto reset attempts restored after used up) = 0 to reset the number of times. After waiting for H3-04 (Time to restore the number of automatic fault reset times), H3-05 (Accumulative number of fault resets) is cleared automatically. The AC drive can perform automatic fault reset again. You can also perform a manual reset to clear H3-05 (Accumulative number of fault resets). After troubleshooting, press the RUN/STOP key  on the operating panel to reset the fault manually.

Note

- Undervoltage (E009.1) is reset automatically when the bus voltage returns to normal. It is not included in the times of fault auto reset.
- Short circuit to ground (E023.2) cannot be reset automatically or manually. Only power cycling of the AC drive can reset it.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
H3-00	Automatic fault reset	1	0: Disable 1: Enable	Used to enable automatic reset of faults. Value description 0: Automatic fault reset is disabled. 1: Automatic fault reset is enabled.
H3-01	Number of automatic fault reset times	0	0 to 100	Sets the number of automatic fault reset times. Additional information: If the number of reset times exceeds the value of this parameter, the AC drive remains in the faulty state.
H3-02	Time interval between automatic fault reset	1.0s	0.1s to 600.0s	Sets the time interval between automatic fault reset. Additional information: This parameter defines the duration from the time when the AC drive reports a fault to the time when an automatic fault reset is performed.
H3-03	Auto reset terminated upon manual reset	1	0: Automatic reset terminated 1: Automatic reset continues	Used to set whether the automatic reset process can be terminated by manual reset. Value description 0: Automatic reset is terminated upon manual reset. 1: Automatic reset continues after manual reset.
H3-04	Time to restore the number of automatic fault reset times	10 min	0 min to 6000 min	Used to set the time for restoring “Number of automatic fault reset times”. Additional information: When it is not set to 0, the number of automatic fault reset times is restored after the time set by H3-04; when it is set to 0, the number of automatic fault reset times is restored all the time.

Param.	Name	Default	Value Range	Descriptions
H3-05	Accumulative number of fault resets	0	0 to 65535	Display the accumulative number of fault resets, which cannot be modified. When the number of manual resets and automatic resets are reached, the number will be cleared.
H3-06	Auto reset attempts restored after used up	0	0 to 1	Selects the auto reset attempts restored after used up. Value description 0: When the number of automatic fault reset times is exhausted and time for restoring the number of automatic fault reset times reached, the number of automatic fault resets can be restored automatically. 1: When the number of automatic fault reset times is exhausted, the number of automatic fault resets cannot be restored automatically.
H3-07	Fault flag output selection	0	0 to 1	This parameter sets whether fault flags are output during automatic fault reset. Value description 0: No output during automatic fault reset. 1: Output during automatic fault reset.

You can set the a blacklist containing up to 10 faults, upon which the AC drive is not allowed to reset.

Param.	Name	Default	Value Range	Descriptions
H3-13	Fault code 1 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 1 that is inhibited from automatic fault reset.
H3-14	Fault code 2 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 2 that is inhibited from automatic fault reset.
H3-15	Fault code 3 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 3 that is inhibited from automatic fault reset.
H3-16	Fault code 4 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 4 that is inhibited from automatic fault reset.
H3-17	Fault code 5 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 5 that is inhibited from automatic fault reset.
H3-18	Fault code 6 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 6 that is inhibited from automatic fault reset.
H3-19	Fault code 7 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 7 that is inhibited from automatic fault reset.
H3-20	Fault code 8 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 8 that is inhibited from automatic fault reset.

Param.	Name	Default	Value Range	Descriptions
H3-21	Fault code 9 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 9 that is inhibited from automatic fault reset.
H3-22	Fault code 10 inhibited from automatic fault reset	0.0	0.0 to 255.9	This parameter specifies the code of fault 10 that is inhibited from automatic fault reset.

6.3 Automatic Restart upon Fault

Description

When the AC drive reports a fault during operation, the automatic reset upon a fault and automatic restart upon a fault functions enable the AC drive to restart after the AC drive resets upon the fault and after the waiting time for automatic restart upon a fault expires. During restart, if the AC drive receives a stop/manual reset command, it will stop and not restart. In this case, set whether the automatic fault restart function takes effect through H3-28 (Restart after automatic fault reset); set the time waiting for restart through H3-29 (Restart delay after automatic fault reset).; set whether to to perform flying start after restart through H3-30 (Forced flying start after automatic fault reset).

You can set a white list containing up to six faults (H3-34 to H3-39), upon which the AC drive will reset and then restart. Or you can also set a black list containing faults, upon which the AC drive is not allowed to reset or restart. And set the method of allowing restart after automatic fault reset through H3-31.

- When H3-31 is set to 0, automatic restart is allowed only for the six faults set in H3-34 to H3-39.
- When H3-31 is set to 1, automatic restart is allowed except for the six faults set in H3-34 to H3-39. You can customize the settings as needed.

Related Parameters

Param.	Name	Default	Value Range	Descriptions
H3-28	Restart after automatic fault reset	0	0: Disable 1: Enable	This parameter is used to define whether the AC drive restarts. Value description 0: Not restart after automatic fault reset. 1: Restart after automatic fault reset.
H3-29	Restart delay after automatic fault reset	0.5s	0.0s to 600.0s	This parameter sets the waiting time from automatic fault reset to automatic restart.
H3-30	Forced flying start after automatic fault reset	0	0: Disable 1: Enable	Used to set whether to enable flying start for automatic restart upon fault. Value description 0: Forced flying start after automatic fault reset is disabled. 1: Forced flying start after automatic fault reset is enabled.

Param.	Name	Default	Value Range	Descriptions
H3-31	Method of allowing restart after automatic fault reset	1	0: White list 1: Black list	Sets the method of allowing restart after automatic fault reset. Value description 0: White list. The AC drive is allowed for restart upon the faults set by H3-34 to H3-39. 1: Black list. The AC drive is allowed for restart upon faults not set by H3-34 to H3-39.
H3-34	Designated fault code 1	0.0	0.0 to 255.9	This parameter sets the code of fault 1 for which restart is allowed after fault reset.
H3-35	Designated fault code 2	0.0	0.0 to 255.9	This parameter sets the code of fault 2 for which restart is allowed after fault reset.
H3-36	Designated fault code 3	0.0	0.0 to 255.9	This parameter sets the code of fault 3 for which restart is allowed after fault reset.
H3-37	Designated fault code 4	0.0	0.0 to 255.9	This parameter sets the code of fault 4 for which restart is allowed after fault reset.
H3-38	Designated fault code 5	0.0	0.0 to 255.9	This parameter sets the code of fault 5 for which restart is allowed after fault reset.
H3-39	Designated fault code 6	0.0	0.0 to 255.9	This parameter sets the code of fault 6 for which restart is allowed after fault reset.

6.4 Protective Action Against Fault

Description

There are 11 types of fault protection actions that can be set: coast to stop, stop at maximum capability, quick stop, decelerate to stop, run with speed restriction, run with power restriction, run with current restriction, run with torque restriction, alarm, prompt, and ignore. You can set different protection actions for specific faults based on actual application conditions.

The fault levels are fault, warning, minor fault, and prompt level. The relationship between the fault protection action and the fault level is as follows:

Fault Protection Action	Fault Level	Description
Coast to stop	Fault	When a fault occurs, the AC drive stops according to the fault protection action selected and displays the fault code Exxx.x.
Stop at maximum capability		
Quick stop		
Decelerate to stop		
Run with speed restriction	Limited running	When a fault occurs, the AC drive continues to run, but the running is limited. Lxxx.x is displayed as a minor fault.
Run with power restriction		
Run with current restriction		
Run with torque restriction		
Display warning	Alarm	After a fault occurs, the AC drive operates normally and displays the warning code Axxx.x.

Fault Protection Action	Fault Level	Description
Prompt	Prompt	After the fault occurs, the AC drive operates normally and displays the prompt code Nxxx.x.
Ignored	-	The AC drive continues to run after a fault occurs without any prompts.

Coast to stop, stop at maximum capability, quick stop, decelerate to stop are of the same level. When these four fault protection actions are selected, the AC drive stops running immediately and the operating panel displays the fault code Exxx.x.

Run with speed restriction, run with power restriction, run with current restriction, run with torque restriction are of the same level. When these four fault protection actions are selected, the AC drive continues to run when the fault occurs, but the operating is limited. The operating panel displays the minor fault code Lxxx.x. During speed-limit operation, the running frequency after speed limit is set through H1-60. During power-limit operation, the power limit is set by H1-64 and H1-65. During torque-limit operation, set the torque limit by H1-66 and H1-67. During current-limit operation, set the current limit through H1-68.

When the fault protection action is “display warning”, the AC drive operates normally when the fault occurs and the operating panel displays the warning code Axxx.x.

When the fault protection action is “prompt”, the AC drive operates normally when the fault occurs and the operating panel displays the prompt code Nxxx.x.

When the fault protection action is “ignore”, the AC drive continues to run after a fault occurs without any prompts. This action must be set carefully to prevent damage to the AC drive.

Panel Display	Meaning	Function Description	Status
	Fault code (Exxx.y)		Alarm code (Axxx.x)
	Minor fault code (Lxxx.x)		Prompt code (Nxxx.x)

Setting Method

Take the AI1 input fault (E154.3) as an example. The fault protection action can be set in the following two ways. Use one of the following methods to set the fault protection action.

1. Set the protection action corresponding to the fault code through the fault protection action selection parameters (H1-00 to H1-13). Set the tens position of H1-12 to select the fault protection action of E154. The default value of H1-12 is 0x30F0, and the default protection action for AI1 input fault is F (Ignore). Set H1-12 to 0x3030 to select the protection action of AI1 input fault to 3 (Decelerate to stop). E154.3 is displayed on the fault operating panel.
2. You can also directly select the fault protection action corresponding to the fault subcode. The product supports up to 10 groups of fault subcodes (H1-30 to H1-49). Set H1-30 to 154.3. In this case, the fault protection action of AI1 input fault is determined by H1-31. Set H1-31 to 0x000D to change the fault protection action of AI1 input fault to “display warning”. The fault operation panel displays A154.3.

Related Parameters

The following table describes the parameters related to the protection action of the fault codes. For details, see *"10.1 Parameter List" on page 560*.

Param.	Name	Default	Value Range	Descriptions
H1-00	Fault protection action selection 0	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Overcurrent (E002) Tens position: Overvoltage (E005) Hundreds position: Pre-charge fault (E008) Thousands position: Undervoltage (E009)	Set the ones, tens, hundreds, and thousands places of this parameter to set the protection action corresponding to the fault. The corresponding fault protection actions are as follows: 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run with speed restriction. The AC drive displays L and continues running with speed restriction. 000AH: Run with power restriction. The AC drive displays L and continues running with power restriction. 000BH: Run with current restriction. The AC drive displays L and continues running with current restriction. 000CH: Run with torque restriction. The AC drive displays L and continues running with torque restriction. 000DH: Alarm. The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt. The AC drive displays prompt N, which has no effect on operation. 000FH: Ignore. The AC drive ignores the fault. For example, if the ones position of H1-00 is set to 0, the protection action for overcurrent fault is coast-to-stop. If the tens position of H1-02 is set to 3, the protection action for external faults is coast-to-stop.
H1-01	Fault protection action selection 1	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Inverter overload (E010) Tens position: Motor overload (E011) Hundreds position: Input phase loss (E012) Thousands position: Output phase loss (E013)	
H1-02	Fault protection action selection 2	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Module overtemperature (E014) Tens position: External fault (E015) Hundreds position: Reserved Thousands position: Current sampling error (E018)	
H1-03	Fault protection action selection 3	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Parameter auto-tuning error (E019) Tens position: Reserved Hundreds position: EEPROM fault (E021) Thousands position: Reserved	

Param.	Name	Default	Value Range	Descriptions
H1-04	Fault protection action selection 4	0xD000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Output short-circuited to ground (E023) Tens position: Cumulative running time reached (E026) Hundreds position: User-defined fault (E027) Thousands position: User-defined warning (E028)	Set the ones, tens, hundreds, and thousands places of this parameter to set the protection action corresponding to the fault. The corresponding fault protection actions are as follows: 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capabilit.y When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run with speed restriction. The AC drive displays L and continues running with speed restriction. 000AH: Run with power restriction. The AC drive displays L and continues running with power restriction. 000BH: Run with current restriction. The AC drive displays L and continues running with current restriction. 000CH: Run with torque restriction. The AC drive displays L and continues running with torque restriction. 000DH: Alarm. The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt. The AC drive displays prompt N, which has no effect on operation. 000FH: Ignore. The AC drive ignores the fault. For example, if the ones position of H1-00 is set to 0, the protection action for overcurrent fault is coast-to-stop. If the tens position of H1-02 is set to 3, the protection action for external faults is coast-to-stop.
H1-05	Fault protection action selection 5	0xD000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Accumulative power-on time reached (E029) Tens position: Three phase loss (E030) Hundreds position: PID fault (E031) Thousands position: Parameter error (E032)	
H1-06	Fault protection action selection 6	0x00D0	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Reserved Tens position: Excessive speed deviation (E042) Hundreds position: Motor speed overlimit (E043) Thousands position: Reserved	
H1-07	Fault protection action selection 7	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Reserved Tens position: Reserved Hundreds: Error in identifying magnetic pole position (E051) Thousands position: Reserved	

Param.	Name	Default	Value Range	Descriptions
H1-08	Fault protection action selection 8	0x0000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Self-test fault 1 (E056) Tens position: Self-test fault 2 (E057) Hundreds position: Self-test fault 3 (E058) Thousands position: Self-test fault 4 (E059)	Set the ones, tens, hundreds, and thousands places of this parameter to set the protection action corresponding to the fault. The corresponding fault protection actions are as follows: 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run with speed restriction. The AC drive displays L and continues running with speed restriction. 000AH: Run with power restriction. The AC drive displays L and continues running with power restriction. 000BH: Run with current restriction. The AC drive displays L and continues running with current restriction. 000CH: Run with torque restriction. The AC drive displays L and continues running with torque restriction. 000DH: Alarm. The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt. The AC drive displays prompt N, which has no effect on operation. 000FH: Ignore. The AC drive ignores the fault. For example, if the ones position of H1-00 is set to 0, the protection action for overcurrent fault is coast-to-stop. If the tens position of H1-02 is set to 3, the protection action for external faults is coast-to-stop.
H1-09	Fault protection action selection 9	0xF000	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Reserved Tens position: Reserved Hundreds position: Reserved Thousands position: Fan fault (E080)	
H1-10	Fault protection action selection 10	0x0F00	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Reserved Tens position: Reserved Hundreds position: Sequence fault (E085) Thousands position: Motor control error 1 (E093)	

Param.	Name	Default	Value Range	Descriptions
H1-11	Fault protection action selection 11	0xDDDD	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Motor control error 2 (E094) Tens position: AC drive pre-overload (E110) Hundreds position: Motor pre-overload (E111) Thousands position: Module pre-overheat (E114)	Set the ones, tens, hundreds, and thousands places of this parameter to set the protection action corresponding to the fault. The corresponding fault protection actions are as follows: 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run with speed restriction. The AC drive displays L and continues running with speed restriction. 000AH: Run with power restriction. The AC drive displays L and continues running with power restriction. 000BH: Run with current restriction. The AC drive displays L and continues running with current restriction. 000CH: Run with torque restriction. The AC drive displays L and continues running with torque restriction. 000DH: Alarm. The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt. The AC drive displays prompt N, which has no effect on operation. 000FH: Ignore. The AC drive ignores the fault. For example, if the ones position of H1-00 is set to 0, the protection action for overcurrent fault is coast-to-stop. If the tens position of H1-02 is set to 3, the protection action for external faults is coast-to-stop.
H1-12	Fault protection action selection 12	0x30F0	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: Reserved Tens position: AI/HDI disconnected (E154) Hundreds position: Automatic fault reset failure (Err159) Thousands position: Modbus communication timeout (E160)	
H1-13	Fault protection action selection 13	0x0033	The ones, tens, hundreds, and thousands places of this parameter are used to set protection actions upon different faults. Ones position: CANopen fault (E161) Tens position: CANlink fault (E162) Hundreds position: Reserved Thousands position: Reserved	

The following table describes the related to the protection action of the fault subcodes.

Param.	Name	Default	Value Range	Descriptions
H1-30	Setting of error codes in group 1	0.0	0.0 to 255.9	A total of 20 parameters (H1-30 to H1-49) are used to set the protection action of the fault subcode (two parameters as a group). For example, if H1-30 (Setting of error codes in group 1) is set to 28.1 (User-defined warning 1), the fault protection action corresponding to the fault code can be set through H1-31 (Setting of error code level in group 1). The fault protection actions are as follows: 0000H: Coast to stop. When a fault occurs, the AC drive displays E and the motor coasts to stop. 0001H: Stop at maximum capability. When a fault occurs, the AC drive displays E and the motor stops at its maximum capacity. 0002H: Quick stop. When a fault occurs, the AC drive displays E and the motor performs quick stop. 0003H: Decelerate to stop. When a fault occurs, the AC drive displays E and the motor decelerates to stop. 0009H: Run with speed restriction. The AC drive displays L and continues running with speed restriction. 000AH: Run with power restriction. The AC drive displays L and continues running with power restriction. 000BH: Run with current restriction. The AC drive displays L and continues running with current restriction. 000CH: Run with torque restriction. The AC drive displays L and continues running with torque restriction. 000DH: Alarm. The AC drive displays alarm A, which has no effect on operation. 000EH: Prompt. The AC drive displays prompt N, which has no effect on operation. 000FH: Ignore. The AC drive ignores the fault. Additional information: When the fault code is set, the parameter automatically becomes the fault protection action currently in effect. The fault level setting adopts a white list, and only allowable levels can be set.
H1-31	Setting of error code level in group 1	0x000F	0x0000 to 0x000F	
H1-32	Setting of error codes in group 2	0.0	0.0 to 255.9	
H1-33	Setting of error code level in group 2	0x000F	0x0000 to 0x000F	
H1-34	Setting of error codes in group 3	0.0	0.0 to 255.9	
H1-35	Setting of error code level in group 3	0x000F	0x0000 to 0x000F	
H1-36	Setting of error codes in group 4	0.0	0.0 to 255.9	
H1-37	Setting of error code level in group 4	0x000F	0x0000 to 0x000F	
H1-38	Setting of error codes in group 5	0.0	0.0 to 255.9	
H1-39	Setting of error code level in group 5	0x000F	0x0000 to 0x000F	
H1-40	Setting of error codes in group 6	0.0	0.0 to 255.9	
H1-41	Setting of error code level in group 6	0x000F	0x0000 to 0x000F	
H1-42	Setting of error codes in group 7	0.0	0.0 to 255.9	
H1-43	Setting of error code level in group 7	0x000F	0x0000 to 0x000F	
H1-44	Setting of error codes in group 8	0.0	0.0 to 255.9	
H1-45	Setting of error code level in group 8	0x000F	0x0000 to 0x000F	
H1-46	Setting of error codes in group 9	0.0	0.0 to 255.9	
H1-47	Setting of error code level in group 9	0x000F	0x0000 to 0x000F	
H1-48	Setting of error codes in group 10	0.0	0.0 to 255.9	
H1-49	Setting of error code level in group 10	0x000F	0x0000 to 0x000F	

Parameters related to limited running are as follows.

Param.	Name	Default	Value Range	Descriptions
H1-60	Running with speed restriction	1	0: Run at limit frequency 1: Run at the running frequency upon 1st fault 2: Run at a specified safe frequency 3: Run at the frequency reference 4: Run at the upper frequency limit in the current direction 5: Run at the lower frequency limit in the current direction	This parameter is used to select the mode in which the AC drive operates with restrictions upon a minor fault. Value description 0: When the limit occurs, the maximum operating frequency is limited by H1-62 and H1-63. 1: When the limit occurs, run at the running frequency upon 1st fault. 2: When the limit occurs, the frequency specified by H1-61 is used. 3: When the limit occurs, run at the set frequency. 4: When the limit occurs, run at the upper frequency limit in the current direction. 5: When the limit occurs, run at the lower frequency limit in the current direction.
H1-61	Specified safety frequency	0.0	0.0% to 800.0%	This parameter sets the designated safe operation frequency under restricted operation conditions. Additional information: If H1-60 (Running with speed restriction) is set to 2, the AC drive runs at the designated safe operation frequency upon a minor fault.
H1-62	Maximum forward frequency in limited operation mode	100.0	0.0% to 800.0%	This parameter sets the maximum frequency in the forward direction under restricted operation conditions. Additional information: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the forward direction upon a minor fault.
H1-63	Maximum reverse frequency in limited operation mode	100.0	0.0% to 800.0%	This parameter sets the maximum frequency in the reverse direction under restricted operation conditions. Additional information: If H1-60 (Running with speed restriction) is set to 0, the AC drive runs at the maximum frequency in the reverse direction upon a minor fault.
H1-64	Maximum motoring power in limited operation mode	50.0	0.0% to 400.0%	This parameter sets the maximum frequency in the reverse direction under restricted operation conditions. Additional information: This parameter is used to set the maximum motoring power when the AC drive operates with limited power upon a minor fault.

Param.	Name	Default	Value Range	Descriptions
H1-65	Maximum regenerative power in limited operation mode	50.0	0.0% to 400.0%	This parameter sets the maximum regenerative power under restricted operation conditions. Additional information: This parameter is used to set the maximum regenerative power when the AC drive operates with limited power upon a minor fault.
H1-66	Maximum forward torque limit	50.0	0.0% to 400.0%	This parameter sets the maximum torque in the forward direction under restricted operation conditions. Additional information: This parameter is used to set the maximum forward torque when the AC drive operates with limited torque upon a minor fault.
H1-67	Maximum reverse torque limit	50.0	0.0% to 400.0%	This parameter sets the maximum torque in the reverse direction under restricted operation conditions. Additional information: This parameter is used to set the maximum reverse torque when the AC drive operates with limited torque upon a minor fault.
H1-68	Maximum current limit	50.0	0.0% to 400.0%	This parameter sets the maximum current under restricted operation conditions. Additional information: This parameter is used to set the maximum current when the AC drive operates with limited current upon a minor fault.

6.5 Controlling Fan According to Heatsink Temperature

Description

When A4-11 (General mode of fan control) is set to 0 or 2, the AC drive controls the fan running based on the value of U2-68 (module temperature) (that is, the module heatsink temperature).

When A4-11 is set to 0, except for undervoltage state, the fan works when the AC drive is running. If the value of U2-68 is higher than 42°C, the fan runs when the AC drive is stopped. If the value of U2-68 is lower than 40°C, the fan does not run when the AC drive is stopped.

When A4-11 is set to 2, except for undervoltage state, the fan runs when the drive is running. When the drive is stopped, the fan runs if the heatsink temperature is higher than 42°C, and does not run if the heatsink temperature is lower than 40°C. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously.

For detailed fan parameters, see *"5.3 Fan Control" on page 402*.

Related Parameters

Item	Name	Default	Value Range	Descriptions
A4-11	General mode of fan control	0	0: Working (forward running when the heatsink temperature is higher than 42°C at stop state) when AC drive is running 1: Working continuously (forward running) 2: Working (forward/ reverse running when the heatsink temperature is higher than 42°C at stop state) when AC drive is running 3: Working continuously (forward/ reverse running) 4: Manufacturer-defined mode 1 5: Manufacturer-defined mode 2	Set the general mode of fan operation. Value description 0: Working during drive running (forward; working during drive shutdown when the temperature exceeds 42°C) Except for undervoltage state, the fan runs when the drive is running. When the drive is stopped, the fan runs if the heatsink temperature is higher than 42°C, and does not run if the heatsink temperature is lower than 40°C. 1: Except for undervoltage state, the fan runs continuously. 2: Working during drive running (forward and reverse; working during drive shutdown when the temperature exceeds 42°C) Except for undervoltage state, the fan runs when the drive is running. When the drive is stopped, the fan runs if the heatsink temperature is higher than 42°C, and does not run if the heatsink temperature is lower than 40°C. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 3: Except for undervoltage state, the fan runs continuously. While the fan is running, it first runs in the forward direction according to A4-14 (forward running time during forward and reverse running), and then runs in the reverse direction according to A4-15 (reverse running time during forward and reverse running). This cycle repeats continuously. 4: Manufacturer-defined mode 1. It is not recommended to set this mode. 5: Manufacturer-defined mode 2. It is not recommended to set this mode.
A4-14	Forward running time of fan in forward/ reverse running mode	60s	60s to 65535s	Sets the forward running time during forward and reverse running. This parameter is valid when A4-11 is set to 2 or 3.
A4-15	Reverse running time of fan in forward/ reverse running mode	60s	60s to 65535s	Sets the reverse running time during forward and reverse running. This parameter is valid when A4-11 is set to 2 or 3.
U2-68	Module temperature	-	-	Displays the temperature of the AC drive heatsink module in °C.

7 Communication

The MD600 series AC drive supports Modbus, CANopen, and CANlink communication protocols, all of which are onboard modules. As shown in the following table:

Supported Protocol	Communication Hardware	Models
Modbus	RS485 communication interface of MD600 series AC drive	MD600S
	CN1 (RJ45) interface of MD600 series AC drive	MD600S, MD600A
CANopen/CANlink	CN1 (RJ45) interface of MD600 series AC drive	MD600A

7.1 Communication Configuration Process

The communication configuration of this product is generally performed according to the following procedure:

1. Check the supported communication protocol according to the AC drive model and select the correct wiring terminal to connect.
2. Set the communication parameters of the AC drive according to the communication protocol. See *"7.2 Communication Parameters" on page 458* for details.
3. When writing a special communication address, you need to set the source to "Communication setting", that is, from a special communication address. To set the frequency source, set b5-00 (Main frequency source) = 9 (Communication).
4. Send the command to the specified parameter address of the AC drive according to the communication command format. See *" Communication" on page 457* for details.

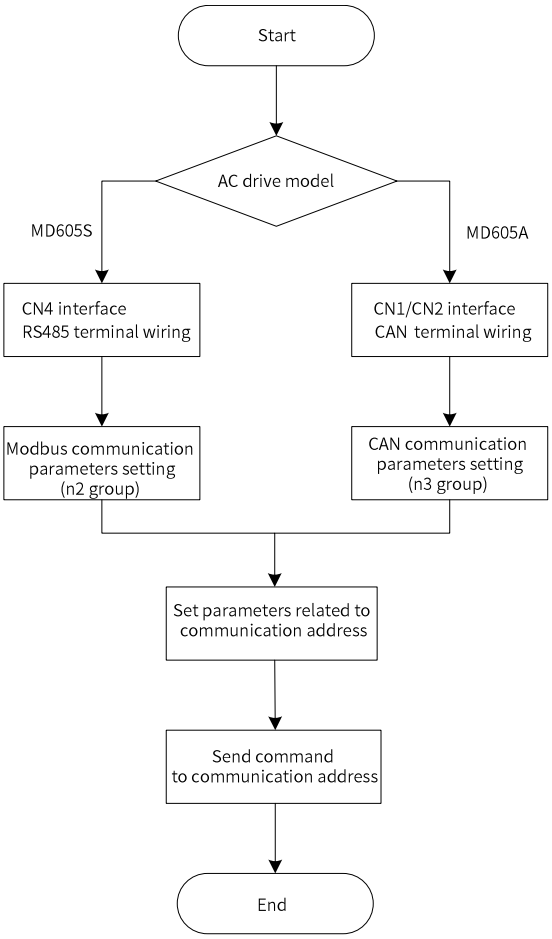


Figure 7-1 Communication configuration process

7.2 Communication Parameters

When the AC drive model is MD600S, that is, A3-06 (AC drive hardware type) = 4, Modbus-RTU communication is available. Set related communication parameters in group n2. Related communication parameters are as follows. For details about the Modbus communication protocol, see *"7.4.1 Overview" on page 470*.

Parameter	Name	Default	Value Range
n2-00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps
n2-01	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)
n2-02	Modbus local address	1	1 to 247
n2-03	Modbus response delay	2 ms	0 ms to 20 ms
n2-04	Modbus communication timeout time	0.0	0.0 to 60.0s
n2-20	Modbus communication enable	0	0: Not supported by the current device 1: Enabled

When the AC drive model is MD600A, that is, A3-06 (AC drive hardware type) = 0, Modbus communication is available. Set related communication parameters in group n3.

Parameter	Name	Default	Value Range
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps
n3-01	CAN communication enable	1	0: Enable 1: Disable
n3-02	CAN station number	1	1 to 247
n3-10	CAN communication protocol selection	2	1: CANopen 2: CANlink
n3-14	CANopen mode	0	0: Default mode 1: Expert mode
n3-15	CANopen inhibit time	0 (unit: 100 μs)	0 to 65535 (unit: 100 μs)
n3-16	CANopen event time	0 ms	0 ms to 65535 ms
n3-26	CAN communication enable	0	0: Not supported by the current device 1: Enabled

When CANopen communication is performed, set n3-10 = 1 and set other CAN communication parameters. For details about CANopen communication protocol, see *"7.6.1 Overview" on page 506*.

When CANlink communication is performed, set n3-10 = 2 and set other CAN communication parameters. For details about CANlink communication protocol, see *"7.5.1 Overview" on page 494*.

7.3 Communication Address

7.3.1 Parameter Data

Parameters of the AC drive include basic function parameters and monitoring function parameters, which are categorized in different parameter groups. Basic function parameters are stored in groups F, A, B, C, and H, as listed in the following table.

Parameter Data	Group F (read/write)	F0, F1, F2
	Group A (read/write)	A0, A2, A3, A4, A5, A6, A7, A8, A9, AA, AB, AC, Ad, AE
	Group b (read/write)	b0, b1, b2, b3, b4, b5, b6, b7, b8, b9, bA
	Group C (read/write)	C2, C3, C4, C5, C6, C7, C8, C9, CA
	Group d (read/write)	d0, d2, d3, d4, d5, d6, d7, d8, d9, dA, db, dC, dd, dE, and dF
	Group E (read/write)	E0, E2, E3, E4, E5, E6, EE, EF
	Group H (read/write)	H1, H2, H3
	Group n (read/write)	n0, n1, n2, n3, nE
	Group o (read/write)	o0, o6, o7, o8, o9, oA
	Group P (read/write)	P0, P1, P2

The following table shows the addresses used by the monitoring function parameters, including running command, running status, running parameters, and alarm information.

Monitoring Function Parameter	Status data (read-only)	U0, U2, U4, 3000H [Note 1]
	Control parameters (write-only)	U3, 1000H, and 2000H to 2004H [Note 1]
	Fault information (read-only)	A0, H6, H7, H8, H9, HA, and Hb
	Connector information (read-only)	L0, L1, L2, L3, L4, L5, L6, L7, L8, L9, LA, Lb, LC, Ld

Note

Note: 1000 H, 2000H to 2004H, and 3000H are Modbus-specific communication addresses.

7.3.2 Parameter Communication Addresses

High-order eight bits in the communication address of a parameter are the parameter group number. Low-order eight bits are the hexadecimal format of the parameter serial number in the parameter group. For example, the communication address of F0-16 is 0xF010. Write parameter values to the communication address, and the values are saved after 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. The following table lists the storage communication addresses of the parameter group.

In addition, non-storage communication addresses are provided. If the parameters modified by the communication do not need to be saved at power failure, you can change the value in the non-storage communication address. To access the non-storage communication address of the parameters, simply add 100 to its storage communication address.

Group No.	Parameter communication addresses
F0 and F2	0xF000 to 0xF263
A0 to AF	0xA000 to 0xAF63
B0 to bA	0xB000 to 0xBA63
C0 to CA	0xC000 to 0xCA63
d0 to dF	0xD000 to 0xDF63
E0 to EF	0xE000 to 0xEF63
H1 to Hb	0x8100 to 0x8B63
n0 to nE	0x2000 to 0x2E63
o0 to oC	0x5000 to 0x5C63
P0 and P2	0x6000 to 0x6263
L0 to Ld	0x9000 to 0x9D63
U0 and U3	0x7000 to 0x7363

Send commands to parameter addresses according to the communication protocol to read and write corresponding parameters. For example, write 0x09C4 (equivalent to the decimal value of 2500) to the communication address 0xF0IE of F0-30 (Digital setting of main frequency) to set the main frequency to 25.00 Hz. For the communication addresses of all parameters of the MD600, see *"10.1 Parameter List" on page 560*.

7.3.3 Special Communication Address

This product provides special communication address that can be read and written. This allows the host controller to write certain values, configuring communication setting of certain functions of the AC drive. The special communication addresses described in this section are not retentive at power failure.

7.3.3.1 Start/Stop Through Communication

Set F0-03/b1-00 or b3-00 (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 AC drive according to the communication protocol, you can control the start, stop, forward running, reverse running, jog, and fault reset of the AC drive.

Communication Address		Description of the communication address
Communication setting control word 2	7311H	The setpoint of 7311H is in decimal format. 0: Stop (stop according to F2-17 (OFF1 stop mode)) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 (OFF1 stop mode)) 7: Reset upon fault 8: Emergency stop For example, write 1 to 7311H to control the forward running of the AC drive.
Communication setting control word 1	7321H	The value format of 7321H is hexadecimal. bit0: ON_OFF1 (start/stop); 0: stop, 0 to 1: run bit1: OFF2 (coast to stop); 0: stop bit2: OFF3 (quick stop); 0: stop bit3: Running allowed; 1: enabled bit4: Reset command; 1: reset bit5: JOG1; 1: enable bit6: JOG2; 1: enable bit7: opposite to the speed; 1: opposite For example, write 0x000F to 7321H to control the start of the AC drive.

Note

Select the command source as communication. When control commands are sent through 7311H and 7321H respectively, the AC drive executes the commands according to the receiving order.

Take 7311H as an example. The following steps are used to set communication as the command source.

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, including Modbus communication parameters in group n2, or CAN communication parameters in group n3.
3. Set the command source to communication. Set b0-02 (Control channel selection) to 0 (Control channel 1) and b1-00 (Main command source of control channel 1) to 2 (Communication).
4. Send a write command to the AC drive through the host controller; write 1 to 7311H to start the AC drive, and write 0 to stop the AC drive.

7.3.3.2 Setting Frequency Through Communication

Set the main frequency source parameters such as b5-00/F0-29 or b6-00 to 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the communication address specified by the AC drive according to the communication protocol, you can

set the main frequency of the AC drive. The following table lists the communication addresses supported by the AC drive.

Communication Address		Description of the communication address
Communication setpoint 2	7310H	The target frequency can be set through the communication address. The attributes of values written by this address is defined by n0-14 [7310H speed setting].

The data format of the special address 7310H is set by n0-14 [7310H speed setting], as shown in the following table.

Parameter	Name	Default	Value Range
n0-14	7310H speed setting	1	0: Frequency (UInt16) 1: Frequency (Int16) 2: Speed (Int16) 3: Percentage (corresponds to rated frequency/Int16/2 decimal places) 4: Percentage (corresponds to maximum frequency/Int16/2 decimal places)

The following table shows the format of the n0-14 [7310H speed setting selection] setpoint.

n0-14 setpoint	Unit	Data format	Number of digits of the decimal part	Writing data	Frequency
0: Frequency (UInt16)	Hz	UInt16	Determined by A0-70 (Frequency decimal place), 2 places by default	1000	10.00 Hz
				2000	20.00 Hz
1: Frequency (Int16)	Hz	Int16	Determined by A0-70 (Frequency decimal place), 2 places by default	1000	10.00 Hz
				-1000	-10.00 Hz
2: Speed (Int16)	rpm	Int16	Determined by A0-70 (Frequency decimal place), 2 places by default	1500 (motor pole pairs 2)	50.00 Hz
				-1500 (motor pole pairs 2)	-50.00 Hz
3: Percentage (corresponds to rated frequency/ Int16/2 decimal places)	%	Int16	Two decimal places	1000: Rated frequency (50.00 Hz)	5.00 Hz
				-1000: Rated frequency (100.00 Hz)	-10.00 Hz
3: Percentage (corresponds to maximum frequency/Int16/ 2 decimal places)	%	Int16	Two decimal places	1000: Maximum frequency (50.00 Hz)	5.00 Hz
				-5000: Maximum frequency (100.00 Hz)	-50.00 Hz

For example, if the communication reference is used as the frequency source, the setting process is as follows:

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, including Modbus communication parameters in group n2, or CAN communication parameters in group n3.
3. Select the set channel by setting b0-03 (Set channel selection) to 0 (Set channel 1). Select the frequency source corresponding to the set channel by setting F0-29 (Main frequency source) to 9 (Communication).
4. Send a write command to the AC drive through the host controller: when n0-14 = 1 and A0-70 = 2 , write 2500 to 7310H to set the main frequency to 25.00 Hz. Write -2500 to 7310H to set the main frequency to -25.00 Hz.

7.3.3.3 Other Special Addresses

AC drive state address

When the AC drive running status is read through communication, the communication address is 703DH to 7044H. The host controller enables you to obtain the current running status information of the drive by reading the address. The addresses are defined as follows:

Communication Address		Address Attribute	Description
Drive state 1	703DH	Read-only	The read results are converted to values in the decimal format. The AC drive states corresponding to different values are as follows: 1: Forward running. The AC drive is running in the forward direction. 2: Reverse running. The AC drive is running in the reverse direction. 3: Stopped. The AC drive has stopped. 4: Auto-tuning. The AC drive is in the auto-tuning status. 5: Faulty. The AC drive is faulty.
Drive state 2	7044H	Read-only	The value format of 7044H is hexadecimal. The AC drive states corresponding to bit values are as follows: Bit 0: Running state 0: Stop. The AC drive has stopped. 1: Running. The AC drive is running. Bit 1: Running direction (forward/reverse) 0: Forward running. The AC drive is running in the forward direction. 1: Reverse running. The AC drive is running in the reverse direction. Bit 2: Whether the AC drive has a fault 0: No fault. No fault occurs on the AC drive. 1: Fault. Faults occur on the AC drive. Bit 3: Whether the frequency reaches the pre-set value 0: Not reached. The AC drive does not reach the preset speed. 1: Reached. The AC drive reaches the preset speed. Bit 4 to bit 7: Reserved Bits 8-15: Fault code. For details, see specific fault descriptions.

DO control

When the RO/DO/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the special address 7312H. The address is defined as follows:

Communication Address		Address Attribute	Description of the communication address
DO control	7312H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. If the value of the bit is 1, the corresponding terminal output is valid. When the value of the bit is 1, the corresponding terminal output is invalid. The relationship between bits and DOs is as follows. bit00: RO1 bit01 to bit03: Reserved bit04: DO1 bit05: DO2 bit06 to bit09: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6

For example, set E1-00 (RO1 function selection) to 20 (communication), and then set the corresponding communication parameters. Write 0001H to 7312H in the instruction format and set the value of bit0 to 1 to set the RO1 to active.

AO terminal control

When E3-00 (AO1 function selection) is set to 14 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 7313H, as defined below.

Communication Address		Address Attribute	Description
AO1 output reference	7313H	Read/Write	Set the AO1 output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO1 output value is 0% to 100%

Set E3-00 (AO1 function selection) to 12 (communication), and then set the corresponding communication parameters. Write 7FFFH to 7313H in the instruction format to set the AO1 output proportion to 100%.

AC drive fault information query

The state of the AC drive is read through communication from the communication address 702DH to 7030H. The host controller can obtain the current running or fault information of the AC drive by reading data in the addresses. The addresses are defined as follows.

Communication Address		Address Attribute	Description
Fault Code	702DH	Read-only	Current AC drive fault code
Minor fault code	702EH	Read-only	Current AC drive minor fault code
Alarm code	702FH	Read-only	Current AC Drive alarm code
Prompt code	7030H	Read-only	Current AC drive prompt code

7.3.3.4 Modbus Compatible Address

In addition to the above special communication addresses, 1000H to 1020H, 2000H to 2004H, 3000H, and 8000H to 8001H are compatible communication addresses dedicated to the Modbus communication, which can also be read and written to the Modbus communication of some preceding products.

Set whether the Modbus communication address is compatible by setting n0-12 (Compatibility with legacy communication address). When n0-12 = 1 [Compatible], the Modbus compatible communication address can be accessed. Otherwise, the Modbus compatible communication address cannot be accessed normally.

Parameter	Name	Default	Value Range
n0-12	Compatibility with legacy communication address	1	0: Not compatible 1: Compatible

The Modbus compatible communication addresses are as follows.

Start/stop command

Set F0-03/b1-00 or b3-00 (Main command source of control channel 1) to 2 (Communication) and configure the Modbus communication parameters correctly. After sending a command to 2000H according to the communication protocol, you can control the start, stop, forward running, reverse running, jog, and fault reset of the AC drive.

Communication Address		Address Attribute	Description of the communication address
Control command input to AC drive 2	2000H	Read/Write	It can be used as the command source for communication. The value format is decimal. 0: Stop (stop according to F2-17 (OFF1 stop mode)) 1: Forward run 2: Reverse run 3: Jog 1 4: Jog 2 5: Coast to stop 6: Stop (stop according to F2-17 (OFF1 stop mode)) 7: Reset upon fault 8: Emergency stop For example, write 2 to 2000H to control the reverse running of the AC drive.

Note

1. For details on how to use this communication address, see 7311H configuration in *"7.3.3.1 Start/Stop Through Communication" on page 461*.
2. When this address is active, the AC drive executes the start/stop commands based on the order in which it receives 2000H, 7311H, and 7321H.

Communication setting

Set the main frequency source parameters such as b5-00/F0-29 or b6-00 to 9 (Communication), and configure the communication-related parameters correctly. After sending a command to the 1000H according to the communication protocol, you can set the main frequency of the AC drive.

Communication Address		Address Attribute	Description of the communication address
Communication setpoint	1000H	Read/Write	The value written to this address can be set as communication reference. The value attribute is switched by n0-13 (1000H set speed).

Note

1. For details on how to use this communication address, see *"7.3.3.2 Setting Frequency Through Communication" on page 462*
2. When this address is valid, the communication value written later in 1000H and 7310H is the final valid communication value.

The data format of the special address 7310H is set by n0-13 [1000H speed setting], as shown in the following table.

Parameter	Name	Default	Value Range
n0-13	1000H speed setting	2	0: Percentage (corresponds to rated frequency/1 decimal place) 1: Percentage (corresponds to rated frequency/2 decimal places) 2: Percentage (corresponds to maximum frequency/ 2 decimal places)

The following table shows the format of the n0-13 [1000H speed setting selection] setpoint.

n0-13 setpoint	Unit	Number of digits of the decimal part	Writing data	Frequency
0: Percentage (corresponds to rated frequency/1 decimal place)	%	Two decimal places	100: Rated frequency (50.00 Hz)	50.00 Hz
			-100: Rated frequency (100.00 Hz)	-100.00 Hz
1: Percentage (corresponds to rated frequency/2 decimal place)	%	Two decimal places	1000: Rated frequency (50.00 Hz)	5.00 Hz
			-1000: Rated frequency (100.00 Hz)	-10.00 Hz

n0-13 setpoint	Unit	Number of digits of the decimal part	Writing data	Frequency
2: Percentage (corresponds to maximum frequency/2 decimal places)	%	Two decimal places	1000: Maximum frequency (50.00 Hz)	5.00 Hz
			-5000: Maximum frequency (100.00 Hz)	-50.00 Hz

State query

When the AC drive running status is read through communication, the host controller enables you to obtain the current running status information of the drive by reading the following address. The addresses are defined as follows:

Parameter	Name	Default	Value Range
Operating frequency	1001H	Read-only	It indicates the AC drive running frequency (unit: 0.01 Hz).
Bus voltage	1002H	Read-only	It is used to set the bus voltage of the AC drive (unit: 0.01 V).
Output voltage	1003H	Read-only	It is used to set the output voltage of the AC drive (unit: 1 V).
Output current	1004H	Read-only	It is used to set the output current of the AC drive (unit: 0.01 A).
Output power	1005H	Read-only	It is used to set the output power of the AC drive (unit 0.1 kW).
Output torque	1006H	Read-only	It is used to set the output torque of the AC drive (unit 0.1%).
Running speed	1007H	Read-only	It indicates the AC drive running speed (unit: 0.01 Hz).
DI input indication	1008H	Read-only	This parameter shows the input state of the DI terminal of the AC drive.
DO output indication	1009H	Read-only	This parameter shows the input state of the DO terminal of the AC drive.
AI1 voltage	100AH	Read-only	It is used to set the AI1 voltage of the AC drive (unit: 0.01 V).
Load speed	100FH	Read-only	It indicates the load running speed (unit: rpm).
PID reference	1010H	Read-only	PID setting
PID feedback	1011H	Read-only	PID feedback
PLC process	1012H	Read-only	PLC step
HDI input pulse frequency	1013H	Read-only	HDI input, unit 0.01 kHz
Feedback speed	1014H	Read-only	Load feedback speed (unit: 0.01 Hz)
Remaining running time	1015H	Read-only	Displays the remaining running time during timed running (unit: 0.1 min).
AI1 voltage before calibration	1016H	Read-only	Displays AI1 raw voltage value (unit: 0.001 V).
Motor speed	1019H	Read-only	Motor speed (rpm)
Current power-on time	101AH	Read-only	Indicates current power-on time of the AC drive (unit: 1 min).
Current operating time	101BH	Read-only	Indicates current running time of the AC drive (unit: 1 min).

Parameter	Name	Default	Value Range
Communication setpoint	101DH	Read-only	The value given by communication.
Display of main frequency X	101FH	Read-only	Main frequency setpoint (unit: 0.01 Hz)
Display of auxiliary frequency Y	1020H	Read-only	Auxiliary frequency setpoint (unit: 0.01 Hz)
Read AC drive state 1	3000H	Read-only	The read results are converted to values in the decimal format. The AC drive states corresponding to different values are as follows: 1: Forward run 2: Reverse run 3: Stop 4: Auto-tuning 5: Fault

DO terminal control

When the RO/DO/VDO function (E1-00/E1-04 to E1-05/E1-10 to E1-15) is set to 20 (communication), the host controller can control the DO of the AC drive through the compatible address 2001H. The address is defined as follows:

Parameter	Name	Default	Value Range
DO control	2001H	Read/Write	The output of the RO/DO/VDO terminal is set through the bit state. If the value of the bit is 1, the corresponding terminal output is valid. When the value of the bit is 1, the corresponding terminal output is invalid. The relationship between bits and DOs is as follows. bit00: RO1 bit01 to bit03: Reserved bit04: DO1 bit05: DO2 bit06 to bit09: Reserved bit10: VDO1 bit11: VDO2 bit12: VDO3 bit13: VDO4 bit14: VDO5 bit15: VDO6

AO terminal control

When E3-00 (AO1 function selection) is set to 14 (Communication), the host controller can control the AO terminals of the AC drive through the communication address 2002H, as defined below.

Parameter	Name	Default	Value Range
AO1 control	2002H	Write-only	Set the AO1 output ratio by writing a hexadecimal value: 0 to 7FFF indicates that the AO1 output value is 0% to 100%

7.4 Modbus Communication

7.4.1 Overview

The AC drive provides two kinds of RS485 communication ports: RS485 communication interfaces of the MD600S model and the RJ45 interfaces supported by both models (MD600S and MD600A). The AC drive connects to the PC/PLC control network that includes one master and multiple slaves as the slave. You can carry out centralized control by using a PC or PLC. Through the communication protocol, you can also set the running commands, modify or read parameters, and read the operating status and fault information of the drive.

7.4.2 Communication Specifications

Item		Description
Communication protocol		Modbus
Standard		Modbus-RTU communication protocol
Maximum number of connections		247
Topology		Bus type
Slave function	The number of request messages can be received at the same time	1

7.4.3 Communication Mode Differences

The AC drive provides two RS485 communication modes for the Modbus-RTU communication. When the RS485 port is used to implement Modbus-RTU communication, connect the RS485 port as in *"7.4.5.2 Networking Topology" on page 476*. The default function of the RJ45 interface of the AC drive is to establish communication between the AC drive and the commissioning software. To enable Modbus-RTU standard protocol communication between the host controller and the AC drive, you need to set the parameter n1-03. When the RJ45 interface is used, the RS485 port of the host controller is recommended to connect to the termination resistor to reduce signal transmission interference.

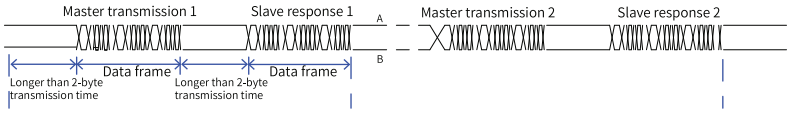
RS485	Modbus-RTU	Default	Parameter Configuration
RS485 port	Supported	Modbus-RTU	n2-00 to n2-04
RJ45: RS485 interface	Supported	Through commissioning software	n1-03 to n1-08

7.4.4 Protocol Description

The AC drive supports the Modbus-RTU slave communication protocol. These protocols define the content and format of messages transmitted during serial communication. If the slave encounters an error upon receiving a message or fails to complete the action required by the master, it responds with a fault message to the master.

7.4.4.1 Communication Transmission Mode

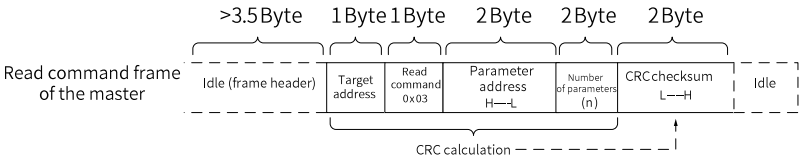
In an RS485 communication network, data is transmitted in the asynchronous serial and half-duplex transmission mode. Data is sent frame by frame in the message format specified by the Modbus RTU protocol. The idle time longer than 3.5-byte transmission time marks the start of a new communication frame.



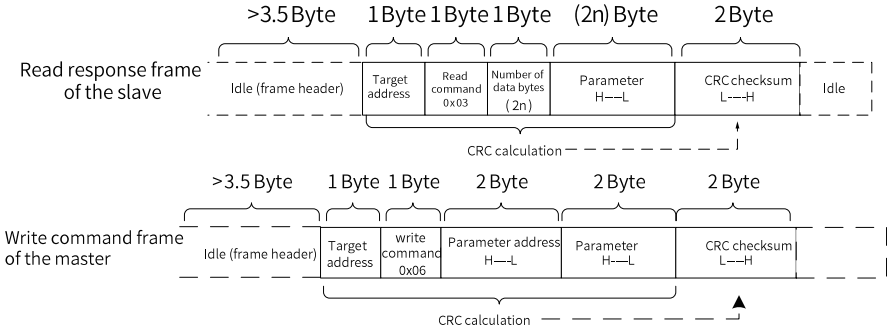
The built-in communication protocol of the AC drive is the Modbus RTU slave communication protocol, which allows the AC drive to respond to the query command from the master or execute the action according to query command from the master and respond with communication data. The master can be a PC, an industrial control device, or a PLC, etc. The master can separately communicate with a slave or issue broadcast information to all slaves. When the master sends a query command to a single slave, the slave needs to return a response frame. For a broadcast message sent by the master, the slaves do not need to return a response to the master.

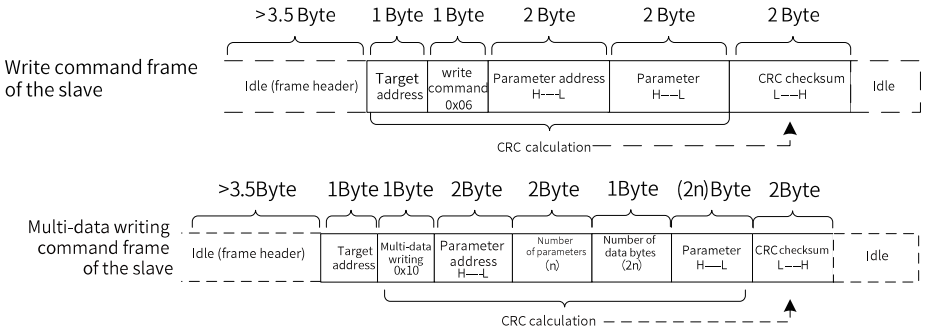
7.4.4.2 Communication Data Frame Structure

The following figure shows the communication data format of the Modbus-RTU protocol. The AC drive supports reading or writing only of word type parameters, and does not support reading or writing of bytes or bits. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is 0x10.

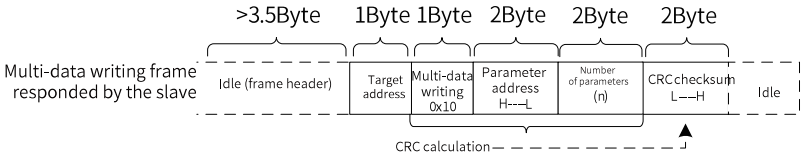


In theory, the host controller can read or write a maximum of 12 consecutive parameters. However, these parameters must be in the same group. Otherwise, a response error occurs.





A maximum of 12 consecutive parameters can be read or written.



If the slave detects a communication frame error or a reading/writing failure caused by other reasons, an error frame will be returned.

Caution

CRC check errors will not be responded to.

The command for a reading error responded by the slave is 0x83. The command for a writing error responded by the slave is 0x86. The command for a multi-data writing error responded by the slave is 0x90.

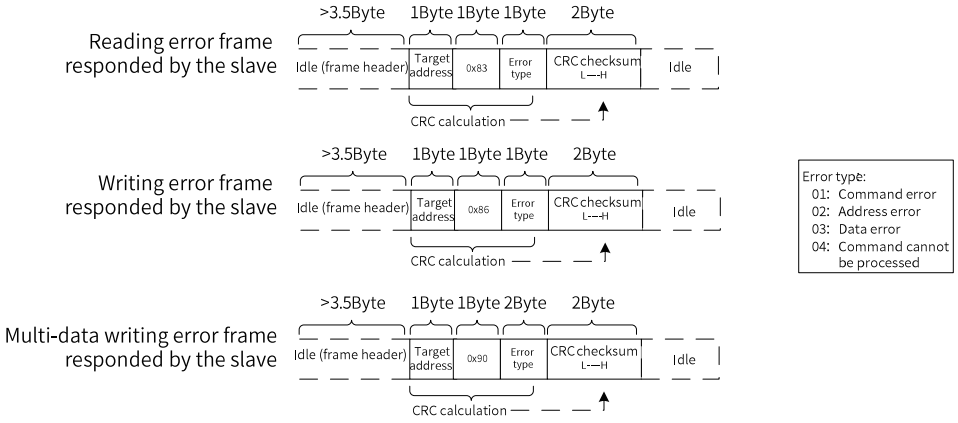


Table 7–1 Description of data frame fields

Field	Status
Frame header (START)	Longer than the time for transmitting 3.5 bytes
Slave address (ADR)	Communication address range: 1 to 247; 0: Broadcast address
Command code (CMD)	0x03: Read a parameter of the slave;0x06: Write a parameter of the slave; 0x10: Write multiple parameters of the slave

Field	Status
Parameter address (H)	Internal parameter address of the drive are in hexadecimal format, which are divided into parameter type and non-parameter type (such as running status parameters and running commands). See the address definition for details. Low-order bytes follow high-order bytes during transmission.
Number of parameters (L)	
Number of parameters (H)	Number of parameters read in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission.
Number of parameters (L)	
Number of data bytes	Data length, which is twice the number of parameters
Data (H)	Response data or data to be written. Low-order bytes follow high-order bytes during transmission.
Data (L)	
CRC low-order bit	Detection value: CRC16 check value. High-order bytes follow low-order bytes during transmission. For details about the calculation method, see the description of CRC in this section.
CRC high-order bit	
END	During 3.5-byte.

CRC check is as follows:

The cyclical redundancy check (CRC) adopts the RTU frame format. A Modbus message includes a CRC-based error check field. The CRC field checks the content of the entire message. The CRC field is two bytes, containing a 16-bit binary value. It is added to the message after being calculated by the transmission device. The reception device recalculates a CRC value in the message, and compares the calculated value with the CRC value in the received CRC field. If the two CRC values are different, transmission errors occur.

The CRC is first stored to 0xFFFF. Then a procedure is invoked to process the consecutive 8-bit byte in the message and the value in the register. Only the 8-bit data in each character is valid for the CRC. The start bit, stop bit and the parity bit do not apply to the CRC.

During generation of CRC, each 8-bit byte is in exclusive or (XOR) with the content in the register. The result is shifted to the least significant bit (LSB), and 0 is filled in the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB is 1, the register then performs XOR with a preset value. If the LSB is 0, no XOR is performed. Repeat this process eight times. After this process is repeated eight times, the next eight-bit byte is in XOR with the register's current value, and the process repeats for eight more shifts as described above. The final value of the register is the CRC value after all the bytes in the message have been applied. The CRC is added to a message from the low-order byte to the high-order byte. A simple function for the CRC is as follows:

```
unsigned int crc_chk_value (unsigned char *data_value,unsigned char length)
{
unsigned int crc_value=0xFFFF;
 int i;
 while（length——）
 {
  crc_value^=*data_value++;
```

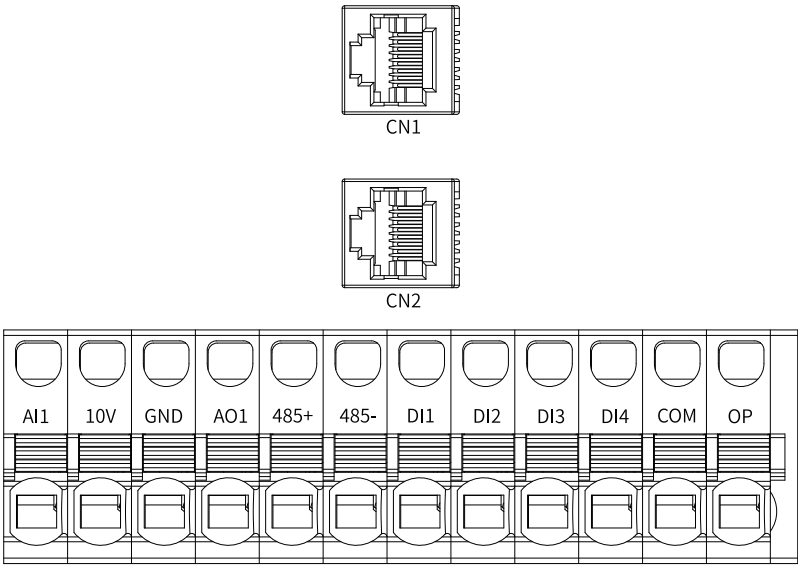
```
  for（i=0;i<8;i++）
  {
   if（crc_value&0x0001）
   {
    crc_value=（crc_value>>1）^0xa001;
   }
   else
   {
return (crc_value);      crc_value=crc_value>>1;
   }
  }
 }
return（crc_value）；
}
```

The parameter address: Read or write parameters (Some parameters cannot be changed, only for manufacturer use or monitoring.)

7.4.5 Hardware Configuration

7.4.5.1 Communication Terminals

The Modbus communication terminals are located at the CN4 interface of the control board, as shown in the following figure.



CN4

Table 7–2 Modbus communication terminals

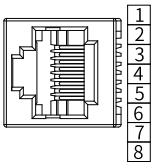
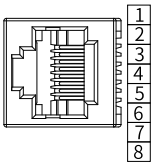
Terminal Mark		Terminal Name	Function	Layout
RJ45 CN1	NC	-	-	
	NC	-	-	
	CGND	Power supply ground	It is used to connect to the reference ground of all RS485 nodes.	
	RS485+	RS485+ input	RS485 commissioning and communication positive terminal	
	RS485-	RS485- input	RS485 commissioning and communication negative terminal	
	NC	-	-	
	NC	-	-	
	GND	Communication ground	Communication ground	
RJ45 CN2	NC	-	-	
	NC	-	-	
	CGND	Power supply ground	It is used to connect to the reference ground of all RS485 nodes.	
	RS485+	RS485+ input	RS485 commissioning and communication positive terminal	
	RS485-	RS485- input	RS485 commissioning and communication negative terminal	
	NC	-	-	
	10 V	Power external operating panel SOP-20	Used to power the power external operating panel SOP-20	
	GND	Communication ground	Communication ground	
CN4	485-	RS485 communication signal (+)	RS485 communication input terminal with the isolation function	-
	485-	RS485 communication signal (-)	RS485 communication input terminal with the isolation function	-
	CGND	Reference ground of RS485 communication signal	Isolated power supply	-

Table 7–3 DIP switches

Terminal Mark	Terminal Name	Function	Position of the Jumper/ DIP Switch
S1, S2	RS485 communication termination resistor setting jumper	The termination resistor is connected.	
		The termination resistor is disconnected.	

Note

- The Modbus communication and the AC drive commissioning software can be used simultaneously. You can modify and monitor parameters by connecting the commissioning device (SOP-20) to CN1 or CN2 terminal.
- CN1 and CN2 can be connected when the operating panel is used as a relay to the computer commissioning software. Only CN2 can be used when the operating panel is connected separately.
- When using RJ45 interfaces CN1 and CN2 as Modbus communication ports, ensure the correct terminal assignment before power-on. The mismatch in the pin port will result in a connection failure and damage to the RJ45 network port circuit of both sides and an external termination resistor needs to be connected.

7.4.5.2 Networking Topology

In a network with a single master and multiple slaves, one of the devices works as the communication master (typically a host controller, PLC, or HMI), and the other devices work as communication slaves. The master establishes communication with the slave to perform read or write operations on slave parameters, and the slave responds to queries or operations from the master. At the same moment, only one device can transmit data and the other can only receive data.

Each communication slave has a unique slave address, The address range of the slaves is from 1 to 247, and 0 is the broadcast address.

RS485 bus topology

Use a three-conductor shielded cable as the RS485 bus to connect to 485+, 485-, and GND terminals of the AC drive. Use the twisted pair cable to connect to the 485+ and 485- terminals and use the other cable to connect to the RS485 reference ground terminal GND. Connect the shield to the equipment ground. In the following figure, the left termination resistor is set by the DIP switch or an external termination resistor is installed. The right termination resistor is also set by the DIP switch. When the RJ45 network port is used for Modbus communication, the connection topology is the same, but an external termination resistor must be used.

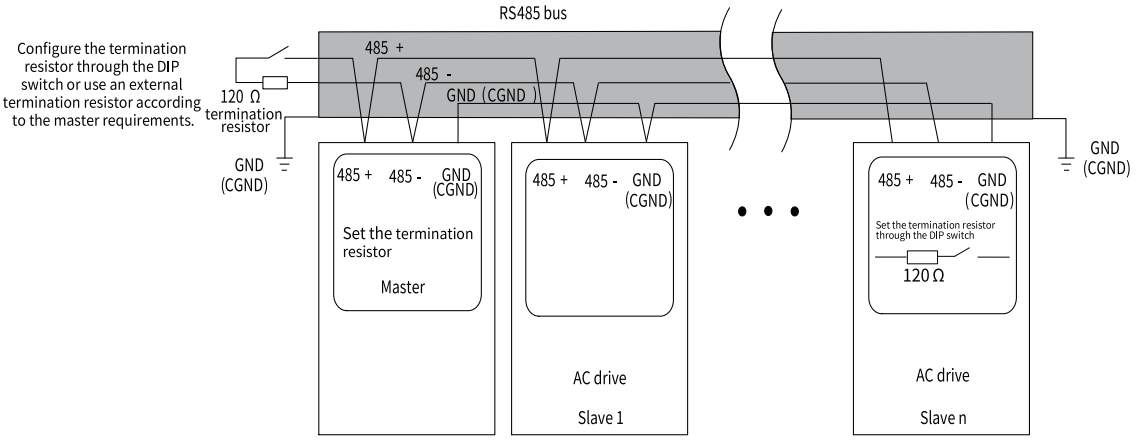


Figure 7-2 RS485 bus topology

Multi-node connection mode

When the number of nodes is large, the RS485 bus must be daisy-chained. If branch connection is required, the cable length between the bus and the node must be as short as possible and no longer than 3 m. Star-type topology is prohibited. The following figures show the common bus topology.

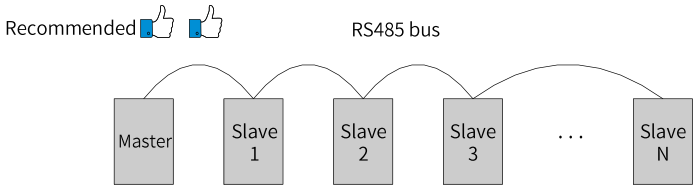


Figure 7-3 Daisy-type topology

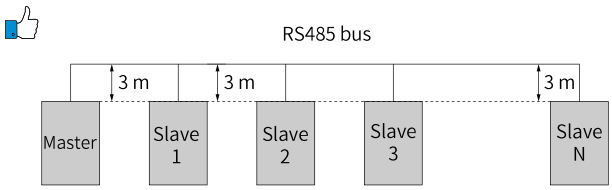


Figure 7-4 Branch topology

It is recommended that the distance between the bus and the node do not exceed 3 m.

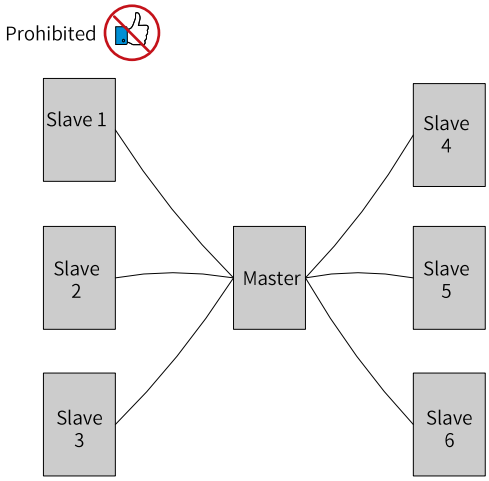
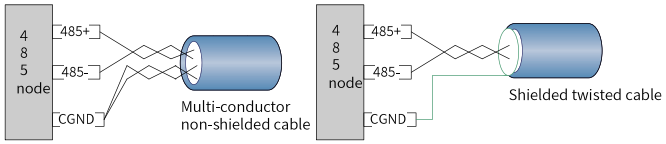


Figure 7-5 Star-type topology (prohibited)

Terminal wiring

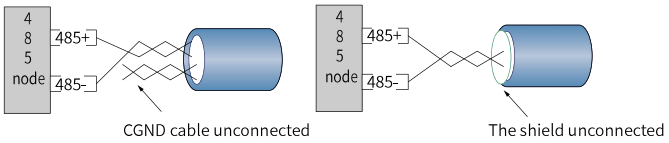
- Terminal wiring for nodes with CGND
  The AC drive has three conductors connected to 485+, 485-, and CGND respectively. Check that the RS485 bus on site contains three cables and the wiring terminals are connected correctly. If a shielded cable is used, connect the shield layer to CGND. Never connect the shield layer to any terminal except CGND, including the drive housing and grounding terminal.

  Given the effect of attenuation, it is recommended to use AWG26 or higher cables for connection longer than 3 m. Twisted pair cables are always recommended for connecting 485+ and 485-.



- Recommended cable 1: Multi-conductor twisted pair cables. Connect the twisted pair cable to 485+ and 485-, and twist the remaining pairs together to connect CGND.
- Recommended cable 2: Use shielded twisted pair cables, with the twisted pair connected 485+ and 485-, and the shield connected to CGND.
- In applications where shielded cables are used, the shield can be connected to CGND only. Never connect the shield to the ground.

- For nodes without CGND, do not connect CGND cable or the shield to the PE terminal of nodes directly. Handle this issue by following the three methods.



  - Method 1: Check whether another port on this node shares a common reference ground with the RS485 circuit. If yes, connect the CGND cable (the shield) of the bus directly to the pin.
  - Method 2: Find the reference ground of the RS485 circuit on the node board and connect the drain wire to CGND or the shield.
  - Method 3: If the reference ground of the RS485 circuit cannot be found, keep the CGND cable or the shield unconnected and use an extra grounding cable to connect this node to the PE terminal of other nodes.

Transmission distance

The following table lists the maximum number of nodes and transmission distance supported by the standard RS485 circuit at different transmission rates.

Table 7–4 Maximum number of nodes and transmission distance

Transmission Distance (m)	Rate (kbps)	Number of nodes	Cable Specification
100	115.2	128	26AWG
1000	19.2	128	26AWG

7.4.6 Communication Parameters

Item	Name	Default	Value Range	Descriptions
n1‑03	Commissioning or Modbus-RTU option	0: Commis-sioning	0: Commissioning 1: [RJ45 interface] Modbus-RTU	Set whether the commissioning interface is used for commissioning or Modbus-RTU communication. Value description 0: Commissioning 1: Modbus RTU
n1‑04	[RJ45 interface] Modbus-RTU data format	0: No check (8-N-2)	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n1‑05	[RJ45 interface] Modbus response delay	2 ms	0 ms to 20 ms	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller.
n1‑06	[RJ45 interface] Modbus timeout time	0s	0.0s to 60.0s	Sets Modbus timeout time.
n1‑07	[RJ45 interface] Modbus-RTU baud rate	5: 9600 bps	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	Sets the Mobus-RTU communication baud rate. The higher the baud rate, the faster the communication speed.
n1‑08	[RJ45 interface] Modbus-RTU address	1	1 to 247	Set the address of the AC drive commissioning interface for Mobus-RTU communication.

Item	Name	Default	Value Range	Descriptions
n2-00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Value description 0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n2-01	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	This parameter defines the format of Modbus data transmitted between the host controller and the AC drive. Value description 0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1) Additional information: Note that the data format of the host controller must be the same as that of the AC drive. Otherwise, communication fails.
n2‑02	Modbus local address	1	1 to 247	Sets the Modbus local address. Additional information: The local address must be unique in the range of 1 to 247, which is the basis for point-point communication between the AC drive and the host controller.

Item	Name	Default	Value Range	Descriptions
n2‑03	Modbus response delay	2 ms	0 ms to 20 ms (valid for Modbus)	This parameter defines the interval from the end of data reception by the AC drive to the start of data transmission to the host controller. Additional information: If the response delay is shorter than the system processing time, the system processing time prevails. This means that the system processes data and then sends the data to the host controller. If the response delay is longer than the system processing time, the system processes data and waits for the response delay time. After the time elapses, the system sends the data to the host controller.
n2‑04	Modbus communication timeout time	0.0s	0.0s: Detection disabled 0.1s to 60.0s	Defines Modbus communication timeout time. Additional information: When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. When it is set to a non-zero value, if the interval between the current communication and the next communication exceeds the Modbus communication timeout time (n2-04), the system reports a communication fault.

7.4.7 Communication Configuration Examples

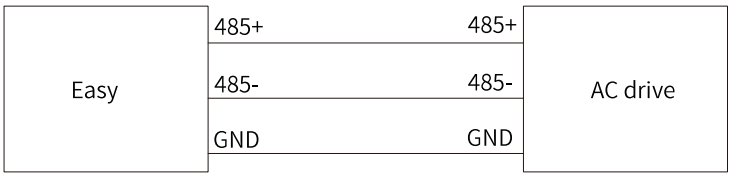
7.4.7.1 Configuration of RS485 Communication Between AC Drive and Easy

Prerequisite

- Log in to the official website of Inovance https://www.inovance.com/portal/allResult?key=Easy) to obtain the Easy programming software.
- Equipments: the AC drive, Easy series PLC, cables.

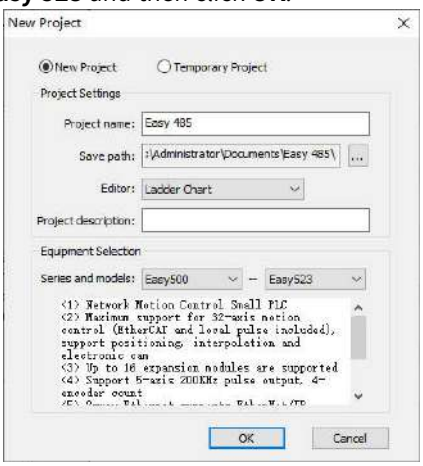
Wiring

Connect 485+ and 485- on the Easy to 485+ and 485- on the AC drive, as shown in the following figure.

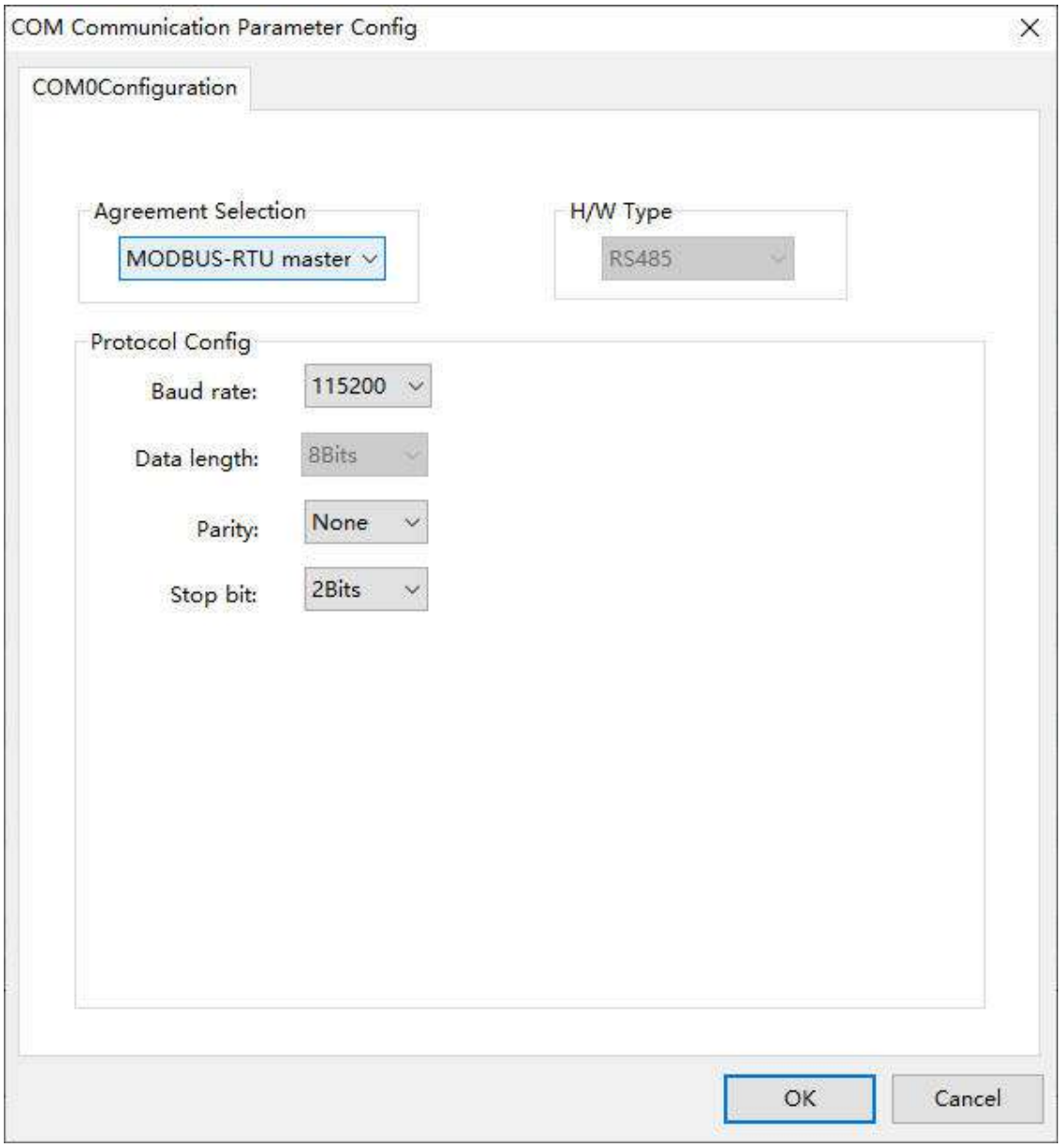


Master and slave configuration

1. Run AutoShop. On the page displayed, click **New Project**, confirm that the value in the **Series and models** field is **Easy 500** and **Easy 523** and then click **OK**.

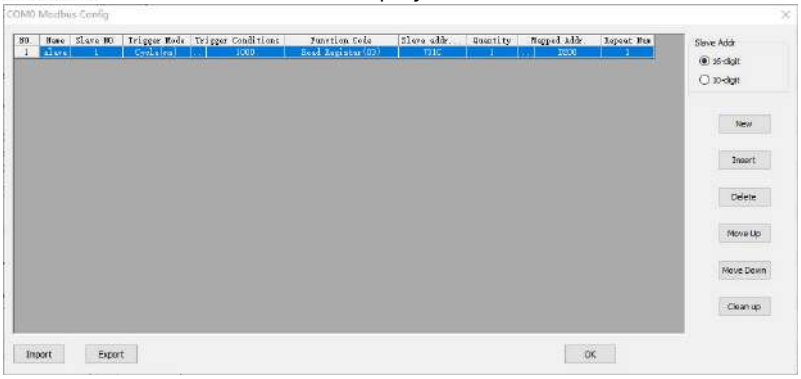


2. Click COM in the left pane to go to the PLC configuration interface, select the protocol and data format, and click **OK**.



1. Agreement selection: Modbus-RTU master; 2. Data length: 8Bits, Parity: None, Stop bit:2Bits.

3. Click COM0 , then click **Add Modbus Config** and **OK**. COM COM0 Modbus Config is displayed. Double-click COM0 Modbus Config and click Add on the displayed interface to access a variable of the AC drive.



4. Write operation: After clicking **Add**, select the **Slave NO.** and **Trigger Mode** (typically **Cycle**).

NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions	Function Code	Slave addr...	Quantity	Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	.. 1000	Write Register(16)	1000	1	.. D0	1

As shown in the preceding figure, **Slave NO.** is **1**, indicating that the operation will be performed on slave 1. Set **Trigger Mode** to **Cycle** and **Function Code** to **Write Register**; otherwise, the write operation will fail. The internal variables of the AC drive are all 16-bit data. Set **Quantity** to **1**. If **Quantity** is set to **2**, the write operation will fail.

5. Read operation: After clicking **Add**, select the **Slave NO.** and **Trigger Mode** (typically **Cycle**).

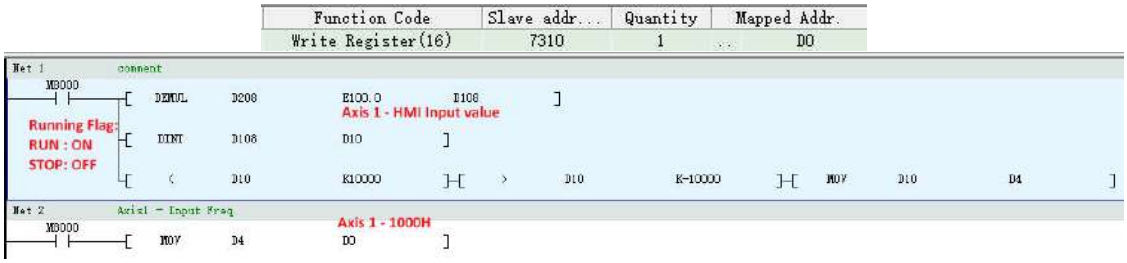
NO.	Name	Slave NO.	Trigger Mode	Trigger Conditions	Function Code	Slave addr...	Quantity	Mapped Addr.	Repeat Num
1	slave	1	Cycle(ms)	1000	Write Register(16)	1000	1	D0	1
2	slave	1	Cycle(ms)	1000	Write Register(16)	2000	1	D2	1
3	slave	1	Cycle(ms)	1000	Read Register(03)	7002	1	D300	1
4	slave	1	Cycle(ms)	1000	Read Register(03)	7003	1	D302	1

As shown in the preceding figure, **Slave NO.** is **1**, indicating that the operation will be performed on slave 1. Set **Trigger Mode** to **Cycle** and **Function Code** to **Read Register**; otherwise, the read operation will fail. The internal variables of the AC drive are all 16-bit data. Set **Quantity** to **1**. If **Quantity** is set to **2**, the read operation will fail.

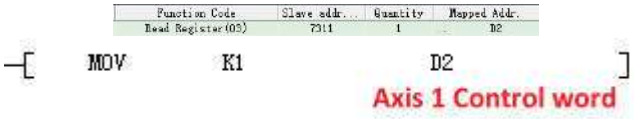
After the read and write operation settings, click **OK** to return to the programming interface.

Instances

1. Write the frequency (F0-29 is set to 9).
   Data conversion: Multiply the required frequency (a) by 100 to obtain an integer, and then write the integer to 7310H. The following figure shows the configuration and the program.

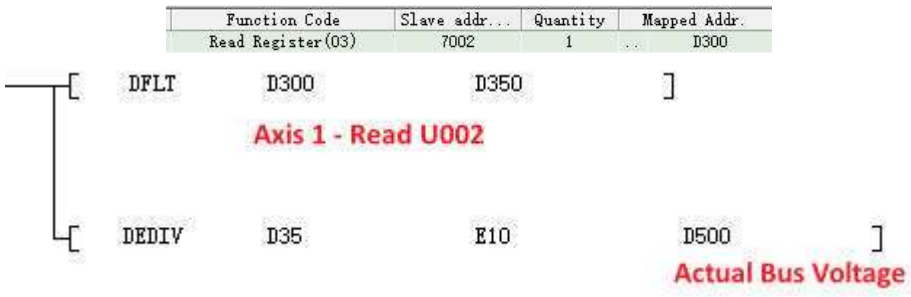


2. Start or stop the AC drive (F0-03 is set to 2).
   Assign a value to the D component corresponding to the station address 7311H to control forward running, reverse running, and stop of the AC drive through communication. The assignment includes 1: Run in forward direction; 2: Run in reverse direction; 3: Jog in forward direction; 4: Jog in reverse direction; 5: Coast to stop; 6: Stop according to the stop mode; 7: Reset upon fault; 8: Emergency stop. The following figure shows the configuration and the program.



   The PLC soft component address corresponding to 7311H is D2. Therefore, to control the AC drive to run in forward direction through communication, write 1 to D2. Similarly, to control the AC drive to decelerate to stop, set D2 to 6.

3. Read the bus voltage.
   Read the bus voltage. Based on the conversion rule, convert the bus voltage U0-02 to 7002 (convert U in the high-order 2 bits to 7, and convert the low-order 2 bits to a hexadecimal equivalent). The actual bus voltage is the read bus voltage (a) divided by 10. According to the communication configuration, the D component address of the bus voltage is D300. Convert D300 to a floating-point number and then divide this value by 10. The following figure shows the configuration and the program.



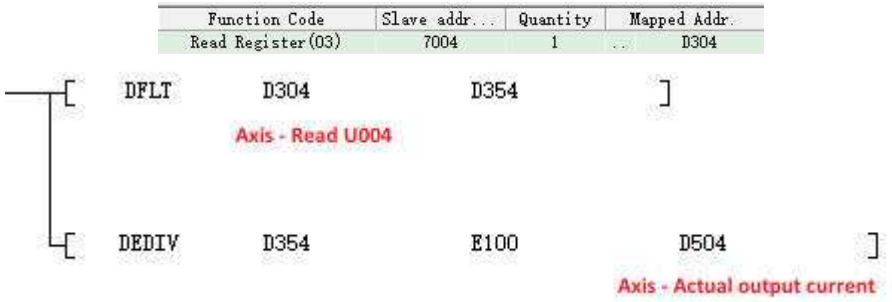
4. Read the output voltage.

   Convert the output voltage U0-03 to 7003 based on the conversion rule. The read value is the actual output voltage. According to the communication configuration, you only need to move the value of D302 to another D component (or not). The following figure shows the configuration and the program.



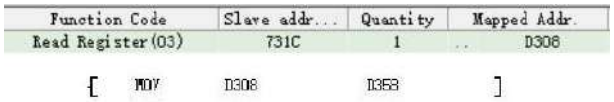
5. Read the output current.

   Convert the output current address U0-04 to 7004 based on the conversion rule. The actual output current is the read output current divided by 100. The following figure shows the configuration and the program.



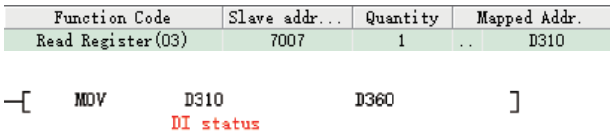
6. Read the AC drive state.

   Read 731CH to directly obtain the current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stopped). The following figure shows the configuration and the program.



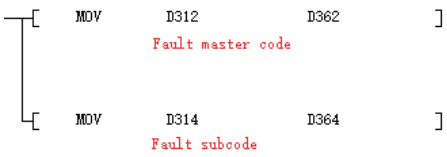
7. Read the DI state.

   According to the conversion rule, convert the DI state U0-07 to 7007. Convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on.



8. Read the fault code.
   Convert the fault code U0-45 to 702D and convert the minor fault code U0-46 to 702E based on the conversion rule. The following figure shows the configuration and the program.

Function Code	Slave addr. (H)	Quantity		Mapped Addr.
Read Register(03)	702D	1	..	D312
Read Register(03)	702E	1	..	D314



Common faults and solutions

Mandatory inspection items:

1. Check whether other pins instead of 485+ and 485- are connected.
2. Check the baud rate (n2-00) of the AC drive to ensure that the communication rate is consistent with that of the host controller.
3. Check the data format (n2-01) of the AC drive to ensure that the data format is consistent with that of the host controller.
4. Check whether the communication address defined by n2 (local address) of each device is unique to avoid conflicts caused by duplicated local addresses.

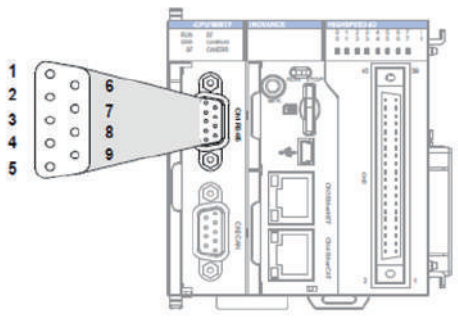
7.4.7.2 Configuration for RS485 Communication Between AC Drive and AM600

Prerequisite

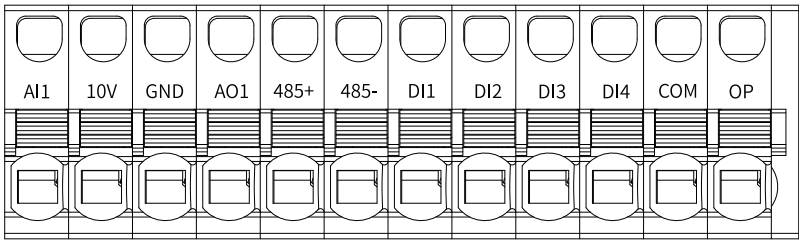
- Log in to the official website of Inovance (https://www.inovance.com/portal/serviceSupport/download) to obtain the AM600 programming software.
- Equipments: the AC drive, AM600 PLC, cables.

Wiring

- Interfaces:
  The AM600 provides two RS485 ports. The two RS485 channels share the same DB9 interface. For details, see the following figure.

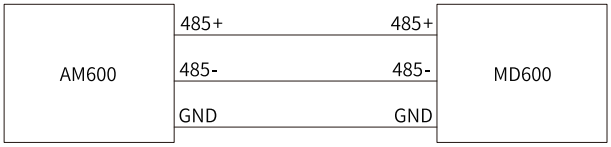
RS485 port on CPU module	Pin	Channel	Assignment	Function
	1	COM0 (RS485)	RS485-	Negative signal of the RS485 differential pair of COM0
	2		RS485+	Positive signal of the RS485 differential pair of COM0
	5		GND0	Power ground of COM0
	6	COM1 (RS485)	RS485-	Negative signal of the RS485 differential pair of COM1
	9		RS485+	Positive signal of the RS485 differential pair of COM1
	3		GND1	Power ground of COM1

Modbus communication connection is implemented through the CN4 interface that include one pair of RJ485 terminals, as shown below.



CN4

- Connection
  Take COM1 as an example. Connect one end of the network cable to CN1 of the AM600 through the DB9 terminal. Strip the other end of the cable, connect the RS485+, RS485–, and GND wires to the 485+, 485–, and GND terminals of the AC drive, respectively, as shown in the following figure.



- Switch the termination resistor of the AC drive to the ON position (to the top).

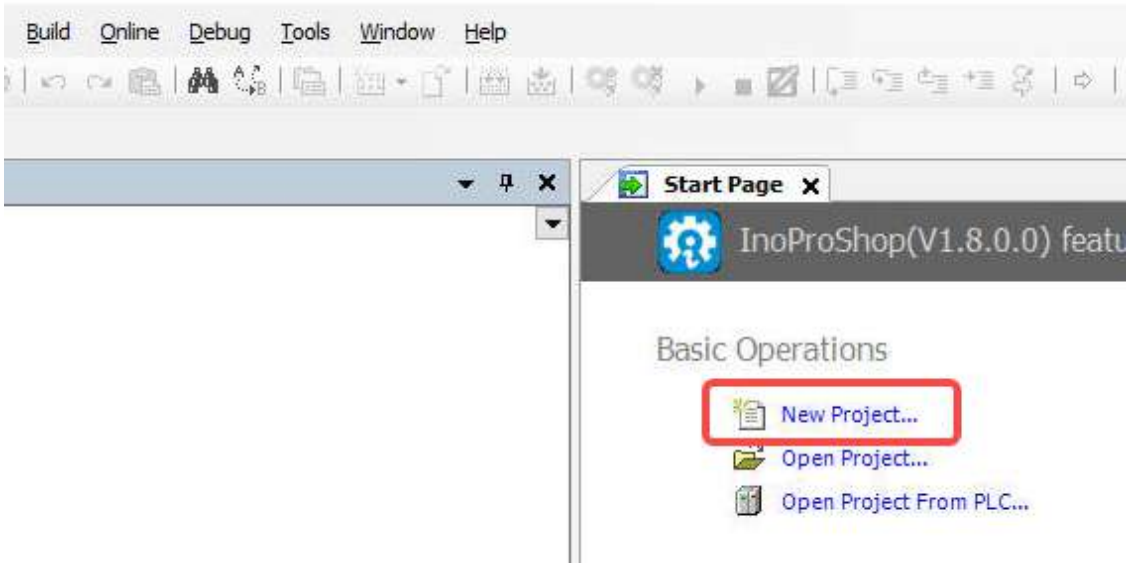


Configuration on AC Drive Side

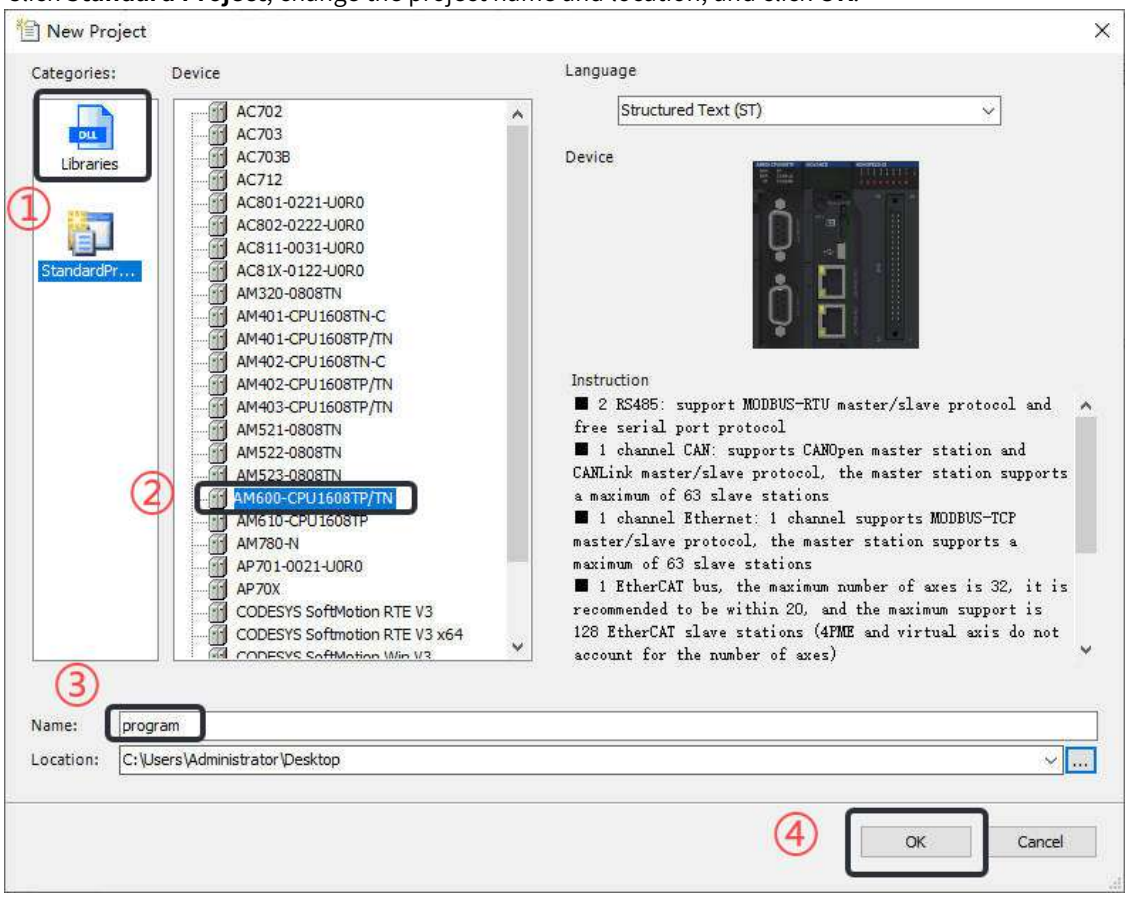
1. Set the following parameters of the AC drive: F0-03 = 2 (command source selected as communication command channel), F0-29 = 9 (main frequency reference selected as communication reference), n2-00 = 5, n2-01 = 0, n2-03 = 2, and n2-04 = 0.0
2. Record the address of n2-02, which is the station number of the AC drive.

Instances

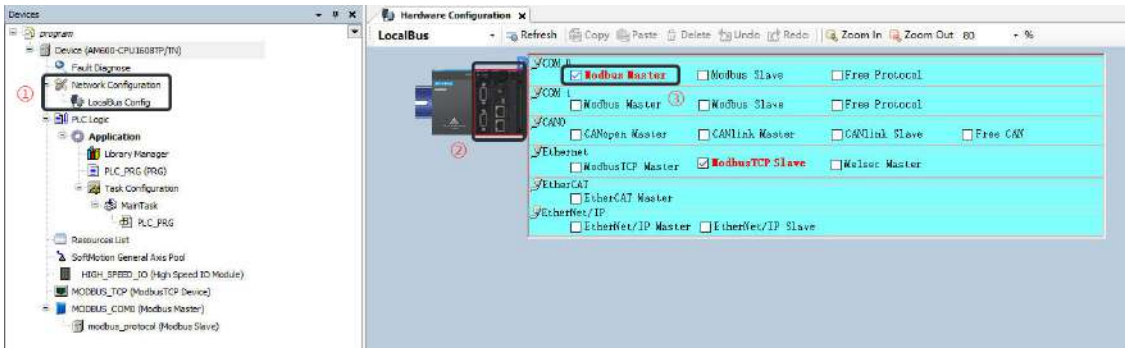
1. Connect the PC and PLC through a network cable or USB, open InoProShop, and create a new project.



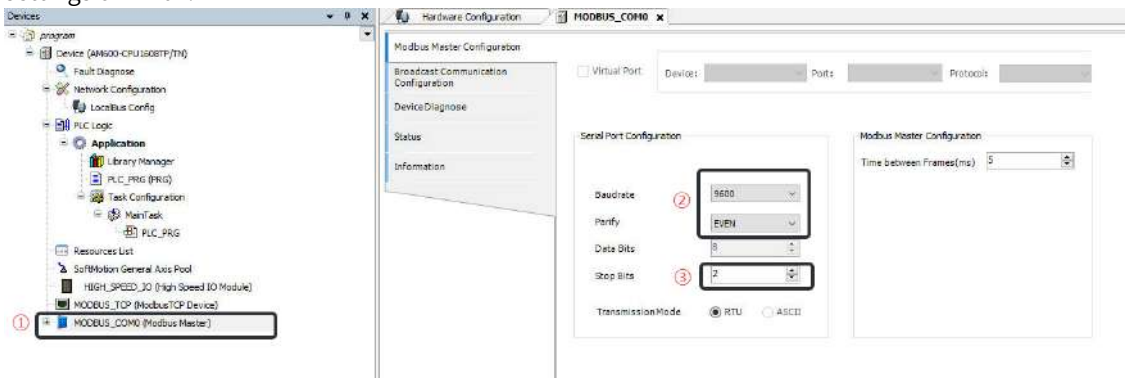
2. Click **Standard Project**, change the project name and location, and click **OK**.



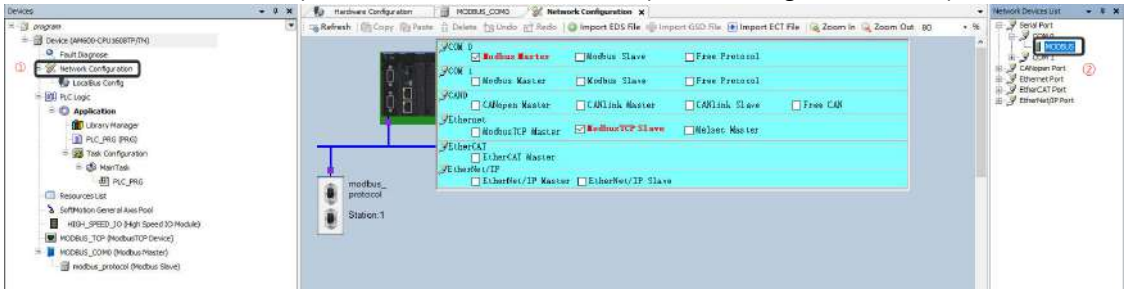
3. Select **AM600-CPU1608TP/TN**, select **Structured Text (ST)** from the **Language** drop-down list, and click **OK**.
4. Click **LocalBus Config**, and click the CPU module. In hardware connection, the RS485 cable of the COM0 is connected to the RS485 terminal of the AC drive. Therefore, select the Modbus master station of the serial port 0.



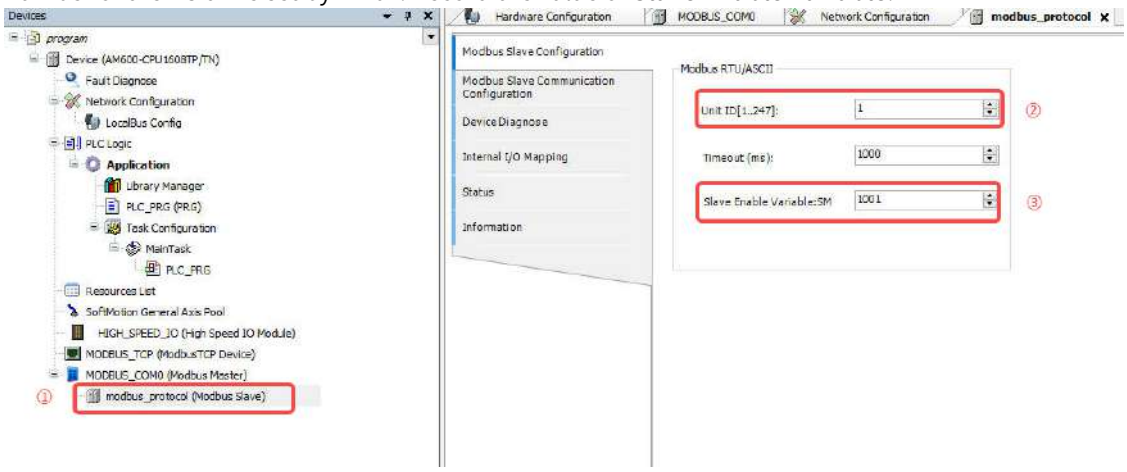
5. Click **ModBus_COM0** in the left pane, and set the baud rate, parity, and stop bit according to the settings of n2-01.



6. Double-click **Network Configuration** in the left pane. Choose **Serial Port** > **COM 0** in the right pane, and double-click **MODBUS**. A new slave is displayed on the Modbus bus in the center of the interface. If there are multiple slaves, click **MODBUS** multiple times to generate multiple slaves.

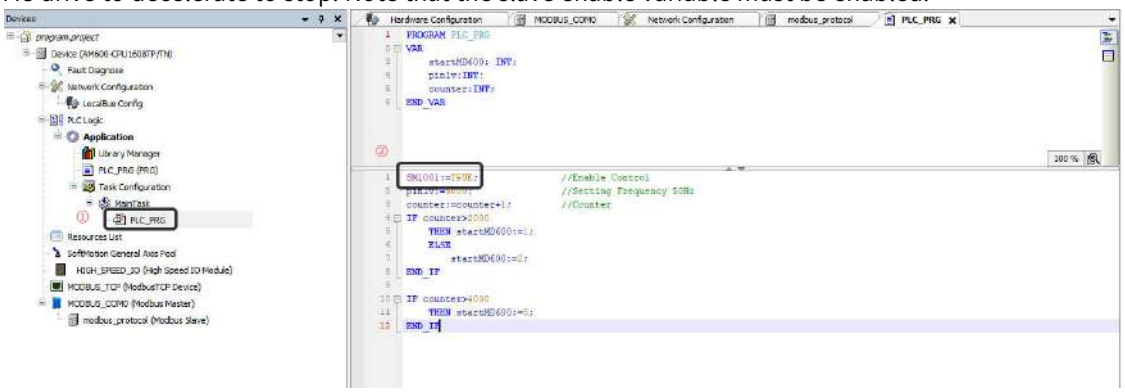


7. Double-click the new Modbus slave station and set its number, which must be same as the station number of the AC drive set by n2-02. Record the value of **Slave Enable Variable**.

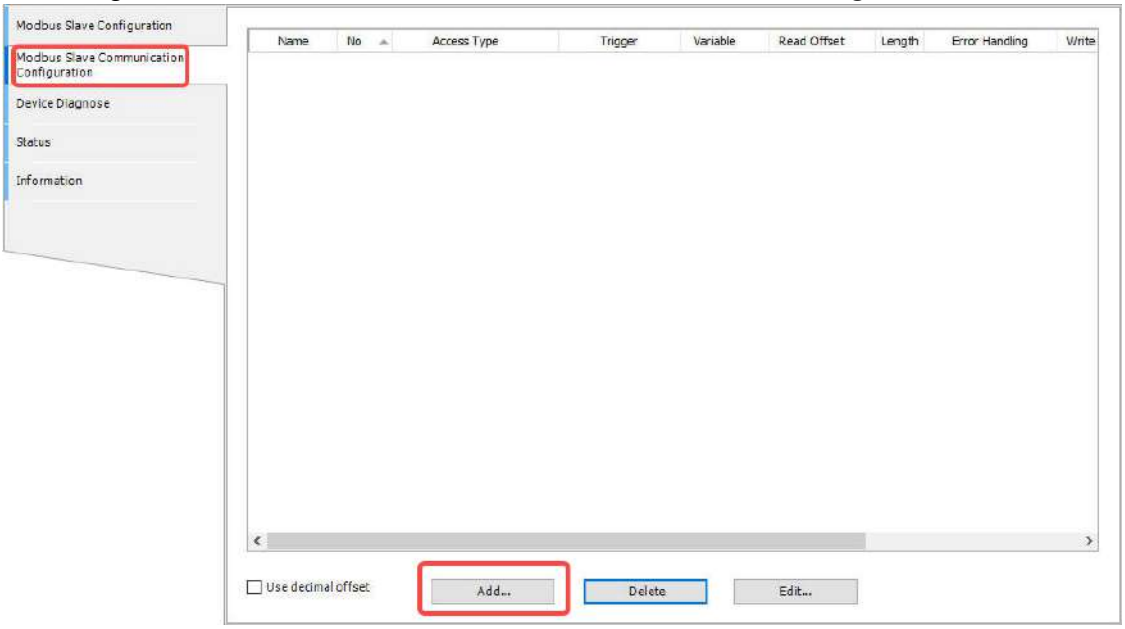


8. Compile the PLC program as follows: Enable the slave enable variable. Set the frequency of the AC drive to 50 Hz. Make the PLC run for 4000 scanning cycles. During the first 2000 scanning cycles,

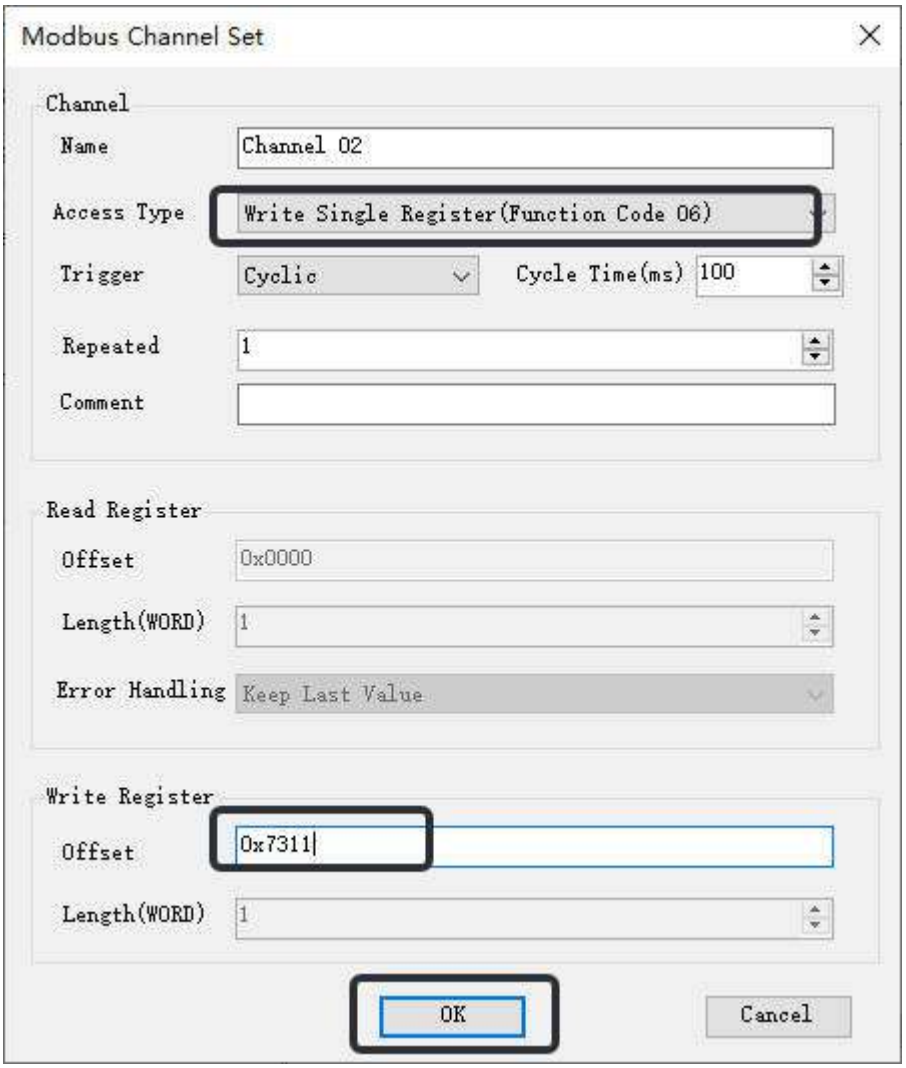
make the PLC control the AC drive to run in the forward direction. During the last 2000 scanning cycles, make the PLC control the AC drive to run in the reverse direction. Make the PLC control the AC drive to decelerate to stop. Note that the slave enable variable must be enabled.

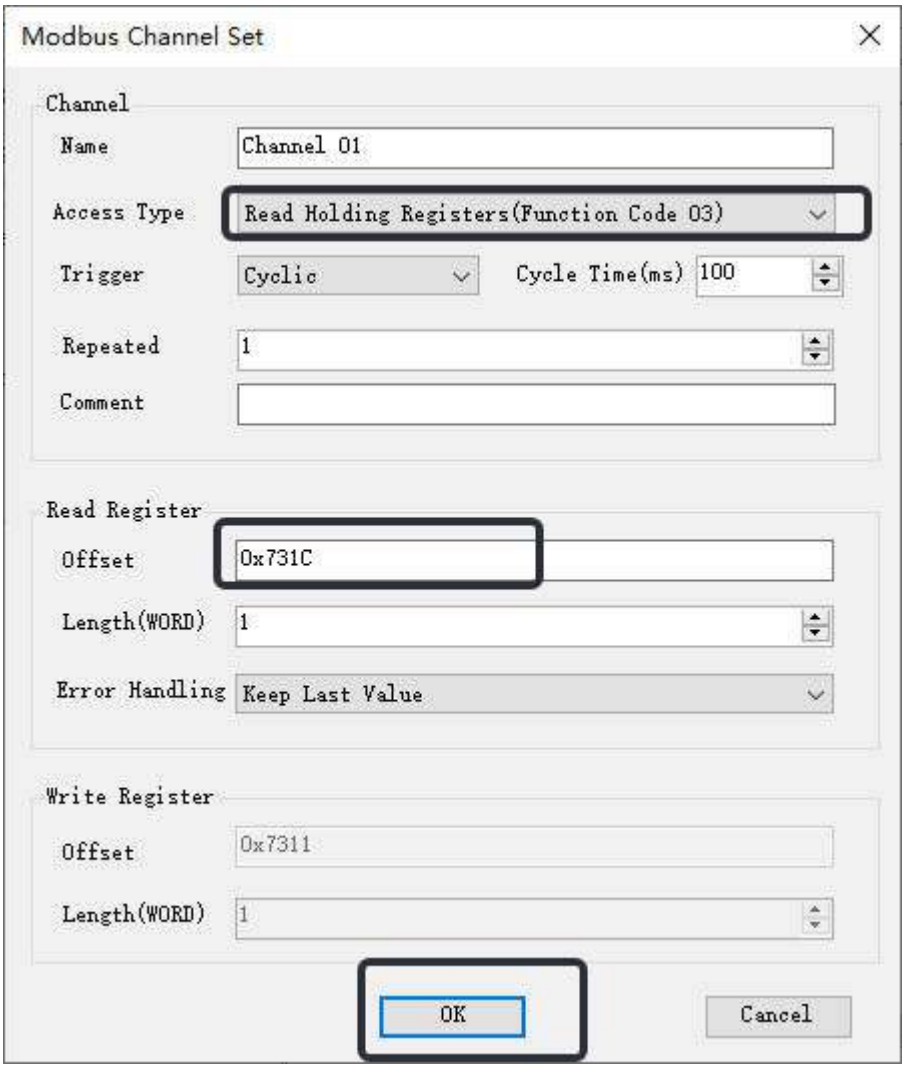


9. Add configuration information on the **Modbus Slave Communication Configuration** tab.

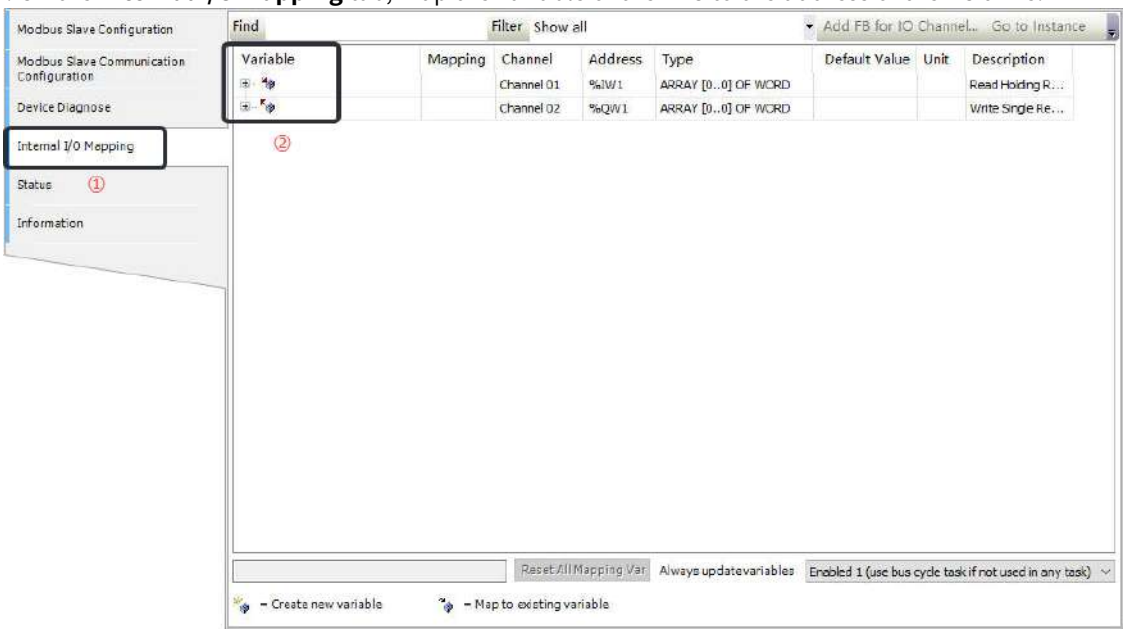


10. Configure the register in the displayed dialog box. The control word reading address of the AC drive is 731CH, the writing address is 7311H, and the frequency address is 7310H.

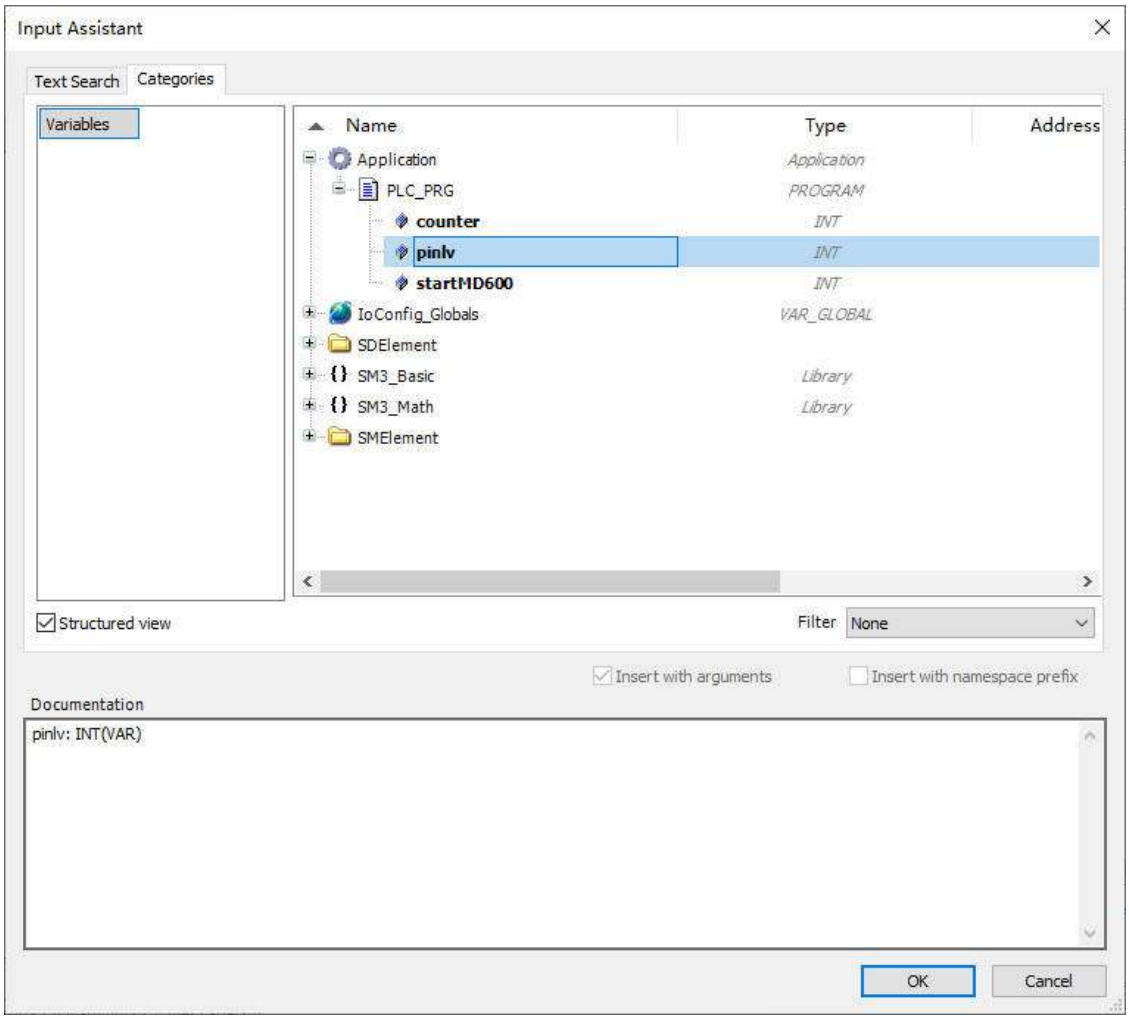

Modbus Channel Set
Channel
Name
Channel 02
Access Type
Write Single Register(Function Code 06)
Trigger
Cyclic
Cycle Time(ms)
100
Repeated
1
Comment
Read Register
Offset
0x0000
Length(WORD)
1
Error Handling
Keep Last Value
Write Register
Offset
0x7311
Length(WORD)
1
OK
Cancel



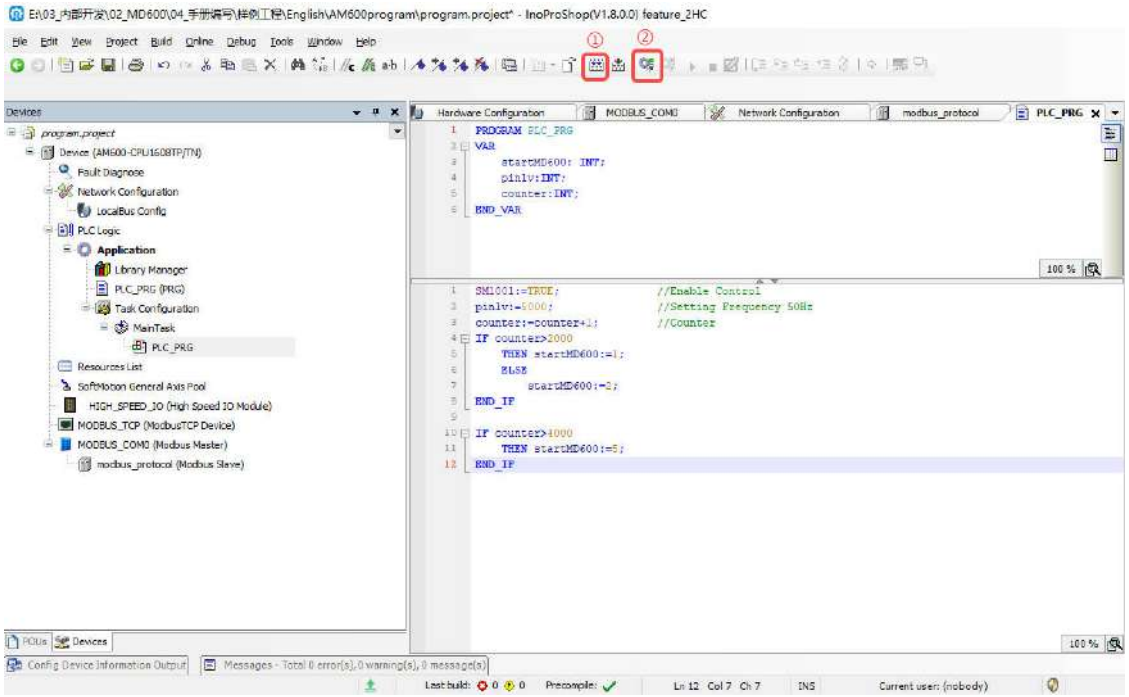
11. On the **Internal I/O Mapping** tab, map the variable of the PLC to the address of the AC drive.



12. Select the variable to be mapped.



13. Compile the program to check whether there are errors. If no error is found, log in to the PLC, download the program, and click the **Execute** button to execute the program.



7.5 CANlink Communication

7.5.1 Overview

The CANlink communication protocol is a special protocol independently developed by Inovance based on CAN bus applications. This protocol can be used to communicate with only Inovance PLCs such as H2U, H3U and AM600. It is mainly used for real-time control and high-speed data exchange among Inovance products, such as PLCs, AC drives, and servo drives.

7.5.2 Communication Specifications

Item		Description
Communication protocol		CANlink Protocol
Standard		CAN2.0
Maximum number of connections		63
Topology		CAN bus topology
Slave function	Disconnection Detection	Set detection time

7.5.3 Protocol Description

In the CANlink network, the master can scan CANlink devices, manage and configure CANlink networks, and monitor devices connected the CANlink bus. The CANlink protocol supports two transmission modes: query/response mode and time-based or condition-based automatic transmission.

7.5.3.1 Communication Data Frame Structure

CANlink protocol can read and write to 16- and 32-bit registers using command frames. Command frames operate in the query and response mode. Responses from the slave nodes are required upon receipt except for broadcasts (with a receiver address of 0). The data structure of the command frame is shown in the following table.

CAN ID (29-bit)					4 bytes/8 bytes			
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	DByte 1	DByte 2	DByte 3	DByte 4
Frame ID	Query and response	Command code	Target node	Source node	-	-	-	-
1000B	1: query	xxH	xxH	yyH	xx	xx	xx	xx
1000B	0: response	xxH	yyH	xxH	xx	xx	xx	xx
4bit	1bit	8bit	8bit	8bit	16bit	16bit	16bit	16bit

- Frame ID: Fixed to 1000B, indicating the command frame.
- Query and response: “1” for commands and “0” for responses.
- Command code: Specify different commands.
- Target node: The address of the node receiving the command frame. The receiving address is written to "0", indicating a broadcast message. In this case, every node on the network receives and processes the message and is not permitted to send a response back.
- Source node: The address of the node sending the command frame.

- Data: Different commands correspond to different data length.

Command code:

- Read and write to registers
  The command that reads 16-bit registers (command code 04H) does not support broadcast address. The address and data are 16-bit. The frame structure is shown in the following table.

CAN ID (29-bit)					4 bytes/8 bytes			
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	Dbyte 1	Dbyte 2	Dbyte 3	Dbyte 4
Frame ID	Query and response	Command code	Target node	Source node	-	-	-	-
1000B	1: query	04H	xxH	yyH	1	Register address 1	1	Register address 2
1000B	0: response	04H	yyH	xxH	Data 1	Register address 1	Data 2	Register address 2
4bit	1bit	8bit	8bit	8bit	16bit	16bit	16bit	16bit

  The command that writes to 16-bit registers (command code 05H) supports broadcast address:

CAN ID (29-bit)					4 bytes/8 bytes			
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	Dbyte 1	Dbyte 2	Dbyte 3	Dbyte 4
Frame ID	Query and response	Command code	Target node	Source node	-	-	-	-
1000B	1: query	05H	xxH	yyH	Data 1	Register address 1	Data 2	Register address 2
1000B	0: response	05H	yyH	xxH	-	-	-	-
4bit	1bit	8bit	8bit	8bit	16bit	16bit	16bit	16bit

  Read and write command can operate one register, address 1 and data 1.The corresponding data length is 4 bytes.

- Read and write to 32-bit registers
  The command that reads 32-bit registers (command code 14H) does not support broadcast address. The address and data are 32-bit. The frame structure is shown in the following table.

CAN ID (29-bit)					0 bytes/8 bytes	
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	Qbyte 1	Qbyte 2
Frame ID	Query and response	Command code	Target node	Source node	-	-
1000B	1: query	14H	xxH	yyH	Address	-
1000B	0: response	14H	yyH	xxH	Address	Data
4bit	1bit	8bit	8bit	8bit	32bit	32bit

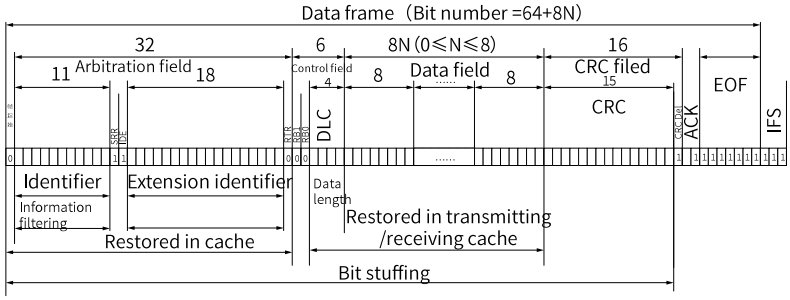
  The command that writes to 32-bit registers (command code 15H) supports broadcast address:

CAN ID (29-bit)					4 bytes/8 bytes	
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	Qbyte 1	Qbyte 2
Frame ID	Query and response	Command code	Target node	Source node	-	-
1000B	1: query	15H	xxH	yyH	Register address	Data

CAN ID (29-bit)					4 bytes/8 bytes	
bit28 to 25	bit24	bit23 to 16	bit15 to 8	bit7 to 0	Qbyte 1	Qbyte 2
1000B	0: response	15H	yyH	xxH	-	-
4bit	1bit	8bit	8bit	8bit	32bit	32bit

7.5.3.2 Communication Transmission Mode

The CANlink protocol is a CAN bus protocol for the application layer developed by Inovance. In the CAN communication network, the CAN controller determines the bus level based on the potential difference on the bus, which is the dominant level and the recessive level. When the bus is idle, all nodes can send data to the bus. When two devices send messages at the same time, the bus level is arbitrated. The data on the CAN bus is transmitted in the asynchronous and half-duplex transmission mode The data is transmitted in the CAN data frame structure. When the bus is idle, the bus level is the recessive level (logic 1). When the bus level is dominant, it indicates the start of frame (logic 0). CANlink is only applicable to the CAN extended frame structure and the 29-bit arbitration ID is used. Other types of frames are not specified. The maximum CANlink frame length is 64 to128 + 28 = 92 to156 bits:

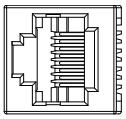


The built-in communication protocol of the AC drive is the CANlink slave communication protocol, which allows the AC drive to respond to the query command from the master or execute the action according to query command from the master and respond with communication data. The master can be Inovance PLC (H2U, H3U, AM600, etc.). The slave determines whether to process this data frame on the bus based on the target AC drive address specified in the data. The slave can communicate with the slave, and the master can communicate with a slave separately or broadcast messages to all the slaves. When the master sends a query command to a slave, the slave needs to return a response frame. For a broadcast message sent by the master, the slaves do not need to return a response to the master.

7.5.4 Hardware Configuration

7.5.4.1 Communication Ports

Dual RJ45 terminals are required for CANlink communication of the AC drive to enable the AC drive to connect to the high-speed CANlink communication network for field bus control.



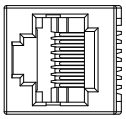


Figure 7-6 CANlink terminals

Table 7–5 CN1 terminal pins

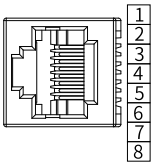
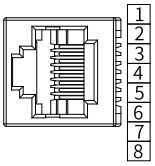
Terminal Mark	Pin No.	Pin Assignment	Terminal Name	Function	Layout
CN1	1	CANH	CAN_high	Connect to the CAN_high terminal.	
	2	CANL	CAN_low	Connect to the CAN_low terminal.	
	3	CGND	Power supply ground	It is used to connect to the reference ground of all CAN nodes.	
	4	485+	RS485+ input	Commission RS485 positive terminal.	
	5	485-	RS485- input	Commission RS485 negative terminal.	
	6	NC	-	-	
	7	NC	-	-	
	8	GND	Communi-cation ground	Communication ground	

Table 7–6 CN3 terminal pins

Terminal Mark	Pin No.	Pin Assignment	Terminal Name	Function	Layout
CN2	1	CANH	CAN_high	Connect to the CAN_high terminal.	
	2	CANL	CAN_low	Connect to the CAN_low terminal.	
	3	CGND	Power supply ground	It is used to connect to the reference ground of all CAN nodes.	
	4	485+	RS485+ input	Commission RS485 positive terminal.	
	5	485-	RS485- input	Commission RS485 negative terminal.	
	6	NC	-	-	
	7	10V	Power external operating panel SOP-20	Used to power the power external operating panel SOP-20	
	8	GND	Communi-cation ground	Communication ground	

Note

Before power-on, ensure the correct terminal assignment. The mismatch in the pin port will result in a connection failure and damage to the RJ45 network port circuit of both sides.

Table 7–7 DIP switches

Terminal Mark	Terminal Name	Function	DIP position
S1, S2	CAN termination resistor	Enable the termination resistor.	
		The termination resistor is disconnected.	

Note

The DIP switch is set from the top view with main terminal block at the bottom. The DIP switch is subject to the silk-screen on the board.

7.5.4.2 Networking Topology

CAN bus topology

Use the daisy chain mode for the CAN bus, as shown in the following figure. Use shielded twisted pair cables for the CAN bus, and use twisted pair cables for CANH and CANL signal cables. In the following

figure, the left termination resistor is set by the DIP switch or an external termination resistor is installed. The right termination resistor is also set by the DIP switch. Connect the CAN signal reference ground of all the nodes (up to 64 nodes) together.

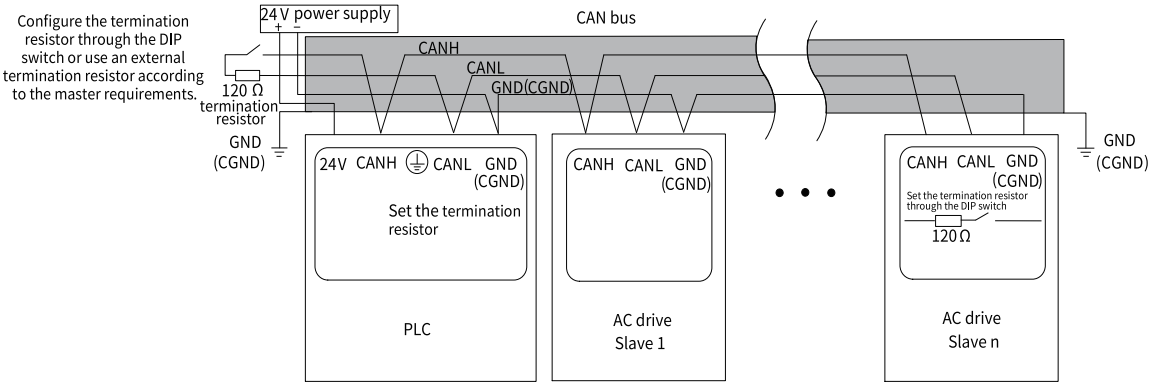
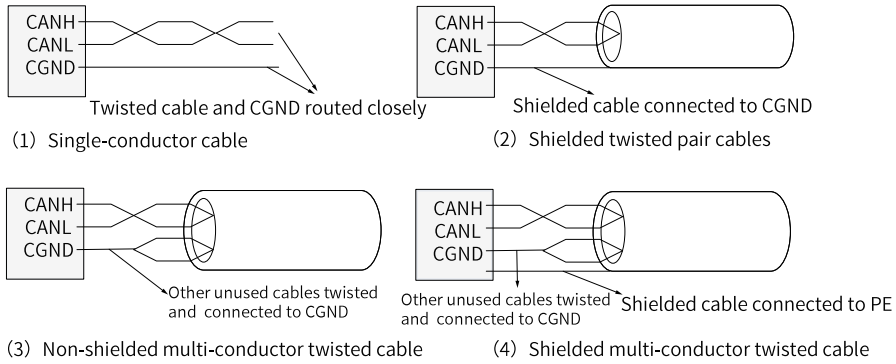


Figure 7-7 CAN bus topology

Recommended usage of different field cables:



Transmission distance

The transmission distance of the CANopen/CANlink bus is directly related to the baud rate and communication cable. The following table describes the relationship between the bus length and the baud rate.

Table 7–8 Relationship between the bus length and the baud rate

Baud Rate (bps)	Length (m)
1 M	25
500 k	100
250 k	250
125 k	500
100 k	500
50 k	1000
20 k	1000

7.5.5 Communication Parameters

Item	Name	Default	Value Range	Descriptions
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Value description 0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n3-01	CAN communication enable	1	0: Enable 1: Disable	Set whether CAN communication is enabled. Value description 0: Disable 1: Enable
n3-02	CAN station number	1	1 to 247	Sets the CAN communication station number.
n3-04	Number of CAN frames received per unit time	0	0 to 65535	Number of CAN frames received per unit time Additional information: This parameter is used to monitor the bus load. It defines the number of CAN frames received by the station per second.
n3-05	Maximum CAN receive error count	0	0 to 65535	Maximum CAN receive error count Additional information: Used to monitor bus errors. It defines the maximum number of error frames received by the node.
n3-06	Maximum CAN transmit error count	0	0 to 65535	Indicates the number of maximum CAN transmit errors. Additional information: Used to monitor bus errors. This parameter defines the maximum value of the CAN transmission error counter of the node.
n3-07	Number of CAN bus disconnections per unit time	0	0 to 65535	Indicates the number of CAN bus disconnections per unit time. Used to monitor bus errors. This parameter defines the CAN bus-off count of the node.

Item	Name	Default	Value Range	Descriptions
n3-10	CAN communication protocol selection	2	1: CANopen 2: CANlink	This parameter is used to select a CAN communication protocol. Value description 1: CANopen communication 2: CANlink communication
n3-26	CAN communication enable	0	0: Not supported by the current device 1: Enabled	Displays whether CAN communication is active.

7.5.6 Communication Configuration Examples

7.5.6.1 Configuration of CANlink Communication Between AC Drive and Easy

Prerequisite

- Log in to the official website of Inovance https://www.inovance.com/portal/allResult?key=Easy) to obtain the Easy programming software.
- Equipments: the AC drive, Easy series PLC, cables.

Wiring

Use twisted pair cables to connect the EASY to the CN1 or CN2 interface on the AC drive.

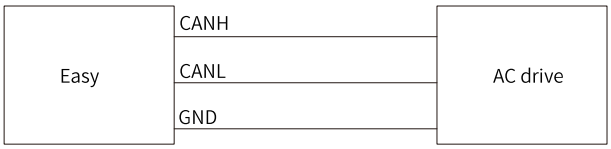
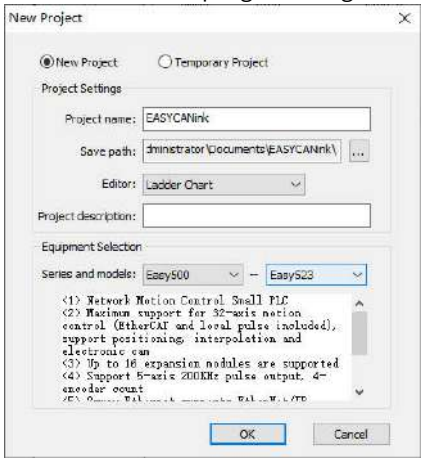


Figure 7-8 Connecting communication interfaces

Master and slave configuration

1. Open the PLC programming software AutoShop, click **New Project**, check that **Series and models** is **Easy 500** and **Easy523**, and click **OK** to enter the programming interface.



2. The CAN module is connected to the EXP-A port on Easy, as shown in the following figure.

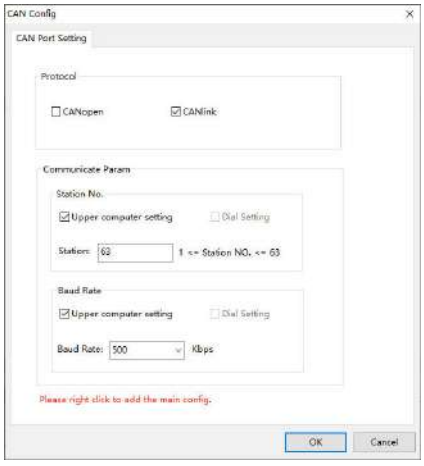


Click EXP-A in the left pane, select GE20-CAN-485 and click CAN(CANLink) to enter the CANlink communication setting interface, set parameters as follows, and then click **OK**.

Protocol: Select **CANlink.**

Station No.: Select **Upper computer setting**. Note that the CANlink station number of the PLC must be different from that of the AC drive.

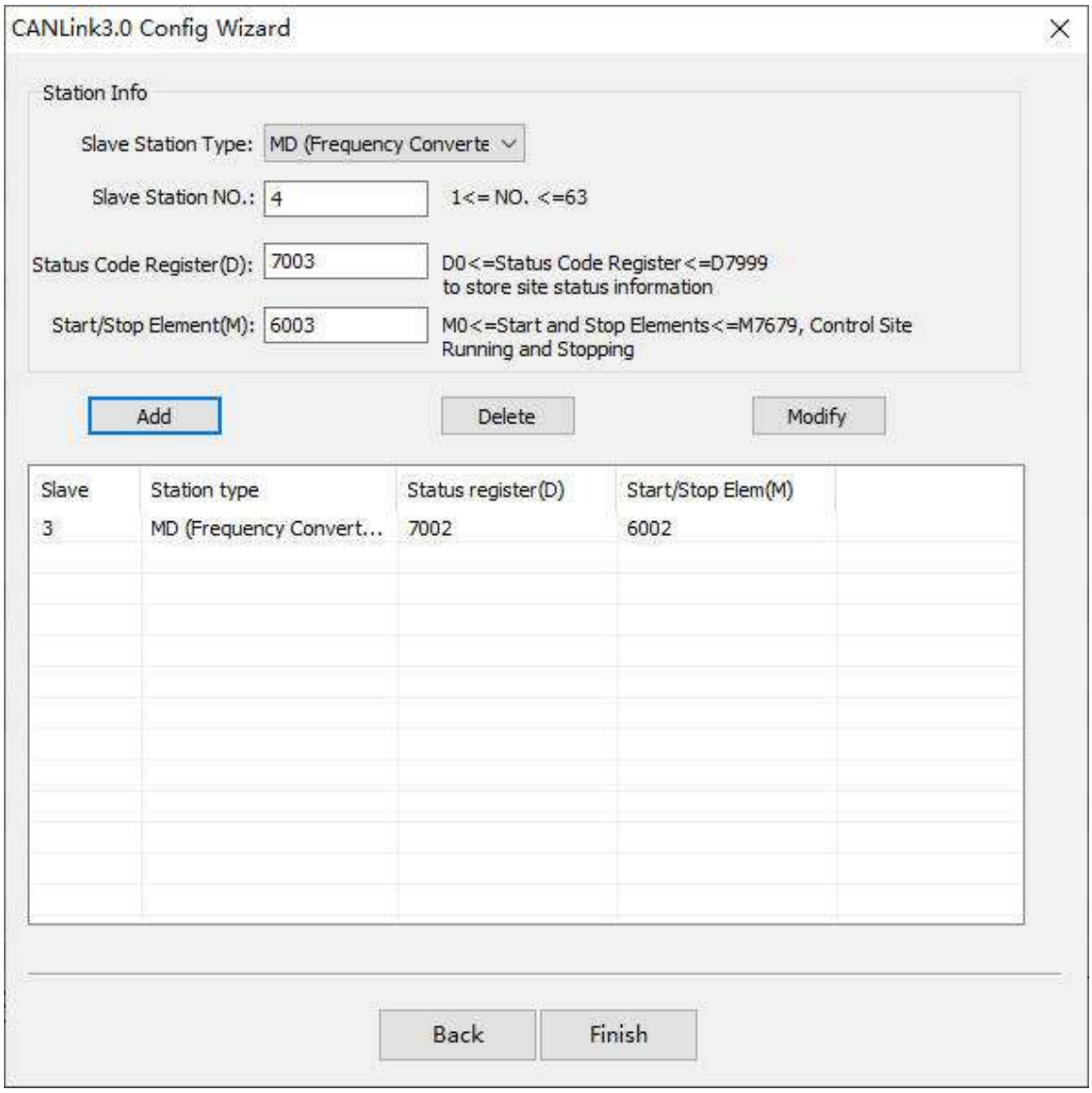
Baud Rate: Select **Upper computer setting**. (The communication baud rate must be consistent with the baud rate of the AC drive.)



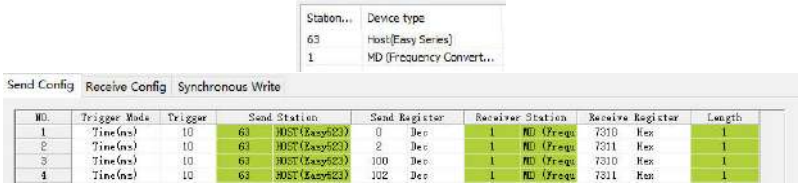
3. Click CAN(CANLink) and then click **Add CAN Config**, and CAN(CANLink) / CANlink Config is displayed. Double-click **CANlink Config**, click **Next** on the page displayed, and then set the parameters as follows on the page displayed next.

a. Set the slave type to MD (AC drive).
b. Set the slave number according to that defined by n3-02 of the AC drive.
c. Set the state register and start/stop component to 7000 and 6000.
d. Click **Add**, and click **Finish**.

In this way, a slave is added. If there are multiple shafts, repeat the preceding steps after clicking **Add**.



4. Write operation: After a slave is added, select the PLC to set the configuration to be written to the D element of the AC drive.



As shown in the preceding figure, assign the value of D2 to the control word address of the AC drive with the station number 1, and assign the value of D102 to the control word address of the AC drive with the station number 2. Write the corresponding register address as required, and make sure that the receiving register address is correct and writable; otherwise, the write operation will fail.

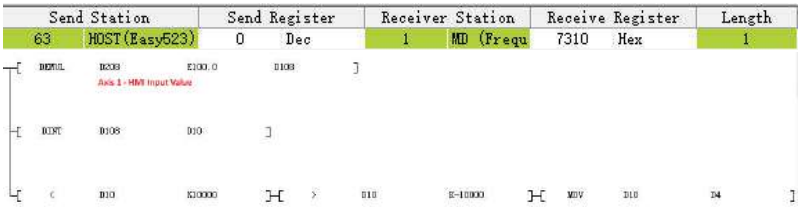
5. Read operation: Select the station (AC drive) to be read and enter the configuration interface for reading the D component of the AC drive. To read station 1, click number 1 to start configuration. To read station 2, click number 2 to start configuration. You cannot read the required value correctly if the station number is incorrect.



As shown in the preceding figure, the bus voltage, output voltage, and output frequency of the AC drive are sent to D300, D302, and D304 of the PLC. Configure the transmission register address and D component correctly as needed. After the read and write operation settings, keep clicking **OK** until you return to the programming interface.

Instances

1. Write the frequency (F0-29 is set to 9). Data conversion: Multiply the required frequency (a) by 100 to obtain an integer, and then write the integer to 7310H. The following figure shows the configuration and the program.



2. Start or stop the AC drive (F0-03 is set to 2). Assign a value to the D component corresponding to the station address 7311H to control forward running, reverse running, and stop of the AC drive through communication. The assignment includes 1: Run in forward direction; 2: Run in reverse direction; 3: Jog in forward direction; 4: Jog in reverse direction; 5: Coast to stop; 6: Decelerate to stop; 7: Reset upon fault The following figure shows the configuration and the program.



The PLC soft component address corresponding to 7311H is D2. Therefore, to control the AC drive to run in the forward direction through communication, write 1 to D2. Similarly, to control the AC drive to decelerate to stop, set D2 to 6.

3. Read the bus voltage. Based on the conversion rule, convert the bus voltage U0-02 to 7002 (convert U in the high-order 2 bits to 7, and convert the low-order 2 bits to a hexadecimal equivalent). The actual bus voltage is the read bus voltage (a) divided by 10. According to the communication configuration, the D component address of the bus voltage is D300. Convert D300 to a floating-point number and then divide this value by 10. The following figure shows the configuration and the program.



4. Read the output voltage. Convert the output voltage U0-03 to 7003 based on the conversion rule. The read value is the actual output voltage. According to the communication configuration, you only need to move the value of D302 to another D component (or not). The following figure shows the configuration and the program.



5. Read the output current. Convert the output current U0-04 to 7004 based on the conversion rule. The actual output current is the read output current divided by 100. The following figure shows the configuration and the program.



6. Read the AC drive state. Read 731CH to directly obtain the current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stopped). The following figure shows the configuration and the program.



7. Read the DI state. According to the conversion rule, convert the DI state U0-07 to 7007. Convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on. The following figure shows the configuration and the program.



8. Read the fault code. Convert the fault code U045 to 702D and convert the minor fault code U046 to 702E based on the conversion rule. The following figure shows the configuration and the program.



Common faults and solutions

Mandatory inspection items:

1. Check the wiring. Check whether other pins instead of CANH and CANL are connected to the PLC.
2. Check n3-10 for all stations. The value 1 indicates CANopen and 2 indicates CANlink.
3. Check whether the CAN communication baud rate defined by n3-00 is consistent with that of the PLC.
4. Check whether the CAN station number defined by n3-02 is unique to avoid conflicts with other AC drives.

Table 7–9 Common faults and solutions

Problem	Solution
Failure to write frequency	1. Check that F0-29 is set to 9 (Communication setting). Check U3-23 (1000H) or U3-16 (7310H) to make sure that both values are consistent with the written values.
	2. Check whether the termination resistor is connected. If not, switch on the termination resistor and then power on the AC drive again.
Failure to start the AC drive	1. Check that F0-03 is set to 2 (0: Operating panel; 1: Terminal; 2: Communication; 3. User-defined).
	2. Check whether the termination resistor is connected. If not, switch on the termination resistor and then power on the AC drive again.

Problem	Solution
Unstable connection	1. Ensure that wiring on the PLC end is reliable. Touch the connection cables on the PLC end to check for poor contact.
	2. Ensure that wiring on the AC drive end is reliable, and make sure that network cables are inserted tightly.
	3. Ensure that the signal cables are far away from the power cable.
Incorrect reading	1. Ensure that the address configured is correct.
	2. Ensure that the program performs data conversion.
	3. Ensure that the D component is not occupied.

7.6 CANopen Communication

7.6.1 Overview

The CAN fieldbus implements only the physical layer and the data link layer. CANopen is an application layer protocol based on the CAN fieldbus. The CANopen communication network generally consists of a master and a variable number of slaves (maximum 126). The master is responsible for the management of the entire network, and the slave is responsible for the underlying network communication and control tasks. The basic communication unit is the Communication Object in the CANopen protocol. Common communication objects include NMT, SYNC, EMERGENCY, TIME STAMP, SDO, and PDO. The Communication Object Identifier (COB-ID) is a CAN identifier that specifies the priority of objects and the identification of communication objects during communication. Each CANopen communication object has a default COB-ID.

7.6.2 Communication Specifications

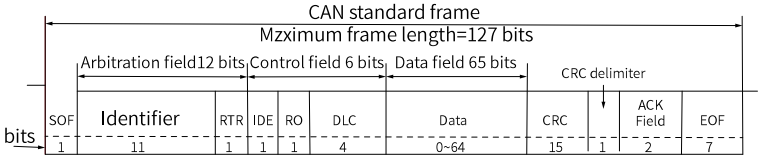
Item		Description
Functions supported by parameters	Setting node address	The node address is set manually, with a maximum of 127. It cannot be assigned automatically
	Setting baud rate	The baud rate is set manually and cannot be assigned automatically.
	Switchover between CANopen and CANlink	CAN communication mode is set manually.
State machine description	Emergency error code description/display	Time-Out, PDO-Lenth-Err
Baud rate	Baud rate: 20 kbps to 1 Mbps	20 kbps, 50 kbps, 100 kbps, 125 kbps, 250 kbps, 500 kbps, and 1 Mbps
SYNC	SYNC Consumer	Synchronous consumer signal
SDO	Enable domain upload/ download	Transmits data smaller than or equal to 4 bytes.
	SDO abort error	The SDO error code is reported according to different conditions.

Item		Description
PDO	Synchronize TPDO/RPDO	The synchronization number ranges from 1 to 240. The total TPDO/RPDO quantity is 4 by default, which is configurable.
	Asynchronous TPDO/RPDO	Time triggered, the total TPDO/RPDO quantity is 4 by default, which is configurable.
EMCY	Emergency message	Heartbeat timeout, PDO length error, node state switchover error, and application layer error
NMT	Bootup Service	Online message transmission is supported.
NMTErrCtl	Life Guard	Optional node protection (not used with heartbeat production)
	Heartbeat Consumer	Supports node heartbeat consumption.
	Heartbeat Producer	Supports node heartbeat production.
Expert mode	Configure the PDO communication parameters and their mapping through parameters.	Manually configure PDO communication parameters and their mapping.

7.6.3 Protocol Description

7.6.3.1 Communication Transmission Mode

CANopen is a high-level communication protocol on the controller area network (CAN). It adopts standard CAN frames and supports up to 127-bit data transmission. CANopen mainly uses frame types in the format of remote request frames and data frames. This product adopts data frames except for two scenarios where remote frames are used: 1. When the master node uses them to issue node protection requests to the slave node. 2. When they are used by synchronous production to transmit synchronous frames. For details of the frame format of each type of service, see *" Communication Data Frame Structure" on page 507*.



7.6.3.2 Communication Data Frame Structure

The AC drive specifies the corresponding method between parameters and object dictionaries, based on which you can determine their corresponding relationship. This facilitates operations on parameters.

The corresponding method between parameters and CANopen object dictionary indexes is described as follows:

- Corresponding method

The parameter groups of the AC drive correspond to indexes 0x2000 to 0x20FF of the CANopen object dictionary. The corresponding method is as follows: An object dictionary index is the high-order eight bits of a parameter address plus 0x2000; an object dictionary sub-index is the low-order eight bits of the parameter address plus 1.

For example, the communication address of n3-02 is 0x2302. The corresponding object dictionary index and sub-index are 0x2023 and 0x03, respectively.

- Corresponding parameter groups
  The AC drive includes twelve groups of parameters: F0 to F2, A0 to AF, b0 to bF, and C0 to CF. d0 to dF, E0 to EF, H1 to HB, n0 to nE, o0 to oC, P0 to P2, L0 to Ld, and U0 to U3.

  For parameter read/write operations, the mapping between parameter groups and object dictionary indexes is as follows.

Table 7–10 Correspondence between the parameter groups and the object dictionary indexes

Group No.	CANopen Object Dictionary Index
F0 to F2	0x20F0 to 0x20F2
A0 to AF	0x20A0 to 0x20AF
B0 to bA	0x20B0 to 0x20BA
C0 to CA	0x20C0 to 0x20CA
d0 to dF	0x20D0 to 0x20DF
E0 to EF	0x20E0 to 0x20EF
H1 to HB	0x2081 to 0x208B
n0 to nE	0x2020 to 0x202E
o0 to oC	0x2050 to 0x205C
P0 and P2	0x2060 to 0x2062
L0 to Ld	0x2090 to 0x209D
U0 to U3	0x2070 to 0x2073

A sub-index is the low-order 16 bits of a parameter address plus 1. The following table describes the corresponding relationship between parameter indexes in a group and the object dictionary sub-indexes.

Table 7–11 Corresponding relationship between parameter indexes in parameter groups and object dictionary sub-indexes

Parameter Index	CANopen Object Dictionary Index
0x0 to 0xFE	0x1 to 0xFF

7.6.3.2.1 Network Management System (NMT)

Only an NMT master node can send an NMTModuleControlNMT packet. *“Table 7–12” on page 509* shows the packet format. COB-ID is fixed at 0x000. Data0 is the command word, which occupies one byte. See *“Table 7–13” on page 509*. Data1 is a CANopen network device address occupying one byte. When it is 0, it indicates a broadcast message that is valid for all slaves in the network.

For example, the command for setting a device with device address "6" to operable state is "0x0000 x01 0x06".

Table 7–12 NMT message format

COB-ID	RTR	Data0	Data1
0x000	0	Command word	Node ID

Table 7–13 NMT packet command format

Command	Description
0x01	StartRemoteNode
0x02	StopRemoteNode
0x80	EnterPre-operationalState
0x81	ResetNode
0x82	ResetCommunication

7.6.3.2.2 Service Data Object (SDO)

The SDO message includes the read/write request message and the response to read/write (including the SDO termination message).

Take F0-02 as an example. When the value of F0-02 is read, the object dictionary index and sub-index are 0x20F0 and 0x03 respectively.

1. The communication master station uses a CANopen SDO to read data from the AC drive. The following table shows the format of data sent by the master.

Table 7–14 SDO object sent for the read operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	Node-ID (device address)
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Command code (0x40)	0x40 read command
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	0 is reserved.
	DATA5	Data 2	0 is reserved.
	DATA6	Data 3	0 is reserved.
	DATA7	Data 4	0 is reserved.

2. The following table shows the SDO responded by the slave to the read operation. If the operation is successful, the returned value of the command code is "0x4B". The index remains unchanged. DATA4 and DATA5 return the read data, and DATA6 and DATA7 return "0".

If the operation fails, the returned value of the command code returns "0x80". The index remains unchanged. DATA4, DATA5, DATA6, and DATA7 return an SDO failure error code.

Table 7–15 SDOs returned for the read operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"

CAN Frame		CANopen Data	Description
8-byte frame data	DATA0	Returned value of the command code	Correct: "0x4B"; Error: "0x80"
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	Success: 0, Failure: SDO operation failure error code
	DATA7	Data 4	

3. SDO for the write operation The CANopen SDO is used to perform the write operation on the AC drive. The following table describes the data format of the SDO sent by the master.

Table 7–16 SDO sent for the write operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Command code	0x2B
	DATA1	Low-order byte of index	Parameter group (0xF0 for group F0)
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	0 is reserved.
	DATA7	Data 4	0 is reserved.

4. The following table shows the SDO responded by the slave for the write operation. If the operation is successful, the command code returns "0x60". The index remains unchanged. DATA4, DATA5, DATA6, and DATA7 return "0".

If the operation fails, the command code returns "0x80". The index remains unchanged. DATA4, DATA5, DATA6, and DATA7 return an SDO failure error code.

Table 7–17 SDO returned for the write operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Returned value of the command code	Success: 0x60; Failure: 0x80
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Success: 0 Failure: SDO operation failure error code
	DATA5	Data 2	
	DATA6	Data 3	0 is reserved.
	DATA7	Data 4	

7.6.3.2.3 Process Data Object (PDO)

The AC drive supports four RPDOs (RPOD1, RPDO2, RPDO3, and RPDO4). and four TPDOs (TPOD1, TPDO2, TPDO3, and TPDO4). The COB-ID of each PDO is shown in the following table.

Table 7–18 PDO COB-ID table

PDO	COB-ID
RPDO1	0x200 + Node-ID
RPDO2	0x300 + Node-ID
RPDO3	0x400 + Node-ID
RPDO4	0x500 + Node-ID
TPDO1	0x180 + Node-ID
TPDO2	0x280 + Node-ID
TPDO3	0x380 + Node-ID
TPDO4	0x480 + Node-ID

You can configure PDO mapping manually using the master or expert mode as needed. Users who know the CANopen protocol can configure PDO mapping of the slave through the operating panel. It is recommended to use the CANopen master to configure mappings. You can also manually change parameters in group nE to configure PDO mappings. The following table shows the mapping relation of every PDO.

Table 7–19 PDO mapping

RPDO	Group nE Address		TPDO	Group nE Address	
RPDO1	Sub-index 1	nE-00	TPDO1	Sub-index 1	nE-32
		nE-01			nE-33
	Sub-index 2	nE-02		Sub-index 2	nE-34
		nE-03			nE-35
	Sub-index 3	nE-04		Sub-index 3	nE-36
		nE-05			nE-37
	Sub-index 4	nE-06		Sub-index 4	nE-38
		nE-07			nE-39
RPDO2	Sub-index 1	nE-08	TPDO2	Sub-index 1	nE-40
		nE-09			nE-41
	Sub-index 2	nE-10		Sub-index 2	nE-42
		nE-11			nE-43
	Sub-index 3	nE-12		Sub-index 3	nE-44
		nE-13			nE-45
	Sub-index 4	nE-14		Sub-index 4	nE-46
		nE-15			nE-47
RPDO3	Sub-index 1	nE-16	TPDO3	Sub-index 1	nE-48
		nE-17			nE-49
	Sub-index 2	nE-18		Sub-index 2	nE-50
		nE-19			nE-51
	Sub-index 3	nE-20		Sub-index 3	nE-52
		nE-21			nE-53
	Sub-index 4	nE-22		Sub-index 4	nE-54
		nE-23			nE-55

RPDO	Group nE Address		TPDO	Group nE Address	
RPDO4	Sub-index 1	nE-24	TPDO4	Sub-index 1	nE-56
		nE-25			nE-57
	Sub-index 2	nE-26		Sub-index 2	nE-58
		nE-27			nE-59
	Sub-index 3	nE-28		Sub-index 3	nE-60
		nE-29			nE-61
	Sub-index 4	nE-30		Sub-index 4	nE-62
		nE-31			nE-63

Each PDO can be configured with four mappings. To configure one mapping, you need to operate two parameters in group nE to implement 32-bit data, of which the high-order 16 bits (with a smaller parameter No.) are the object dictionary index, and the low-order 16 bits (with a larger parameter No.) are the object dictionary sub-index and object length. The object length is calculated in bits. The format of mapping objects is as follows:

Index	Sub-index	Object Length
High-order bits of the parameter in group nE	Low-order bits of the parameter in group nE	-

According to the preceding relation between the parameter and the object dictionary, when a parameter needs to be mapped to a PDO, you only need to write the object dictionary index and sub-index and data length corresponding to the parameter into group nE according to the preceding rules.

Take configurations of two mappings to RPDO1 as examples. One mapping is 0x7311 and the other mapping is 0x7310. The operation is as follows.

Table 7–20 Mapping example of group nE

Assumed Address	Group AF Address	Description	Remarks
0x7311	nE-00	0x2073	The parameter address index is 73+0x2000.
	nE-01	0x1210	High-order bit 12: Parameter group No. offset + 1 Low-order bit 10: 16-bit parameter length
0x7310	nE-02	0x2073	The parameter address index is 73+0x2000.
	nE-03	0x1110	High-order bit 11: Object dictionary sub-index Low-order bit 10: 16-bit object length

After the PDO and its mapping are configured correctly, the PDO data can be exchanged when the node is running. Take the RPDO1 mapping configuration as an example. If the control word (0x07311, If the value is 1) and the frequency is set (0x07310, the value is 1500), the data frame format of RPDO1 is as follows:

Table 7–21 Message sent by the master to read F0-02

Message ID (Hex)	Data (Hex)
0x200+Node-Id	01 00 dc 05

7.6.3.2.4 Synchronization Object (SYNC)

The following table lists the remote frames sent by the synchronous producer in the CANopen network.

COB-ID	RTR
0x80	1

Caution

This product does not support synchronous frame production.

7.6.3.2.5 Emergency (EMCY) Object Service

The emergency message format is as follows. (The COB-ID is 0x80+Node-ID.)

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x80+Node-ID	Node-ID (device address) set by the DIP switch
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Low-order byte of emergency error code	-
	DATA1	High-order byte of emergency error code	-
	DATA2	Error register	-
	DATA3	Predefined error code	-
	DATA4	Predefined error code	-
	DATA5	Predefined error code	-
	DATA6	Predefined error code	-
	DATA7	Predefined error code	-

Note

- Emergency error code: For details, see relevant chapters of the DS301 documentation. 0x8100 indicates the communication error, and 0xFF00 indicates predefined errors.
- Error register: For details, see the data value in 1001H of the object dictionary in relevant chapters of the DS301 documentation. Bit0 is the error flag, bit4 is the communication error flag, and bit7 is the predefined error.
- Vendor defined error code: The fault code of the AC drive.

Fault Code

See the following table for standard fault codes. For more details, see *"10.1 Parameter List" on page 560*.

Table 7–22 Fault code

Fault Code	Fault Name	Fault Code	Fault Name	Fault Code	Fault Name
2	Overcurrent	26	Cumulative running time reached	58	Self-check failure 3
5	Overvoltage	27	User-defined fault	59	Self-check failure 4
8	Pre-charge power supply fault	28	User-defined alarm	80	Fan fault
9	Undervoltage	29	Cumulative power-on time reached	85	Timing fault
10	AC drive overload	30	Output three-phase loss	93	Motor control error 1
11	Motor overload	31	PID feedback loss during operation	94	Motor control error 2

Fault Code	Fault Name	Fault Code	Fault Name	Fault Code	Fault Name
12	Input phase loss exists.	32	Parameter error	110	AC drive pre-overload
13	Output phase loss occurs.	40	Pulse-by-pulse current limit fault	111	Motor pre-overload
14	Overtemperature	42	Excessive speed deviation	114	Module pre-overtemperature
15	External fault	43	Motor overspeed	154	Input exception protection
18	The current sampling circuit abnormal	46	Load monitoring fault	159	Automatic reset fault
19	Motor parameter auto-tuning error	51	Error in identifying magnetic pole position	160	Modbus communication timeout
21	EEPROM fault	56	Self-check failure 1	161	CANopen fault
23	Output short-circuited to ground	57	Self-check failure 2	162	CANlink fault

7.6.3.2.6 Heartbeat Frame

A node can be configured to produce periodic heartbeat messages, in which bit 7 is 0, and bit 6 to bit 0 are the same as those of the NodeGuarding message. See *"Table 7–23" on page 514* for details. The heartbeat time is defined by the standard protocol object 0x1017. A node can support either the NodeGuarding protocol or the Heartbeat protocol.

Table 7–23 Heartbeat message

COB-ID	RTR	Data0
0x700+Node-ID	0	Status word

7.6.3.2.7 Node Protection

The standard protocol object 0x100C is used to set GuardTime and 0x100D is used to set the multiplication factor of GuardTime. The GuardTime and its multiplication factor jointly determine the node protection time period.

"Table 7–24" on page 514 shows a remote frame sent by the NMT master node.

Table 7–24 NodeGuarding packet sent by the master node

COB-ID	RTR
0x700+Node-ID	1

"Table 7–25" on page 514 shows a response packet returned from an NMT slave node. A status word occupies one byte, as shown in *"Table 7–26" on page 515*.

Table 7–25 NodeGuarding response packet returned from a slave node

COB-ID	RTR	Data0
0x700+Node-ID	0	Status word

Table 7–26 Status word returned by the NodeGuarding slave node

Data Bit	Description
bit7	0 or 1 alternative
Bit 6 to bit 0	Status (4: Stopped; 5: Operational; 127: Pre-operational)

7.6.4 Hardware Configuration

7.6.4.1 Communication Ports

The CAN communication module of the AC drive must be integrated on the control board and connected to the CAN network through an RJ45 interface for field bus control.

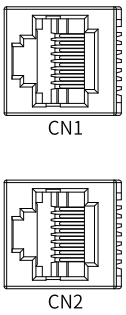


Figure 7-9 CANopen communication terminals

Table 7–27 CN1 terminal pins

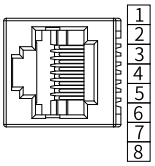
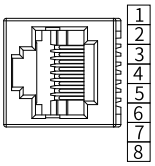
Type	Pin No.	Terminal Name	Assignment	Function Description	Layout
CN1	1	CANH	CAN_high	Connect to the CAN_high terminal.	
	2	CANL	CAN_low	Connect to the CAN_low terminal.	
	3	CGND	Power supply ground	It is used to connect to the reference ground of all CAN nodes.	
	4	485+	RS485+ input	Commission RS485 positive terminal.	
	5	485-	RS485- input	Commission RS485 negative terminal.	
	6	NC	-	-	
	7	NC	-	-	
	8	GND	Communi-cation ground	Communication ground	

Table 7–28 CN3 terminal pins

Type	Pin No.	Terminal Name	Assignment	Function Description	Layout
CN2	1	CANH	CAN_high	Connect to the CAN_high terminal.	
	2	CANL	CAN_low	Connect to the CAN_low terminal.	
	3	CGND	Power supply ground	It is used to connect to the reference ground of all CAN nodes.	
	4	485+	RS485+ input	Commission RS485 positive terminal.	
	5	485-	RS485- input	Commission RS485 negative terminal.	
	6	NC	-	-	
	7	10V	Power external operating panel SOP-20	Used to power the power external operating panel SOP-20	
	8	GND	Communi-cation ground	Communication ground	

Note

Before power-on, ensure the correct terminal assignment. The mismatch in the pin port will result in a connection failure and damage to the RJ45 network port circuit of both sides.

Table 7–29 DIP switches

Type	Terminal Name	Function	DIP position
S1, S2	CAN termination resistor	Enable the termination resistor.	
		The termination resistor is disconnected.	

Note

The DIP switch is set from the top view with main terminal block at the bottom. The DIP switch is subject to the silk-screen on the board.

7.6.4.2 Networking Topology

Communication networking

Use the daisy chain mode for the CAN bus, as shown in the following figure. Use shielded twisted pair cables for the CAN bus, and use twisted pair cables for CANH and CANL signal cables. In the following figure, the left termination resistor is set by the DIP switch or an external termination resistor is

installed. The right termination resistor is also set by the DIP switch. Connect the CAN signal reference ground of all the nodes (up to 64 nodes) together.

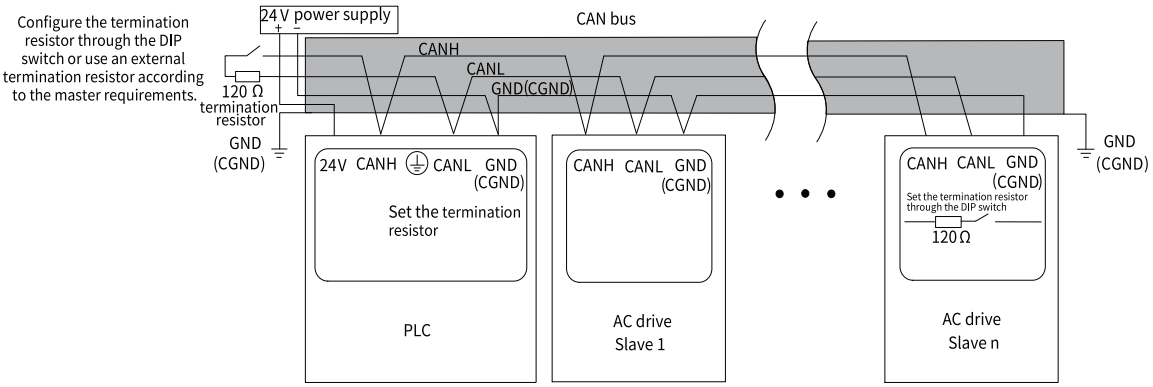
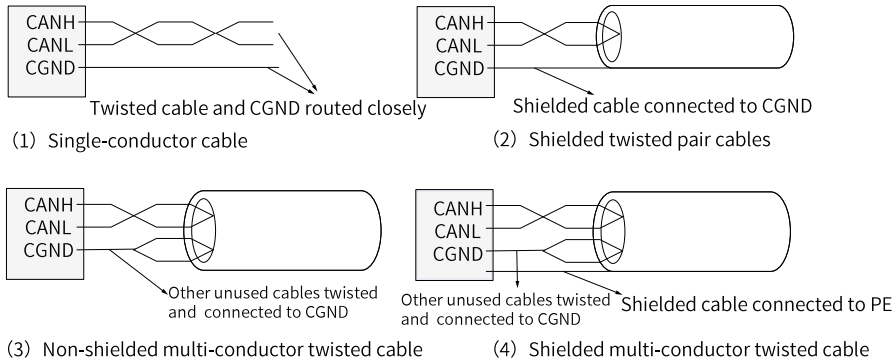


Figure 7-10 CAN bus topology

Recommended usage of different field cables:



Transmission distance

The transmission distance of the CANopen bus is directly related to the baud rate and communication cable. The following table describes the relationship between the bus length and the baud rate.

Table 7–30 Relationship between the bus length and the baud rate

Baud Rate (bps)	Length (m)
1 M	25
500 k	100
250 k	250
125 k	500
100 k	500
50 k	1000
20 k	1000

7.6.5 Communication Parameters

Item	Name	Default	Value Range	Descriptions
n3-00	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the speed of data transmitted between the host controller and the AC drive. Value description 0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps Additional information: The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.
n3-01	CAN communication enable	1	0: Enable 1: Disable	Sets whether CAN communication is enabled. Value description 0: Disable 1: Enable
n3-02	CAN station number	1	1 to 247	Sets the CAN communication station number.
n3-04	Number of CAN frames received per unit time	0	0 to 65535	Number of CAN frames received per unit time Additional information: This parameter is used to monitor the bus load. It defines the number of CAN frames received by the station per second.
n3-05	Maximum CAN receive error count	0	0 to 65535	Maximum CAN receive error count Additional information: Used to monitor bus errors. It defines the maximum number of error frames received by the node.
n3-06	Maximum CAN transmit error count	0	0 to 65535	Indicates the number of maximum CAN transmit errors. Additional information: Used to monitor bus errors. This parameter defines the maximum value of the CAN transmission error counter of the node.
n3-07	Number of CAN bus disconnections per unit time	0	0 to 65535	Indicates the number of CAN bus disconnections per unit time. Used to monitor bus errors. This parameter defines the CAN bus-off count of the node.

Item	Name	Default	Value Range	Descriptions
n3-09	CAN communication disconnection coefficient	3	1 to 15	This parameter sets for how many consecutive timeout periods in CANopen communication without data reception before an alarm is triggered.
n3-10	CAN communication protocol selection	2	1: CANopen 2: CANlink	This parameter is used to select a CAN communication protocol: The value 1 represents CANopen communication. The value 2 represents CANlink communication.
n3-14	CANopen mode	0	0: Default mode 1: Expert mode	Used to set CANopen user control mode. 0: Default mode 1: Expert mode
n3-15	CANopen inhibit time	0	0 to 65535	This parameter sets the inhibit time in CANopen expert mode in the unit of 100 μs.
n3-16	CANopen event time	0	0 to 65535	Used to set the event time of CANopen expert mode in ms.
n3-26	CAN communication enable	0	0: Not supported by the current device 1: Enabled	Displays whether CAN communication is active.

7.6.6 Communication Fault

7.6.6.1 Emergency Message and AC Drive Faults

When a fault occurs, CANopen sends an emergency message. For details on the format of the emergency message and the corresponding faults, see *"7.6.3.2.5 Emergency (EMCY) Object Service" on page 513*.

7.6.6.2 Simple Diagnosis

Description

The parameter n3-07 provides a simple diagnostic function that displays the number of CAN bus shutdown times due to strong interference after the AC drive is powered on.

Diagnosis

If the value is greater than 0 but does not continue to increase, the network has suffered strong interference for a long time. If the value is greater than 0 and increases within 5 minutes, the network is suffering interference or the configuration is incorrect, which requires troubleshooting.

Solution

Check all nodes for the same baud rate or address. Check whether the DIP switch is set correctly and in place and whether the baud rate and address of the master are set correctly. Check whether the

termination resistor is connected only to both ends of the bus. Power off all devices and check whether the resistance between CANH and CANL of the bus is between 50 Ω and 60 Ω by using a multimeter.

Check whether CANH and CANL of a node are reversely connected and whether CGND of the bus is connected (typically CGND terminals of all devices are connected together and not grounded).

7.6.7 Configuration for CANopen Communication Between AC Drive and Easy

Prerequisite

1. Log in to the official website of Inovance https://www.inovance.com/portal/allResult?key=Easy) to obtain the Easy programming software.
2. Equipments: the AC drive, Easy series PLC, cables.

Wiring

Use twisted pair cables to connect the EASY to the CN1 or CN2 interface on the AC drive.

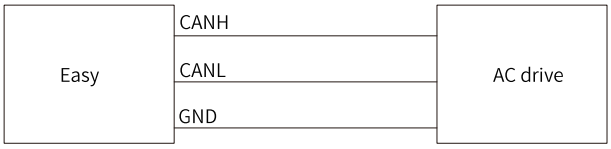
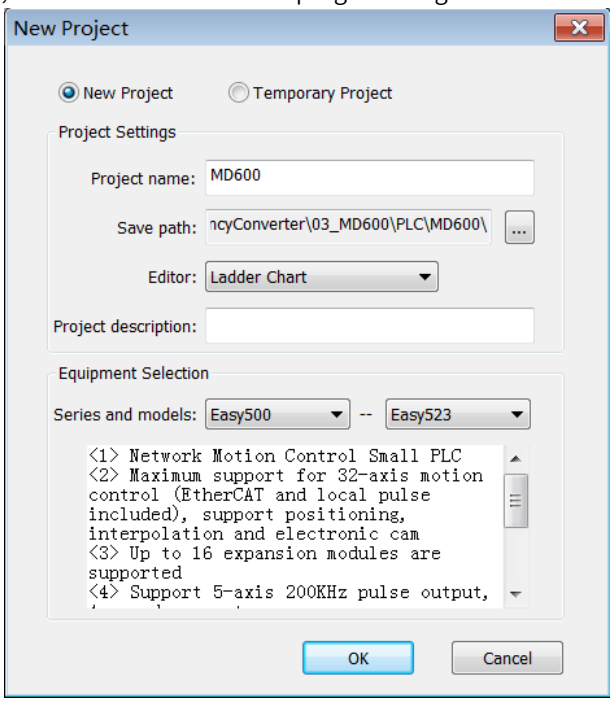


Figure 7-11 Connecting communication interfaces

Master and slave configuration

1. Open the PLC programming software AutoShop, click **New Project**, check that **Series and models** is **Easy 500** and **Easy523**, and click **OK** to enter the programming interface.



2. Click CAN(CANopen) in the left pane, set parameters as follows, and click **OK**.
   Protocol: Select **CANopen.**

Station No.: Select **Upper computer setting**. Note that the CANopen station number of the PLC must be different from that of the AC drive.

Baud Rate: Select **Upper computer setting**. (The communication baud rate must be consistent with the baud rate of the AC drive.)

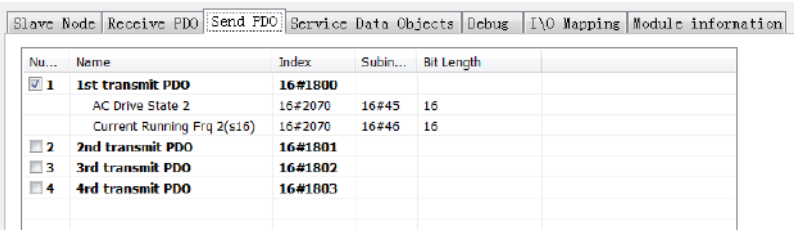
3. Configure the master and slave. Click CAN(CANopen) , and click **AddCAN Config**.

   CAN(CANopen)
   CANOpen Config is displayed. Double-click **CANopen Config**, and double-click the AC drive slave in the **CANopen Device List** on the right.

4. Configure the RPDOs and TPDOs of the slave. Double-click the slave to configure.

   RPDO: The PDOs for writing the running frequency and control commands are added by default.

   TPDO: Click to send PDO. The AC drive status and output frequency are added by default.

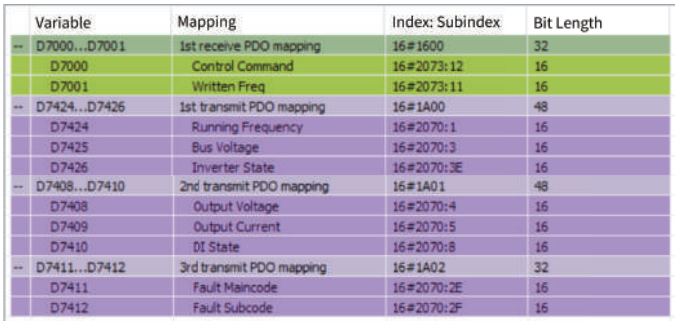


Caution

Only four PDOs can be added to each group. As the annotation of the EDS file used during configuring the PDO may be wrong, it is recommended to check the PDOs again based on parameters after all the PDOs are added.

5. I/O Mapping

   This step is to map data (that is, the value to be read or written) in the PDO. The D component is used as a bridge to implement data exchange between the PLC and the AC drive. The Easy high-performance small-sized PLC of Inovance automatically performs I/O mapping based on the configured PDOs. Therefore, you only need to click the I/O mapping to determine the D component to perform the read and write operations on the D component.



Instances

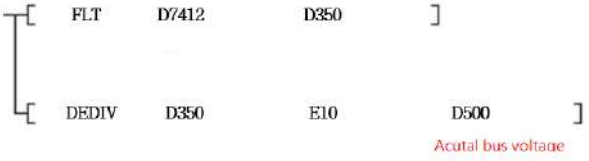
1. Write frequency (n0-14 is set to 2 and A0-70 is set to 2). For example, if you write 1000, the frequency written is 10 Hz and to D7001).



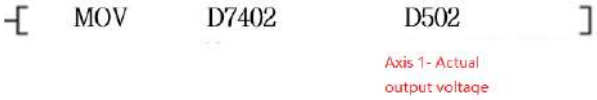
2. Start or stop the AC drive. Assign a value to the D component corresponding to the control word of the desired station to control forward running, reverse running, and stop of the AC drive through communication. The assignment includes 0: Coast to stop; 1: Run in forward direction; 2: Run in reverse direction; 3: Jog 1; 4: Jog 2; 5: Coast to stop; 6: Stop according to the stop mode; 7: Reset upon fault; 8: Emergency stop. The PLC soft component address corresponding to the control word is D7000. Therefore, to control the AC drive to run in forward direction through communication, write 1 to D7000. Similarly, to control the AC drive to stop, set D7000 to 5.



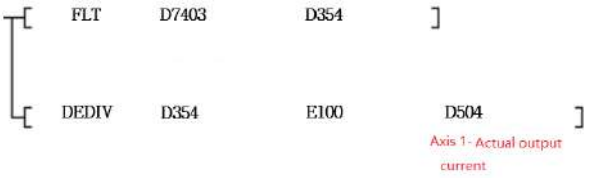
3. Read the bus voltage. The actual bus voltage is the read bus voltage (a) divided by 10. According to the communication configuration, the D component address of the bus voltage is D7412. Convert D7412 to a floating-point number and then divide this value by 10.



4. Read the output voltage. According to the communication configuration, you only need to move the value of D7402 to another D component (or not).



5. Read the output current. According to the conversion rule, the actual output current is the read output current divided by 100.



6. Read the AC drive state. Based on the IO mapping, read D7413 to directly obtain the current state of the AC drive (1: Running in forward direction; 2: Running in reverse direction; 3: Stop; 4: Auto-tuning; 5: Fault).



7. Read the DI state. According to the conversion rule, the DI state maps to D7404 based on the I/O mapping. Convert the read value into a binary value. The LSB indicates DI1, the second bit indicates DI2, and so on.



Common faults and solutions

Mandatory inspection items:

1. Check the wiring to prevent that other pins instead of CANH and CANL are connected to the PLC.
2. Check n3-10 for all stations. The value 1 indicates CANopen and 2 indicates CANlink.
3. Check the CAN communication baud rate defined by n3-00 is consistent with that of the PLC.
4. Check the CAN station number defined by n3-02 is unique to avoid conflicts with other AC drives.

Table 7–31 Common faults and solutions

Problem	Solution
Unstable connection	1 Ensure that wiring on the PLC end is reliable. Touch the connection cables on the PLC end to check for poor contact. 2 Ensure that wiring on the AC drive end is reliable, and make sure that network cables are inserted tightly. 3 Ensure that the signal cables are far away from the power cable.
Incorrect reading	1 Ensure that the address configured is correct. 2 Ensure that the program performs data conversion. 3 Ensure that the D component is not occupied. 4 Check the D component of I/O mapping.

8 Troubleshooting

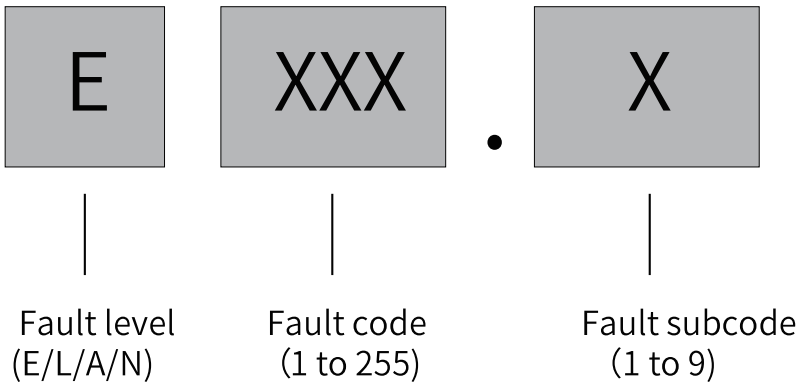
8.1 Fault Level and Display

8.1.1 Fault Levels

Faults are divided into four types depending on the degree of urgency.

- Error: Used to indicate that a major fault or error has occurred and the device stops running immediately. You should troubleshoot the fault as soon as possible.
- Limit: The device has encountered a minor fault and can continue to run after derating. However, the running results may deviate from the settings. There are four modes: Speed-limited operation, power-limited operation, current-limited operation, and torque-limited operation.
- Alarm: Indicates that an alarm has occurred, which does not affect the operation state. You can handle alarms as needed.
- Notice: Used to indicate that an abnormality has occurred, but normal operation is not affected. You can determine the subsequent handling plan.

A fault code is represented in four segments, as shown in the following figure. E indicates an error (fault), L indicates a limit (minor fault), A indicates an alarm, and N indicates a notice.



E is the fault level and is indicated by a letter. The urgency level of the fault ranges from high to low, and E - error, L - limit, A - alarm, and N - notice.

XXX is the fault code, which is represented by three digits.

X is the fault subcode and is represented by a single digit. The fault code and fault subcode are separated by a decimal point. A combination of the above three codes indicates a complete fault code.

8.1.2 Fault display

When the AC drive is in an abnormal state, the fault protection action set in group H1 is executed and the fault code is displayed in the operating panel. When the fault type is Error, the fault indicator  on the operating panel is also on. As shown in the figure, E002.1 indicates the AC drive hardware overcurrent.



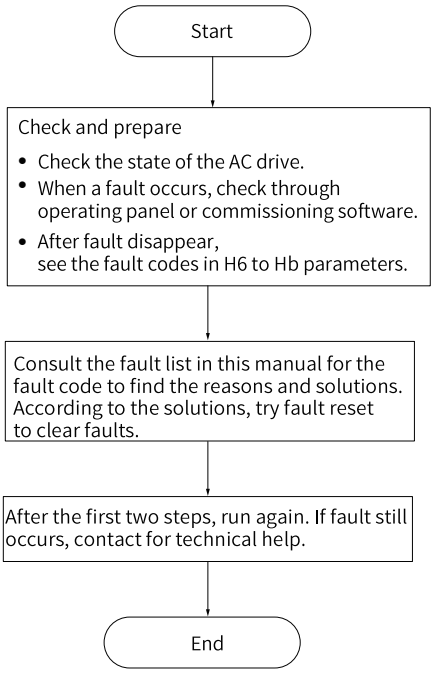
Figure 8-1 Display of faults

Caution

Do not repair or modify the AC drive by yourself. In case of any fault that cannot be rectified, contact the agent or Inovance for technical support.

8.2 Troubleshooting

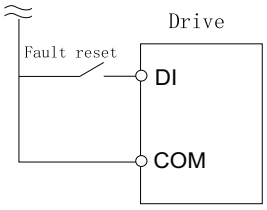
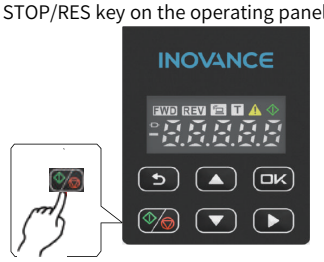
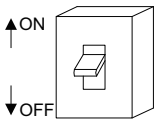
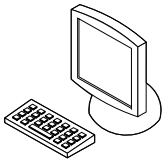
The following figure shows the troubleshooting process.



8.3 Fault Reset

View the current fault code, fault subcode, fault information, minor fault code, minor fault subcode, minor fault information, warning code, warning subcode, warning information through the operating panel.

Table 8–1 Fault view and start method after fault occurrence

Stage	Solution	Status
Faulty	Fault display: View the current fault code, fault subcode, fault information, minor fault code, minor fault subcode, minor fault information, warning code, warning subcode, warning information through the operating panel.	View the record through A1-00 to A1-47.
	Fault record: View the fault code, fault subcode, fault information, frequency, current, bus voltage, input terminal status, output terminal status, AC drive status, power-on time, running time, status word A, status word B, and command word of the last six faults through the operating panel.	View the record through groups H6 to Hb.
Before fault reset	Find the fault cause according to the fault code displayed on the operating panel and eliminate the fault. Then, reset the AC drive.	/
Reset mode to clear faults	1. Allocate function 9 (Fault reset) to the DI by setting any of E0-00 to E0-04 to 9.	
	2. Reset the fault through the LED panel.	Press the STOP/RES key on the operating panel. 
	3. Power off and then power on the AC drive for automatic reset. Disconnect the main circuit power supply. Wait until the fault code disappears, and then connect the power supply again.	
	4. Reset the drive through communication. When b1 (Command source) is set to 2 (Communication control), write "16" (bit4 fault reset) to communication address 7321H using the host controller to reset the AC drive after the fault is cleared.	

8.4 List of Faults and Alarms

For complete information on fault and alarm codes, see *MD600 Series Compact AC Drive Parameter Guide.*

Table 8–2 List of fault codes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E002.1	Hardware overcurrent	0: Coast to stop	0: Coast to stop	Yes
E002.2	Software overcurrent	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E005.1	Bus overvoltage	0: Coast to stop	0: Coast to stop	Yes
E008.1	Frequent contactor action	0: Coast to stop	0: Coast to stop	Yes
E009.1	Undervoltage	0: Coast to stop	0: Coast to stop	Yes
E009.3	Pre-drive timeout	0: Coast to stop	0: Coast to stop	Yes
E010.1	AC drive overload	0: Coast to stop	0: Coast to stop	Yes
E011.1	Motor overload	0: Coast to stop	0: Coast to stop	Yes
E012.1 / A012.1 / L012.1 / N012.1	Input phase loss exists.	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E013.1	U phase loss	0: Coast to stop	0: Coast to stop	Yes
E013.2	V phase loss	0: Coast to stop	0: Coast to stop	Yes
E013.3	W phase loss	0: Coast to stop	0: Coast to stop	Yes
E014.1	AC drive overtemperature	0: Coast to stop	0: Coast to stop	Yes
E015.1 / A015.1 / L015.1 / N015.1	External fault 1	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E015.2 / A015.2 / L015.2 / N015.2	External fault 2	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E018.1	Current detection circuit fault	0: Coast to stop	0: Coast to stop	Yes
E019.1	Motor parameter auto-tuning times out.	0: Coast to stop	0: Coast to stop	Yes
E019.2	Motor parameter auto-tuning interrupted	0: Coast to stop	0: Coast to stop	Yes
E019.4	An exception occurs during back EMF auto-tuning.	0: Coast to stop	0: Coast to stop	Yes
E019.3	Overcurrent during auto-tuning	0: Coast to stop	0: Coast to stop	Yes
E019.5	Incorrect motor type	0: Coast to stop	0: Coast to stop	Yes
E019.6	The current sampling phase-to-phase gain deviation auto-tuning error occurs.	0: Coast to stop	0: Coast to stop	Yes
E019.7	No-load current auto-tuning beyond the limit	0: Coast to stop	0: Coast to stop	Yes
E021.1	Uninterrupted operation on the EEPROM timeout	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.2	EEPROM read error	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.3	An EEPROM write error occurs.	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.4	The number of write-read operations on the EEPROM exceeds the setpoint within 1s.	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes
E021.5	EEPROM beyond the limit	0: Coast to stop 2: Quick stop 3: Decelerate to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E023.1	The AC drive output is short-circuited to ground.	0: Coast to stop	0: Coast to stop	Yes
E026.1 / A026.1 / L026.1 / N026.1	Operating time reached	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.1 / A027.1 / L027.1 / N027.1	User-defined fault 1	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.2 / A027.2 / L027.2 / N027.2	User-defined fault 2	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E027.3 / A027.3 / L027.3 / N027.3	User-defined fault 3	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.4 / A027.4 / L027.4 / N027.4	User-defined fault 4	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.5 / A027.5 / L027.5 / N027.5	User-defined fault 5	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E027.6 / A027.6 / L027.6 / N027.6	User-defined fault 6	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.7 / A027.7 / L027.7 / N027.7	User-defined fault 7	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E027.8 / A027.8 / L027.8 / N027.8	User-defined fault 8	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E028.1 / A028.1 / L028.1– N028.1	User-defined alarm 1	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E028.2 / A028.2 / L028.2 / N028.2	User-defined alarm 2	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E028.3 / A028.3 / L028.3 / N028.3	User-defined alarm 3	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E028.4 / A028.4 / L028.4 / N028.4	User-defined alarm 4	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E028.5 / A028.5 / L028.5 / N028.5	User-defined alarm 5	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E028.6 / A028.6 / L028.6 / N028.6	User-defined alarm 6	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E028.7 / A028.7 / L028.7 / N028.7	User-defined alarm 7	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E028.8 / A028.8 / L028.8 / N028.8	User-defined alarm 8	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E029.1 / A029.1 / L029.1 / N029.1	Cumulative power-on time reached	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E030.1 / A030.1 / L030.1 / N030.1	Output three-phase loss	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E031.1 / A031.1 / L031.1 / N031.1	PID feedback loss during operation	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E032.1 / A032.1 / L032.1 / N032.1	The parameter is reset improperly.	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E032.2 / A032.2 / L032.2 / N032.2	Parameter backup error	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E032.3 / A032.3 / L032.3 / N032.3	Parameter power-off error	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E032.4 / A032.4 / L032.4 / N032.4	Parameter setting error	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E032.6 / A032.6 / L032.6 / N032.6	Parameter check error upon power-on	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E032.7 / A032.7 / L032.7 / N032.7	Parameter backup invalid	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E032.8 / A032.8 / L032.8 / N032.8	Parameter initialization exception at power-on	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	No
E040.1	Pulse-by-pulse current limit fault	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E042.1 / A042.1 / L042.1 / N042.1	Excessive speed deviation	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E042.2 / A042.2 / L042.2 / N042.2	Actual speed opposite to the set speed	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E043.1 / A043.1 / L043.1 / N043.1	Motor overspeed	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E043.2 / A043.2 / L043.2 / N043.2	Asynchronous motor (SVC) stall	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E046.1	Load monitoring overload fault	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
A046.2	Load monitoring overload alarm	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E046.3	Load monitoring load loss fault	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
A046.4	Load monitoring load loss alarm	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E051.1	Magnetic pole position auto-tuning abnormal	0: Coast to stop	0: Coast to stop	Yes
E056.1	Self-test interruption	0: Coast to stop	0: Coast to stop	Yes
E056.2	Self-test: IGBT V phase upper bridge short circuited	0: Coast to stop	0: Coast to stop	Yes
E056.3	Self-test: IGBT V phase lower bridge short circuited	0: Coast to stop	0: Coast to stop	Yes
E056.4	Self-test: IGBT U phase upper bridge short circuited	0: Coast to stop	0: Coast to stop	Yes
E056.5	Self-test: IGBT U phase lower bridge short circuited	0: Coast to stop	0: Coast to stop	Yes
E056.9	Self-test: Output phase loss occurs	0: Coast to stop	0: Coast to stop	Yes
E057.1	Self-test: U phase upper bridge or V phase lower bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E057.2	Self-test: U phase lower bridge or V phase upper bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes
E057.3	Self-test: V phase upper bridge or W phase lower bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes
E057.4	Self-test: V phase lower bridge or W phase upper bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes
E057.5	Self-test: W phase upper bridge or U phase lower bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes
E057.6	Self-test: W phase lower bridge or U phase upper bridge IGBT energization failure	0: Coast to stop	0: Coast to stop	Yes
E057.7	Self-test: U/V phase output short-circuit	0: Coast to stop	0: Coast to stop	Yes
E057.8	Self-test: V/W phase output short-circuit	0: Coast to stop	0: Coast to stop	Yes
E057.9	Self-test: W/U phase output short-circuit	0: Coast to stop	0: Coast to stop	Yes
E058.1	Self-test: U phase current sensor inversely installed	0: Coast to stop	0: Coast to stop	Yes
E058.2	Self-test: V phase current sensor inversely installed	0: Coast to stop	0: Coast to stop	Yes
E058.3	Self-test: W phase current sensor inversely installed	0: Coast to stop	0: Coast to stop	Yes
E058.4	Self-test: U/V phase current sensors misaligned	0: Coast to stop	0: Coast to stop	Yes
E058.5	Self-test: V/ W phase current sensors misaligned	0: Coast to stop	0: Coast to stop	Yes
E058.6	Self-test: W/ U phase current sensors misaligned	0: Coast to stop	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E059.1 / A059.1 / L059.1 / N059.1	V/W phase imbalance	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E059.2 / A059.2 / L059.2 / N059.2	Self-test: U/W phase imbalance	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E059.3 / A059.3 / L059.3 / N059.3	Self-test: U/V phase imbalance	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E080.1 / A080.1 / L080.1 / N080.1	Fan fault	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	15: Ignore fault	Yes
E085.4 / A085.4 / L085.4 / N085.4	Internal fault	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	15: Ignore fault	Yes
E093.1 / A093.1 / L093.1 / N093.1	Motor stall	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E093.2 / A093.2 / L093.2 / N093.2	Motor stall	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E093.3 / A093.3 / L093.3 / N093.3	Current control error	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E094.1 / A094.1 / L094.1 / N094.1	Inconsistency between calculated and set number of pole pairs	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E094.2 / A094.2 / L094.2 / N094.2	Mismatch among the motor power, voltage, and current.	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E094.3 / A094.3 / L094.3 / N094.3	No-load current error	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E094.4 / A094.4 / L094.4 / N094.4	Mutual inductance and no-load current inconsistent with the rated voltage	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E094.5 / A094.5 / L094.5 / N094.5	Rotor resistance abnormal	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E110.1 / A110.1 / L110.1 / N110.1	Inverter pre-overload	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E111.1 / A111.1 / L111.1 / N111.1	Motor pre-overload	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E114.1 / A114.1 / L114.1 / N114.1	Module pre-overtemperature	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	13: Display warning	Yes
E154.1 / A154.1 / L154.1 / N154.1	HDI wire breakage	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	15: Ignore fault	Yes
E154.3 / A154.3 / L154.3 / N154.3	AI1 abnormal	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	15: Ignore fault	Yes

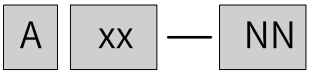
Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E160.1 / A160.1 / L160.1 / N160.1	Modbus communication timeout	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E161.1 / A161.1 / L161.1 / N161.1	The CANopen heartbeat times out.	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E161.2 / A161.2 / L161.2 / N161.2	CANopen PDO mapping	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E162.1 / A162.1 / L162.1 / N162.1	CANlink heartbeat message timeout	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E162.2 / A162.2 / L162.2 / N162.2	CANlink station number conflict	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes
E163.1	Modbus-RTU communication timeout (RJ45)	0: Coast to stop	0: Coast to stop	Yes
E189.1 / A189.1 / L189.1 / N189.1	Debug software communication fault	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop 4-8: Reserved 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Display warning 14: Notification 15: Ignore fault	0: Coast to stop	Yes

Fault Code	Fault Name	Fault Level Range	Default fault level	Resettable
E193.1	Undervoltage caused by voltage sag	0: Coast to stop	0: Coast to stop	Yes
E195.1	Parameter downloading interrupted	0: Coast to stop	0: Coast to stop	Yes

9 Function Parameter

Parameters of the AC drive are grouped by function and displayed in three levels of menus, as shown below:



- A indicates the level-I menu, which is represented by one letter and corresponds to a group of complete functions.
- XX indicates the level-II menu, which is represented by one or two digits, corresponding to the function category when combined with level-I menus.
- NN indicates the level-III menu, which is represented by a a 2-digit number, corresponding to a certain parameter when combined with level-I and level-II menus.

Level-II and level-III menus are usually separated by the symbol "-".

The following table lists the parameter categories. Group F parameters are common parameters, which are common parameters from other groups for easy commissioning.

Level-I Group Name	Level-I Group Description	Level-II Group Name	Level-II Group Description	Remarks
F	Common parameter	F0	F0: Basic commissioning parameter	Basic parameters for motor commissioning
		F1	Basic motor parameter	Basic parameters of motor information
		F2	Motor control parameter	Basic parameters for motor control
A	System	A0	Parameter management	Management of user-defined parameters and device initialization
		A1	Fault and warning	Current fault
		A2	System information	Store the current system information
		A3	Model information	Set the AC drive model and related parameters
		A4	Hardware configuration	AC drive fan and braking unit setting
		A5	Carrier frequency and pulsing configuration	Set carrier frequency and wave generation of the AC drive
		A6	Operating panel and display	Set the operating panel
		A8	Oscilloscope trigger	Trigger oscilloscope function
		AE	User-defined parameters	Set user-defined parameters

Level-I Group Name	Level-I Group Description	Level-II Group Name	Level-II Group Description	Remarks
b	Command Channel	b0	Configure command channel	Configuration of the AC drive command
		b1	Main command word of control channel 1	Command configuration for channel 1 of the AC drive
		b2	Auxiliary command word of control channel 1	Auxiliary command configuration for channel 1 of the AC drive
		b3	Main command word of control channel 2	Command configuration for channel 2 of the AC drive
		b4	Auxiliary command word of control channel 2	Auxiliary command configuration for channel 2 of the AC drive
		b5	Set channel 1	Setting for channel 1 of the AC drive
		b6	Set channel 2	Setting for channel 2 of the AC drive
		b7	Ramp (acceleration/ deceleration) setting	Ramp acceleration/deceleration setting of the AC drive
		b8	Multi-reference	Multi-reference value of the AC drive frequency
		b9	Terminal start/stop module	Terminal start/stop settings
C	Motor parameter	C2	Auto-tuning and self-test	Motor auto-tuning
		C4	Basic motor parameter	Setting basic motor parameters
		C5	Motor expansion parameter	Motor expansion parameter setting
d	Motor control	d0	Motor basic control	Setting basic motor control parameters
		d1	Motor limit and protection	Setting motor parameter limit and protection
		d2	Motor V/f control	Setting motor V/f control parameters
		d3	Motor speed control	Motor speed control
		d4	Motor current control	Setting motor current control parameters
		d5	Motor excitation control	Setting motor excitation control parameters
		d6	Motor Model	Setting motor model parameters
		d7	Motor control optimization	Motor control optimization parameters
E	Input/Output	E0	DI	Setting input terminal
		E1	DO/RO	Setting output terminal
		E2	AI	Setting analog input terminal
		E3	AO	Setting analog output terminal
		E4	HDI (DI4)	Setting high-speed input terminal
		E6	Terminal auxiliary function	Auxiliary function of terminals
		EE	Input and output correction (user)	Input and output correction (user)

Level-I Group Name	Level-I Group Description	Level-II Group Name	Level-II Group Description	Remarks
H	Protection and auxiliary	H1	Fault levels	AC Drive fault level settings
		H2	User-defined fault	User-defined fault setting
		H3	Automatic fault reset/restart	Automatic fault reset/restart settings
		H6	Historical fault record 1	Information of current fault
		H7	Historical fault record 2	Information of the latest fault
		H8	Historical fault record 3	Information of 2nd to last fault
		H9	Historical fault record 4	Information of the 3rd to last fault
		HA	Historical fault record 5	Information of the 4th to last fault
		Hb	Historical fault record 6	Information of the 5th to last fault
n	Communica-tion Configuration	n0	Communication general configuration	Communication general configuration
		n1	Commissioning communication	Communication commissioning parameters
		n2	Modbus Communication	Parameters related to Modbus communication
		n3	CAN communication	CAN communication parameter
		nE	Process data address mapping parameters	Mapping address setting
o	Free function block	o6	Logic operation 1	Parameter 1 related to logic operation
		o7	Logic operation 2	Parameter 2 related to logic operation
P	Application function	P0	Auxiliary function	AC Drive auxiliary function setting
		P1	Simple PLC	Simple PLC setting
		P2	Process PID	AC drive process PID parameter setting
L	Connector	L0	Bit connector 1	Observation bit connector 1
		L1	Bit connector 2	Observation bit connector 2
		L3	Bit connector 4	Observation bit connector 4
		L4	Bit connector 5	Observation bit connector 5
		L5	Word connector 1	Observation word connector 1
		L6	Word connector 2	Observation word connector 2
		L7	Word connector 3	Observation word connector 3
		L9	Double-word connector 1	Observation double-word connector 1
		Lb	Float connector 1	Observation float connector 1
		LC	Float connector 2	Observation float connector 2
		Ld	Float connector 3	Observation float connector 3

Level-I Group Name	Level-I Group Description	Level-II Group Name	Level-II Group Description	Remarks
U	Common monitoring	U0	General monitoring parameter 0	Monitoring parameter connector 0
		U2	General monitoring parameter 2	Monitoring parameter connector 2
		U3	General monitoring parameter 3	Monitoring parameter connector 3

Note

Group F parameters are common parameters, which are common parameters from other groups for easy commissioning. For example, group F1 parameters are mainly the mapping of group C (motor parameters) in group F. When setting the basic motor parameters, you can set them in group F or group C. The settings of the two parameter groups are equivalent and the parameter values are automatically synchronized.

9.1 Parameter Permission and Lock

This product supports parameter access permission classification. The parameters available at different levels are different. You can switch to the corresponding access level for operation and maintenance. When switching to a higher level of permission, the operating people shall possess the necessary knowledge and skills for operating the AC drive. Therefore, access can be secured by setting a password to prevent unauthorized modifications to the expert parameters.

This product supports parameter lock. You can customize the parameter lock password. After the parameter lock is activated, access to and modification of all parameters are prohibited. This is applicable to scenarios such as preventing incorrect modification of parameters of equipments or the need for patent protection.

9.1.1 Parameter Permissions

Parameter access level

This product defines parameters into four levels: standard, expansion, expert, and factory. The following parameters are allowed to be read and written at different levels.

Parameter Access Level	Description	Remarks
1	Standard parameter	Default parameter access level, which allows you to access the basic function parameters of the AC drive.
2	Expansion parameter	which mainly include AC drive expansion function parameters, such as user-defined parameters and frequency detection parameters.
3	Expert parameters	You can set passwords and complex motor performance commissioning parameters.
4	Factory parameter	It is locked by password. Only the manufacturer can access this kind of parameters and the manufacturer can access all parameters.

Note

1. Standard parameters and expansion parameters can meet routine commissioning requirements.
2. The expert parameters need to be confirmed by the commissioning personnel with professional knowledge of the AC drive. If any questions about the use of parameters, contact the manufacturer for technical support.
3. The modification of factory parameters shall be confirmed by the after-sales maintenance personnel of the manufacturer. The on-site modification is prohibited.

Parameter permission switchover

The default parameter access level is standard. You can switch the parameter access level according to the requirements. The parameter access level currently in effect are displayed in A0-10.

Param.	Name	Default	Value Range	Descriptions
A0-10	System parameter access level	0	0: Standard 1: Expansion 2: Expert 3: Factory	This parameter sets the parameter level that you can access. Value description 0: Standard. You are allowed to access the standard-level parameters, that is, the basic function parameters, which is the default permission. Default parameter access level, which allows you to access the basic function parameters of the AC drive. 1: Expansion. You are allowed to access the expansion-level parameters, which mainly include motor expansion function parameters, such as user-defined parameters and frequency detection parameters. 2: Expert. You are allowed to access the expert-level parameters. You can set passwords and complex motor performance commissioning parameters. 3: Factory. You are allowed to access the factory-level parameters, which are locked by password. Only the manufacturer can access this kind of parameters and the manufacturer can access all parameters.

The following figure shows how to switch parameter permissions.

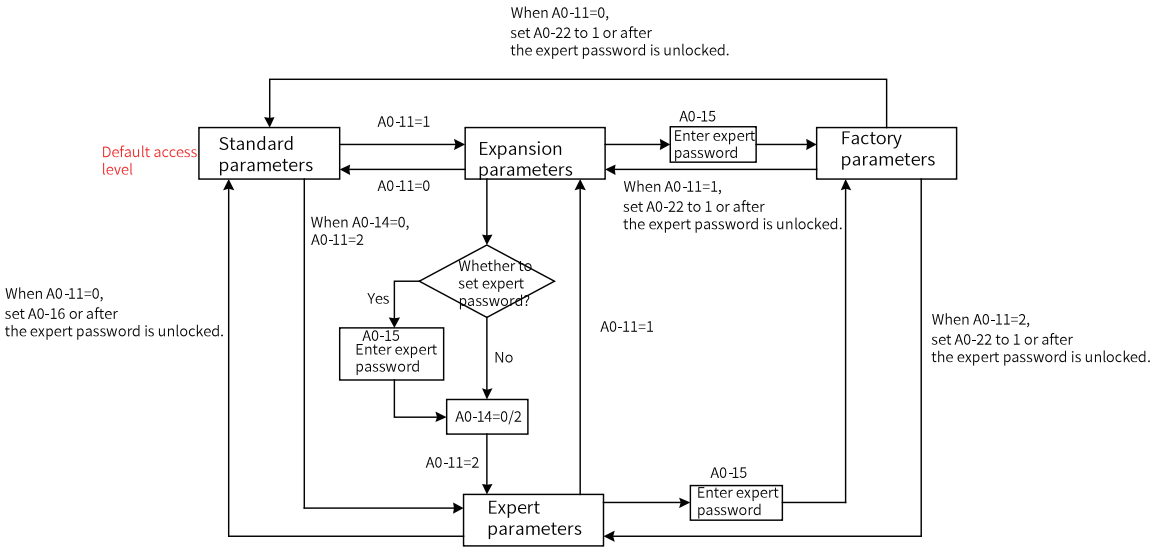


Figure 9-1 Parameter permission switchover method

The following rules apply to the switchover of parameter permissions:

1. For standard parameters and expansion parameters, change the value of A0-11 directly. When A0-11 (Parameter access level setting) = 0, the parameter access level is standard. When A0-11 (Parameter access level setting) = 1, the parameter access level is expansion..

Table 9–1

Param.	Name	Default	Value Range	Descriptions
A0-11	Parameter access level setting	0	0: Standard 1: Expansion 2: Expert	Sets the parameter access level. Value description 0: Standard. Standard-level parameters can be accessed. 1: Expansion. Expansion-level parameters can be accessed. 2: Expert. Expert-level parameters can be accessed. Additional information: If the expert password status (A0-23) is locked, you cannot switch directly to expert level.

2. Set the expert password through parameter A0-16 (Expert password setting). The expert password is invalid in default settings. When A0-14 (Expert password status) is set to 0 (Invalid) or 2 (Unlocked), set A0-11 (Parameter access level setting) to 2 to switch directly to expert parameters. In this case, standard parameters, expansion parameters, and expert parameters can be switched freely.
3. When A0-14 (Expert password status) = 1 (Locked), switch to the expansion parameter first. Enter the set expert password in A0-15 (Expert password input). After unlocking, A0-14 (Expert password status) is 2 (Unlocked). Then set A0-11 (Parameter access level setting) to switch to expert parameters.
4. There are three ways to exit from expert parameters: change the expert password in A0-16 (Expert password setting), switch the parameter level through A0-11 (Parameter access level setting), or wait for 1 hour after the expert password is unlocked. Then exit the expert parameter automatically. The expert password is 0 by default. The timeout exit mechanism is triggered only after the expert password is set to take effect.

Param.	Name	Default	Value Range	Descriptions
A0-14	Expert password status	0	0: Invalid (no expert password assigned) 1: Locked (expert password set) 2: Unlocked (expert password set)	This parameter displays the current expert password status. 0: Invalid (no expert password assigned). The expert password is set to 0. That is, no expert password is set. In this case, you can switch the expert level directly through A0-11. 1: Locked (expert password set). The expert password is set, and the expert level parameter is locked. You need to enter the correct expert password to switch to the expert level through A0-11. 2: Unlocked (expert password set). The expert password is set and the correct expert password is entered. You can switch to the expert level directly through A0-11.
A0-15	Expert password input	-	-	This parameter is used to input the expert password. Additional information: If the data entered through A0-15 is consistent with the expert password set in A0-16, you can unlock the expert-level parameter.
A0-16	Expert password setting	-	0 to 65535	This parameter sets 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. Additional information: 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 you enter the password incorrectly, you cannot enter the expert level.

Communication and parameter permissions

When the host controller communicates with the AC drive, the parameters that can be accessed are limited by A0-10 (System parameter access level). By default, A0-10 is set to 0 (Standard). Only standard parameters can be read and written during communication. To access higher-level parameters, you need to adjust the parameter access levels. For example, to access the expansion parameters, set A0-11 (Parameter access level setting) to 1 (Expansion).

9.1.2 Parameter Lock

To prevent inadvertent or unauthorized modification of parameters after on-site commissioning, you can enable the parameter lock function through A0-31 (Parameter lock setting). After setting the parameter lock password, only users who know the password can modify the parameters. The parameter lock is set as follows:

1. By default, the parameter lock is invalid. All users can modify the parameters. Set the parameter lock password through A0-31 to enable the parameter lock and the AC drive parameter menu is locked immediately.
2. After the parameter menu is locked, it can be unlocked only by entering the correct password. After unlocking, the value of A0-30 (Parameter lock status) is 2 (Parameter lock unlocked). Parameters can

be modified normally. The parameter menu is automatically locked after the time set by A0-32 (Unlock effective time of parameter lock) is reached.

3. After setting the parameter lock password, you can set A0-33 (Lock parameter lock) to 1 (Lock) to activate the parameter lock function, in addition to waiting for the time set by A0-32.
4. When A0-30 (Parameter lock status) is set to 0 (Parameter lock inactive), setting A0-33 (Lock parameter lock) or A0-32 (Unlock effective time of parameter lock) is invalid, and the parameter lock will not be activated.

Param.	Name	Default	Value Range	Descriptions
A0-30	Parameter lock status	0	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	This parameter displays the parameter lock status. Value description 0: Parameter lock inactive (parameter lock not set) Parameter lock is set to 0, that is, parameter lock is not set. The parameter lock is inactive. 1: Parameter lock locked (parameter lock set). Parameter lock is set, and the parameter lock is in the locked state. You need to enter the correct parameter lock to unlock it. 2: Parameter lock unlocked (parameter lock set). The parameter lock is set, and the correct parameter lock is entered. The parameter lock is unlocked. Additional information: 1. If the value of A0-31 is non-zero, the parameter lock takes effect. 2. When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.
A0-31	Parameter lock setting	-	0 to 65535	This parameter sets the parameter lock. If the parameter lock is set to 0, the parameter lock is inactive. If the parameter lock is set to a value other than 0, the parameter lock is active. Additional information: 1. If the value of A0-31 is non-zero, the parameter lock takes effect. 2. When the parameter lock is in the locked state, you need to enter the correct parameter lock to access the parameter list.

Param.	Name	Default	Value Range	Descriptions
A0-32	Unlock effective time of parameter lock	3600s	60s to 65535s	This parameter sets the effective time of the parameter lock in the unlocked status after the parameter lock is activated and the correct parameter lock is entered. Additional information: The parameter lock is automatically locked after the unlock time exceeds the effective time. You need to enter the correct parameter lock again to unlock the parameter.
A0-33	Lock parameter lock	0	0: No operation 1: Lock	This parameter sets whether to lock the parameter lock manually. Value description 0: No operation. No operation is performed. 1: Lock. The the parameter lock is locked. Additional information: 1. The parameter lock is valid when A0-31 is not 0. 2. After A0-33 is set to 1, you do not need to wait for the time set by A0-32, and the parameter lock is locked immediately. You need to enter the correct parameter lock again to unlock the parameter. 3. Automatic clearing is performed after parameter lock is locked.

10 Parameter List

10.1 Parameter List

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-01	0xF001	Motor control mode	0: SVC 2: V/f	2	-	At stop
F0-02	0xF002	Motor control method	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	At stop
F0-03	0xF003	Command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	At stop
F0-07	0xF007	Mode of terminal start/ stop module A	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-10	0xF00A	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Running 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 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC state reset 29: Torque control inhibited 30: Pulse frequency input (available only for DI4)	1	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-10	0xF00A	DI1 function selection	Continued on 32: Immediate DC braking 33: Normally closed (NC) input of external fault 34: Frequency modification enable 35: Opposite to the PID action direction 36: External stop terminal 1 38: PID integral pause 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/torque control selection 47: Emergency stop 49: Decelerate to DC braking 50: Clear current operating time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced local control 67: Forced terminal control 68: Forced communication control 69: Forced custom control 70: Control channel selection 71: Set channel selection 72: Terminal module A/B selection 77: Running enable (all modes) 78: Forward running allowed 79: Reverse running allowed 80: RFG input set to zero	1	-	At stop
F0-11	0xF00B	DI2 function selection	Same as F0-10	4	-	At stop
F0-12	0xF00C	DI3 function selection	Same as F0-10	9	-	At stop
F0-13	0xF00D	DI4 function selection	Same as F0-10	12	-	At stop
F0-14	0xF00E	DI5 function selection (for MD600A)	Same as F0-10	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-17	0xF011	RO1 output function selection	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Cumulative running time reach 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 43: Output upon minor fault or warning Others: B connector	2	-	Real time
F0-21	0xF015	DO1 function selection (for MD600A)	Same as F0-20	1	-	Real time
F0-22	0xF016	DO2 function selection (for MD600A)	Same as F0-20	4	-	Real time
F0-25	0xF019	Frequency decimal place	1: One decimal place 2: Two decimal places	2	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-29	0xF01D	Main frequency source	0: F0-30 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-30	0xF01E	Digital setting of main frequency	0.00 Hz to A2-17	50.00	Hz	At once
F0-31	0xF01F	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-32	0xF020	Main and auxiliary frequency operation	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (|main frequency|, |auxiliary frequency|) 3: Min. (|main frequency|, |auxiliary frequency|) 4: Main frequency x auxiliary frequency	0	-	Real time
F0-33	0xF021	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-34	0xF022	Main frequency gain coefficient source	0: 100% 2: AI1 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-35	0xF023	Auxiliary frequency gain coefficient source	0: 100% 2: AI1 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-38	0xF026	Multi-reference 0 setting mode	0: F0-39 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse reference 5: PID 6: b5-01/b6-01 (main frequency digital setting) Others: F connector	0	-	Real time
F0-39	0xF027	Multi-reference 0	b8-43 to b8-42	0.0	-	Real time
F0-40	0xF028	Multi-reference 1	b8-43 to b8-42	0.0	-	Real time
F0-41	0xF029	Multi-reference 2	b8-43 to b8-42	0.0	-	Real time
F0-42	0xF02A	Multi-reference 3	b8-43 to b8-42	0.0	-	Real time
F0-45	0xF02D	Ramp acceleration/ deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	-	Real time
F0-46	0xF02E	Ramp acceleration/ deceleration time base frequency	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Set frequency	1	-	Real time
F0-48	0xF030	Ramp 1 acceleration time	0.0s to 6500.0s	20.0	s	Real-time
F0-49	0xF031	RFG 1 deceleration time	0.0s to 6500.0s	20.0	s	Real-time
F0-50	0xF032	Ramp 1 acceleration start arc	0.00s to 650.00s	0.00	s	Real-time
F0-51	0xF033	Ramp 1 acceleration end arc	0.00s to 650.00s	0.00	s	Real-time
F0-52	0xF034	Ramp 1 deceleration start arc	0.00s to 650.00s	0.00	s	Real-time
F0-53	0xF035	Ramp 1 deceleration end arc	0.00s to 650.00s	0.00	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F0-56	0xF038	Jogging frequency 1 source	0: F0-57 2: AI1 5: Pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-57	0xF039	Digital setting of jogging frequency 1	-50.00 Hz to 50.00 Hz	2.00	Hz	At once
F0-58	0xF03A	Jogging frequency 2 source	0: F0-59 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F0-59	0xF03B	Digital setting of jogging frequency 2	-50.00 Hz to 50.00 Hz	-2.00	Hz	At once
F0-62	0xF03E	Jogging ramp source	0: Normal running ramp time 1: Jogging ramp time	0	-	Real time
F0-63	0xF03F	Ramp acceleration time of jogging	0.00s to 650.00s	20.00	s	Real-time
F0-64	0xF040	Ramp deceleration time of jogging	0.00s to 650.00s	20.00	s	Real-time
F1-00	0xF100	Motor type	0: Asynchronous motor 2: Synchronous motor	0	-	At stop
F1-01	0xF101	Rated motor power	0.1 kW to 1000.0 kW	3.7	kW	At stop
F1-03	0xF103	Rated motor voltage	1 V to 2000 V	380	V	At stop
F1-04	0xF104	Rated motor current	0.01 A to 655.35 A	9.00	A	At stop
F1-06	0xF106	Rated motor frequency	0.01 Hz to 599.00 Hz	50.00	Hz	At stop
F1-07	0xF107	Rated motor speed	1 RPM to 65535 RPM	1460	rmp	At stop
F1-10	0xF10A	Maximum motor frequency	C4-06 to 599.00 Hz	50.00	Hz	At stop
F1-11	0xF10B	Minimum motor frequency	0.00 Hz to C4-10	0.00	Hz	At stop
F1-12	0xF10C	Synchronous motor back EMF	0.0 V to 6553.5 V	300.0	V	Real-time
F1-13	0xF10D	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F1-14	0xF10E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	-	At stop
F1-15	0xF10F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
F1-20	0xF114	Stator resistance	0.001 to 65.535	1.204	Ω	At once
F1-22	0xF116	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	At once
F1-24	0xF118	Asynchronous motor stator leakage inductance	0.01 mH to 655.35 mH	5.28	mH	Real time
F1-28	0xF11C	Mutual inductance (asynchronous motor)	0.1 mH to 6553.5 mH	156.8	mH	Real time:
F1-30	0xF11E	Asynchronous motor no-load current	0.01 A to 655.35 A	4.20	A	Real time
F1-32	0xF120	Synchronous motor shaft D inductance	0.01 mH to 655.35 mH	5.28	mH	Real time
F1-34	0xF122	Synchronous motor shaft Q inductance	0.01 mH to 655.35 mH	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	0.01s to 655.35s	1.00	s	Unchangeable
F1-69	0xF145	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 11: Synchronous motor with-load auto-tuning 12: No-load dynamic auto-tuning of synchronous motor 13: Static auto-tuning on partial parameters of synchronous motor 14: Auto-tuning on gain difference between U-phase and V-phase	0	-	At stop
F2-02	0xF202	Speed loop Kp in SVC mode	0.00 to 100.00	5.00	-	Real time
F2-03	0xF203	Speed loop Ti in SVC mode	0.000s to 20.000s	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 correction factor	0.0% to 1000.0%	100.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F2-06	0xF206	Zero speed Ti correction 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
F2-08	0xF208	Low speed Kp correction factor	0.0% to 1000.0%	100.0	%	Real-time
F2-09	0xF209	Low speed Ti correction factor	0.0% to 1000.0%	20.0	%	Real-time
F2-10	0xF20A	High speed switchover frequency	d3-09 to 400.0%	100.0	%	Real-time
F2-11	0xF20B	High speed Kp correction factor	0.0% to 1000.0%	100.0	%	Real-time
F2-12	0xF20C	High speed Ti correction factor	0.0% to 1000.0%	100.0	%	Real-time
F2-14	0xF20E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	-	At stop
F2-15	0xF20F	Start mode	0: Direct start 1: Flying start	0	-	Real time
F2-16	0xF210	Flying start mode	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	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	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
F2-21	0xF215	Negative speed	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
F2-22	0xF216	Digital setting of positive frequency upper limit 1	F2-26 to 800.0%	800.0	%	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F2-23	0xF217	Digital setting of negative frequency upper limit 1	-800.00% to F2-27	-800.0	%	At stop
F2-24	0xF218	Source of positive frequency upper limit 2	0: 800% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F2-25	0xF219	Source of negative frequency upper limit 2	0: -800% 1: Opposite to positive frequency upper limit 2 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
F2-26	0xF21A	Digital setting of positive frequency lower limit 1	0.0% to F2-22	0.0	%	At stop
F2-27	0xF21B	Digital setting of negative frequency lower limit 1	F2-23 to 0.0%	0.0	%	At stop
F2-30	0xF21E	Digital setting of torque upper limit 1	0.0% to 800.0%	180.0	%	Real-time
F2-31	0xF21F	Digital setting of torque lower limit 1	-800.0% to 0.0%	-180.0	%	Real-time
F2-32	0xF220	Source of torque upper limit 2	0: 800% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
F2-33	0xF221	Source of torque lower limit 2	0: -800% 1: Opposite torque upper limit 2 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	1	-	Real time
F2-36	0xF224	Overexcitation gain (V/f)	0% to 200%	90	%	Real-time
F2-37	0xF225	Overcurrent suppression	0: Disable 1: Enable	1	-	At stop
F2-38	0xF226	Overcurrent suppression point	80% to 300%	200	%	At stop
F2-39	0xF227	Overvoltage suppression	0: Disable 1: Enable	1	-	At stop
F2-40	0xF228	Overvoltage suppression action voltage	330.0 V to 800.0 V	770.0	V	Real-time
A0-00	0xA000	Parameters initialization	0: No action 1: Restore parameters (excluding motor parameters) to factory settings 2: Clear records 3: Restore parameters (including motor parameters) to factory settings 4: Back up current user parameters 5: Clear fault information 501: Restore user parameters from backup 503: Restore parameters (including motor parameters) to factory settings and clear records	0	-	At stop
A0-10	0xA00A	System parameter access level	0: Standard 1: Expansion 2: Expert 3: Factory	0	-	Unchangeable
A0-11	0xA00B	Parameter access level setting	0: Standard 1: Expansion 2: Expert	0	-	Real time
A0-14	0xA00E	Expert password status	0: Invalid expert password (no expert password) 1: Expert password locked (Expert password is set but locked.) 2: Unlock the expert password (The expert password is set and unlocked.)	0	-	Unchangeable
A0-15	0xA00F	Expert password input	0 to 65535	0	-	Real time
A0-16	0xA010	Expert password setting	0 to 65535	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-20	0xA014	Displays the status of the factory password.	1: Factory password locked 2: Factory password unlocked	0	-	Unchangeable
A0-21	0xA015	Factory password input	0 to 65535	0	-	Real time
A0-22	0xA016	This parameter sets whether to exit the factory level manually.	0: No operation 1: Exit	0	-	Real time
A0-30	0xA01E	Parameter lock status	0: Parameter lock inactive (parameter lock not set) 1: Parameter lock locked (parameter lock set) 2: Parameter lock unlocked (parameter lock set)	0	-	Unchangeable
A0-31	0xA01F	Parameter lock setting	0 to 65535	0	-	Real time
A0-32	0xA020	Unlock effective time of parameter lock	60s to 65535s	3600	s	Real-time
A0-33	0xA021	Lock parameter lock	0: No operation 1: Lock	0	-	Real time
A0-37	0xA025	Backed-up parameter clear	0: No operation 500: Clear all backed-up user parameters 1000: Clear all backed-up motor parameters	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-38	0xA026	Backed-up parameter restoration	0: No operation 500: Restore user backup 501: Restore user macro backup 1 502: Restore user macro backup 2 503: Restore user macro backup 3 504: Restore user macro backup 4 505: Restore User macro backup 5 506: Restore user macro backup 6 2011: Restore motor macro backed-up parameter 1 to motor 1 2021: Restore motor macro backed-up parameter 2 to motor 1 2031: Restore motor macro backed-up parameter 3 to motor 1 2041: Restore motor macro backed-up parameter 4 to motor 1 2051: Restore motor macro backed-up parameter 5 to motor 1 2061: Restore motor macro backed-up parameter 6 to motor 1 2071: Restore motor macro backed-up parameter 7 to motor 1 2081: Restore motor macro backed-up parameter 8 to motor 1 2091: Restore motor macro backed-up parameter 9 to motor 1 2101: Restore motor macro backed-up parameter 10 to motor 1 2111: Restore motor macro backed-up parameter 11 to motor 1 2121: Restore motor macro backed-up parameter 12 to motor 1 2131: Restore motor macro backed-up parameter 13 to motor 1 2141: Restore motor macro backed-up parameter 14 to motor 1 2151: Restore motor macro backed-up parameter 15 to motor 1 2161: Restore motor macro backed-up parameter 16 to motor 1 2171: Restore motor macro backed-up parameter 17 to motor 1 2181: Restore motor macro backed-up parameter 18 to motor 1 2191: Restore motor macro backed-up parameter 19 to motor 1 2201: Restore motor macro backed-up parameter 20 to motor 1	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-39	0xA027	Back-up parameter option	0: No operation 400: Back up user parameters 401: Back up user macro parameters to address 1 402: Back up user macro parameters to address 2 403: Back up user macro parameters to address 3 404: Back up user macro parameters to address 4 405: Back up user macro parameters to address 5 406: Back up user macro parameters to address 6 1011: Back up motor 1 parameters to address 1 1021: Back up motor 1 parameters to address 2 1031: Back up motor 1 parameters to address 3 1041: Back up motor 1 parameters to address 4 1051: Back up motor 1 parameters to address 5 1061: Back up motor 1 parameters to address 6 1071: Back up motor 1 parameters to address 7 1081: Back up motor 1 parameters to address 8 1091: Back up motor 1 parameters to address 9 Continued on next page.	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-39	0xA027	Back-up parameter option	1101: Back up motor 1 parameters to address 10 1111: Back up motor 1 parameters to address 11 1121: Back up motor 1 parameters to address 12 1131: Back up motor 1 parameters to address 13 1141: Back up motor 1 parameters to address 14 1151: Back up motor 1 parameters to address 15 1161: Back up motor 1 parameters to address 16 1171: Back up motor 1 parameters to address 17 1181: Back up motor 1 parameters to address 18 1191: Back up motor 1 parameters to address 19 1201: Back up motor 1 parameters to address 20	0	-	At stop
A0-44	0xA02C	Parameter write protection	0: Disable 1: Enable	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-47	0xA02F	Parameter group display on operating panel	Bit 0: Group F 0: Hidden 1: Displayed Bit 1: Group A 0: Displayed 1: Displayed Bit 2: Group B 0: Hidden 1: Displayed Bit 3: Group C 0: Hidden 1: Displayed Bit 4 : Group D 0: Hidden 1: Displayed Bit 5: Reserved 0: Hidden 1: Displayed Bit 6: Group E 0: Hidden 1: Displayed Bit 7: Group H 0: Hidden 1: Displayed Bit 8: Reserved 0: Hidden 1: Displayed Bit 9: Group N 0: Hidden 1: Displayed Bit 10: Group O 0: Hidden 1: Displayed Bit 11: Group P 0: Hidden 1: Displayed Bit 12: Group L 0: Hidden 1: Displayed Bit 13: Group U 0: Displayed 1: Displayed Bit 14: Reserved Bit15: Reserved	0xEBFF	-	Real time
A0-70	0xA046	Frequency decimal place	1: One decimal place 2: Two decimal places	2	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A0-71	0xA047	Number of decimal places for load speed display (group U0)	Ones place: Number of decimal places of U0-14/U0-24 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places Tens place: Number of decimal places of U0-19/U0-29 1: 1 decimal place 2: 2 decimal places Hundreds place: Number of decimal places of U0-30/U0-31 0: 0 decimal place 1: 1 decimal place 2: 2 decimal places Thousands place: Number of decimal places of U0-69 1: 1 decimal place 2: 2 decimal places Ten thousands place: Reserved	2220	-	Real time
A0-72	0xA048	Individualized parameter display	Ones place: User mode 0: Hidden 1: Displayed Tens place: Correction mode 0: Hidden 1: Displayed Hundreds place: Error menu 0: Hidden 1: Displayed Thousands place: Reserved Ten Thousands place: Reserved	111	-	Real time
A1-00	0xA100	Current fault 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-02	0xA102	Current fault 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-04	0xA104	Current fault 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-06	0xA106	Current fault 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-08	0xA108	Current fault 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-10	0xA10A	Current fault 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-12	0xA10C	Current minor fault 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-14	0xA10E	Current minor fault 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-16	0xA110	Current minor fault 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-18	0xA112	Current minor fault 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-20	0xA114	Current minor fault 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-22	0xA116	Current minor fault 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-24	0xA118	Current warning 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-26	0xA11A	Current warning 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-28	0xA11C	Current warning 3	0.0 to 6553.5	0.0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A1-30	0xA11E	Current warning 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-32	0xA120	Current warning 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-34	0xA122	Current warning 6	0.0 to 6553.5	0.0	-	Unchangeable
A1-36	0xA124	Current prompt 1	0.0 to 6553.5	0.0	-	Unchangeable
A1-38	0xA126	Current prompt 2	0.0 to 6553.5	0.0	-	Unchangeable
A1-40	0xA128	Current prompt 3	0.0 to 6553.5	0.0	-	Unchangeable
A1-42	0xA12A	Current prompt 4	0.0 to 6553.5	0.0	-	Unchangeable
A1-44	0xA12C	Current prompt 5	0.0 to 6553.5	0.0	-	Unchangeable
A1-46	0xA12E	Current prompt 6	0.0 to 6553.5	0.0	-	Unchangeable
A2-00	0xA200	Per-unit base value of voltage	0.0 V to 6553.5 V	0.0	V	Unchangeable
A2-01	0xA201	Per-unit base value of current	0.0 A to 6553.5 A	0.0	A	Unchangeable
A2-02	0xA202	Per-unit base value of speed	0rpm to 65535rpm	0	rmp	Unchangeable
A2-04	0xA204	Per-unit base value of frequency	0.0 Hz to 6553.5 Hz	0.0	Hz	Unchangeable
A2-05	0xA205	Per-unit base value of power	0.00 kW to 655.35 kW	0.00	kW	Unchangeable
A2-06	0xA206	Per-unit base value of torque	0.00 N·m to 655.35 N·m	0.00	N·m	Unchangeable
A2-17	0xA211	Effective value of maximum motor frequency	0.00 Hz to 599.00 Hz	50.00	Hz	Unchangeable
A2-22	0xA216	Performance software version	0.00 to 655.35	0.00	-	Unchangeable
A2-23	0xA217	Function software version	0.00 to 655.35	0.00	-	Unchangeable
A2-24	0xA218	Performance software sub-version	0.00 to 655.35	0.00	-	Unchangeable
A2-25	0xA219	Function software sub-version	0.00 to 655.35	0.00	-	Unchangeable
A3-02	0xA302	Rated AC drive power	0.0 kW to 6553.5 kW	4.0	kW	Unchangeable
A3-03	0xA303	Rated AC drive current	0.0 A to 6553.5 A	9.5	A	Unchangeable
A3-04	0xA304	Rated AC drive voltage	0 V to 65535 V	380	V	Unchangeable
A3-05	0xA305	Maximum AC drive current	0% to 600%	150	%	Real-time
A3-06	0xA306	AC drive hardware type	0: MD600A (CAN version) 4: MD600S (Modbus version)	0	-	Unchangeable
A3-51	0xA333	Module overtemperature threshold	0°C to 65535°C	0	°C	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A4-00	0xA400	Braking unit action voltage	300.0 V to 820.0 V	760.0	V	At stop
A4-01	0xA401	Active braking unit action voltage	300.0 V to 820.0 V	760.0	V	Unchangeable
A4-02	0xA402	Braking duty cycle	0% to 100%	100	%	Real-time
A4-11	0xA40B	General mode of fan control	0: Working during drive running (forward; working during drive shutdown when the temperature exceeds 42°C) 1: Working continuously (forward) 2: Working during drive running (forward and reverse; working during drive shutdown when the temperature exceeds 42°C) 3: Working continuously (forward and reverse) 4: Factory-defined mode 1 5: Factory-defined mode 1	0	-	Real time
A5-00	0xA500	Maximum carrier frequency	0.0 kHz to 24.0 kHz	16.0	kHz	Unchangeable
A5-01	0xA501	Set carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Real time
A5-02	0xA502	Active carrier frequency	0.8 kHz to 20.0 kHz	4.0	kHz	Unchangeable
A5-03	0xA503	DPWM switchover frequency	5.0 Hz to 6000.0 Hz	2000.0	Hz	At once
A5-04	0xA504	Dead-zone compensation mode	0: No compensation 1: Compensation mode 1	1	-	Real time
A5-05	0xA505	Cut-off frequency for deadzone compensation	0.0 Hz to 600.0 Hz	600.0	Hz	At once
A5-06	0xA506	Overmodulation coefficient	0.0% to 110.0%	103.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A5-08	0xA508	PWM command word	Bit 0: Carrier frequency adjusted with temperature 0: Disable 1: Enable Bit 1: Carrier frequency adjusted with synchronization frequency 0: Disable 1: Enable Bit 2: Synchronous modulation mode 0: Disable 1: Enable Bit 3: Reserved Bit 4: Output voltage calculation mode 0: High speed 1: High accuracy Bit 5: Overmodulation mode 0: Amplitude 1: Phase Bit 6: Common mode rejection 0: Disable 1: Enable Bit 7: DPWM carrier frequency processing 0: Disable 1: Enable Bit 8 to bit 15: Reserved	0x0022	-	Real-time
A5-09	0xA509	Hysteresis for adjusting carrier frequency with synchronous frequency	0.0 Hz to 100.0 Hz	3.0	Hz	At once
A5-10	0xA50A	Start frequency for adjusting carrier frequency with synchronous frequency	0.0 Hz to 600.0 Hz	5.0	Hz	At once
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 kHz to 20.0 kHz	6.0	kHz	Real time
A5-13	0xA50D	Carrier frequency upper limit at low speed (SVC)	0.8 kHz to 8.0 kHz	2.0	kHz	Real time
A6-01	0xA601	STOP/RES key function	0: Valid only in operating panel control mode 1: Valid for ON_OFF1 (start/stop) command 2: Valid for OFF2 (coast to stop) command 3: Valid for OFF3 (quick stop)	1	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-03	0xA603	Parameter 1 displayed on LED operating panel during operation	Bit 0: Operating frequency (Hz) 0: Hidden 1: Displayed Bit 1: Set frequency (Hz) 0: Hidden 1: Displayed Bit 2: Bus voltage (V) 0: Hidden 1: Displayed Bit 3: Output voltage (V) 0: Hidden 1: Displayed Bit 4: Output current (A) 0: Hidden 1: Displayed Bit 5: Output power (kW) 0: Hidden 1: Displayed Bit 6: Output torque (%) 0: Hidden 1: Displayed Bit 7: DI input status 0: Hidden 1: Displayed Bit 8: DO output status 0: Hidden 1: Displayed Bit 9: AI1 voltage (V) 0: Hidden 1: Displayed Bit 10: Reserved Bit 11: Voltage (V) of potentiometer MD-BP-M : Hidden 1: Displayed Bit 12: Reserved 0: Hidden 1: Displayed Bit 13: Reserved 0: Hidden 1: Displayed Bit 14: Load speed 0: Hidden 1: Displayed Bit 15: PID setting 0: Hidden 1: Displayed	0x1F	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-04	0xA604	Parameter 2 displayed on LED operating panel during operation	Bit 0: PID feedback 0: Hidden 1: Displayed Bit 1: PLC stage 0: Hidden 1: Displayed Bit 2: HDI input frequency (kHz) 0: Hidden 1: Displayed Bit 3: Operating frequency 2 (Hz) 0: Hidden 1: Displayed Bit 4: Remaining running time 0: Hidden 1: Displayed Bit 5: Voltage before AI1 correction (V) 0: Hidden 1: Displayed Bit 6: Free mapping 0 0: Hidden 1: Displayed Bit 7: Free mapping 1 0: Hidden 1: Displayed Bit 8: Motor speed 0: Hidden 1: Displayed Bit 9: Current power-on time (hour) 0: Hidden 1: Displayed Bit 10: Current running time (min.) 0: Hidden 1: Displayed Bit 11: HDI input frequency (Hz) 0: Hidden 1: Displayed Bit 12: Communication set value 0: Hidden 1: Displayed Bit 13: Reserved Bit 14: Main frequency X 0: Hidden 1: Displayed Bit 15: Auxiliary frequency Y 0: Hidden 1: Displayed	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-05	0xA605	Parameter displayed on the LED operating panel upon stop	Bit 0: Set frequency (Hz) 0: Hidden 1: Displayed Bit 1: Bus voltage (V) 0: Hidden 1: Displayed Bit 2: DI input state 0: Hidden 1: Displayed Bit 3: DO output state 0: Hidden 1: Displayed Bit 4: AI1 voltage (V) 0: Hidden 1: Displayed Bit 5: Reserved Bit 6: Voltage (V) of potentiometer MD-BP-M 0: Hidden 1: Displayed Bit 7: Reserved Bit 8: Reserved Bit 9: PLC stage 0: Hidden 1: Displayed Bit 10: Load speed 0: Hidden 1: Displayed Bit 11: PID setting 0: Hidden 1: Displayed Bit 12: HDI input frequency (kHz) 0: Hidden 1: Displayed Bit 13: Reserved Bit 14: Free mapping 0 0: Hidden 1: Displayed Bit 15: Free mapping 1 0: Hidden 1: Displayed	0x13	-	Real-time
A6-40	0xA628	MD-BP-M potentiometer zero crossing threshold	0.0% to 100.0%	1.0	%	Real-time
A6-45	0xA62D	Commissioning software activation	0: Disabled 1: Enabled	1	-	At stop
A6-46	0xA62E	Setting of speed controlled by commissioning software	-800.0% to 800.0%	100.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
A6-47	0xA62F	Setting of jog 1 speed controlled by commissioning software	-100.0% to 100.0%	4.0	%	Real-time
A6-48	0xA630	Setting of jog 2 speed controlled by commissioning software	-100.0% to 100.0%	-4.0	%	Real-time
Ad-00	0xAD00	Cumulative running time (h)	0h to 65535h	0	h	Unchangeable
Ad-01	0xAD01	Cumulative running time (s)	0s to 3599s	0	s	Unchangeable
Ad-02	0xAD02	Cumulative power-on time (h)	0h to 65535h	0	h	Unchangeable
Ad-03	0xAD03	Cumulative power-on time (s)	0s to 3599s	0	s	Unchangeable
Ad-04	0xAD04	Cumulative power consumption	0 kWh to 65535 kWh	0	kWh	Unchangeable
Ad-05	0xAD05	Auxiliary calculation 1 of cumulative power consumption	0 to 65535	0	-	Unchangeable
Ad-06	0xAD06	Auxiliary calculation 2 of cumulative power consumption	0 to 65535	0	-	Unchangeable
Ad-07	0xAD07	Cumulative power consumption k	0.0 kWh to 6553.5 kWh	0.0	kWh	Unchangeable
Ad-08	0xAD08	Cumulative power consumption M	0 MWh to 65535 MWh	0	MWh	Unchangeable
Ad-09	0xAD09	Cumulative energy auxiliary calculation 1	0 to 65535	0	-	Unchangeable
Ad-10	0xAD0A	Cumulative energy auxiliary calculation 2	0 to 65535	0	-	Unchangeable
Ad-11	0xAD0B	Cumulative energy saving K	0.0kWh to 999.9kWh	0.0	kWh	Unchangeable
Ad-12	0xAD0C	Cumulative energy saving M	0 MWh to 999 MWh	0	MWh	Unchangeable
Ad-13	0xAD0D	Cumulative energy saving G	0 GWh to 65535 GWh	0	GWh	Unchangeable
Ad-14	0xAD0E	Cumulative cost saving	0.0 to 999.9	0.0	-	Unchangeable
Ad-15	0xAD0F	Cumulative cost saving K	0 to 65535	0	-	Unchangeable
Ad-16	0xAD10	Cumulative CO2 emission reduction (ton)	0.0 to 999.9	0.0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Ad-17	0xAD11	Cumulative CO2 emission reduction (kiloton)	0 to 65535	0	-	Unchangeable
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	0: Energy tax rate 1 1: Energy tax rate 2	0	-	At stop
Ad-21	0xAD15	Currency unit	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 kW to 6553.5 kW	0.0	kW	At stop
Ad-24	0xAD18	Reset of cumulative energy calculation	0: Disable 1: Enable	0	-	At stop
AE-00	0x2F00	User-defined parameter 0	0x0 to 0xFFFF	0x0	-	Real time
AE-01	0x2F01	User-defined parameter 1	0x0 to 0xFFFF	0x0	-	Real time
AE-02	0x2F02	User-defined parameter 2	0x0 to 0xFFFF	0x0	-	Real time
AE-03	0x2F03	User-defined parameter 3	0x0 to 0xFFFF	0x0	-	Real time
AE-04	0x2F04	User-defined parameter 4	0x0 to 0xFFFF	0x0	-	Real time
AE-05	0x2F05	User-defined parameter 5	0x0 to 0xFFFF	0x0	-	Real time
AE-06	0x2F06	User-defined parameter 6	0x0 to 0xFFFF	0x0	-	Real time
AE-07	0x2F07	User-defined parameter 7	0x0 to 0xFFFF	0x0	-	Real time
AE-08	0x2F08	User-defined parameter 8	0x0 to 0xFFFF	0x0	-	Real time
AE-09	0x2F09	User-defined parameter 9	0x0 to 0xFFFF	0x0	-	Real time
AE-10	0x2F0A	User-defined parameter 10	0x0 to 0xFFFF	0x0	-	Real time
AE-11	0x2F0B	User-defined parameter 11	0x0 to 0xFFFF	0x0	-	Real time
AE-12	0x2F0C	User-defined parameter 12	0x0 to 0xFFFF	0x0	-	Real time
AE-13	0x2F0D	User-defined parameter 13	0x0 to 0xFFFF	0x0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
AE-14	0x2F0E	User-defined parameter 14	0x0 to 0xFFFF	0x0	-	Real time
AE-15	0x2F0F	User-defined parameter 15	0x0 to 0xFFFF	0x0	-	Real time
AE-16	0x2F10	User-defined parameter 16	0x0 to 0xFFFF	0x0	-	Real time
AE-17	0x2F11	User-defined parameter 17	0x0 to 0xFFFF	0x0	-	Real time
AE-18	0x2F12	User-defined parameter 18	0x0 to 0xFFFF	0x0	-	Real time
AE-19	0x2F13	User-defined parameter 19	0x0 to 0xFFFF	0x0	-	Real time
AE-20	0x2F14	User-defined parameter 20	0x0 to 0xFFFF	0x0	-	Real time
AE-21	0x2F15	User-defined parameter 21	0x0 to 0xFFFF	0x0	-	Real time
AE-22	0x2F16	User-defined parameter 22	0x0 to 0xFFFF	0x0	-	Real time
AE-23	0x2F17	User-defined parameter 23	0x0 to 0xFFFF	0x0	-	Real time
AE-24	0x2F18	User-defined parameter 24	0x0 to 0xFFFF	0x0	-	Real time
AE-25	0x2F19	User-defined parameter 25	0x0 to 0xFFFF	0x0	-	Real time
AE-26	0x2F1A	User-defined parameter 26	0x0 to 0xFFFF	0x0	-	Real time
AE-27	0x2F1B	User-defined parameter 27	0x0 to 0xFFFF	0x0	-	Real time
AE-28	0x2F1C	User-defined parameter 28	0x0 to 0xFFFF	0x0	-	Real time
AE-29	0x2F1D	User-defined parameter 29	0x0 to 0xFFFF	0x0	-	Real time
AE-30	0x2F1E	User-defined parameter 30	0x0 to 0xFFFF	0x0	-	Real time
AE-31	0x2F1F	User-defined parameter 31	0x0 to 0xFFFF	0x0	-	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 (MD600A) Others: B connector	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b0-03	0xB003	Reference channel selection	0: Reference channel 1 1: Reference channel 2 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	At stop
b1-00	0xB100	Command source of control channel 1	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	At stop
b1-01	0xB101	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b1-02	0xB102	User-defined OFF2 (coast to stop) source 1	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b1-03	0xB103	User-defined OFF3 (quick stop) source 1	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b1-04	0xB104	Self-defined running permission command source	0: Running inhibited 1: Running allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b1-05	0xB105	Self-defined fault reset command source 1	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b1-06	0xB106	User-defined JOG1 (jogging) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b1-07	0xB107	User-defined JOG2 (jogging) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b1-08	0xB108	Self-defined speed inversion source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	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
b2-00	0xB200	OFF2 (coast to stop) source 2	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b2-01	0xB201	OFF2 (coast to stop) source 3	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b2-02	0xB202	OFF3 (quick stop) source 2	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b2-03	0xB203	OFF3 (quick stop) source 3	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b2-04	0xB204	Fault reset source 2	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b2-05	0xB205	Fault reset source 3	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b2-06	0xB206	RFG prohibition source	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b2-07	0xB207	RFG pause source	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b2-08	0xB208	Source of setting RFG reference to 0	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b3-00	0xB300	Command source of control channel 2	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b3-01	0xB301	User-defined ON_OFF1 (start/stop) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b3-02	0xB302	User-defined OFF2 (coast to stop) source 1	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b3-03	0xB303	User-defined OFF3 (quick stop) source 1	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b3-04	0xB304	Self-defined running permission command source	0: Running inhibited 1: Running allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b3-05	0xB305	Self-defined fault reset command source 1	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b3-06	0xB306	User-defined JOG1 (jogging) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b3-07	0xB307	User-defined JOG2 (jogging) source	0: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b3-08	0xB308	Self-defined speed inversion source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
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	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b4-01	0xB401	OFF2 (coast to stop) source 3	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b4-02	0xB402	OFF3 (quick stop) source 2	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b4-03	0xB403	OFF3 (quick stop) source 3	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b4-04	0xB404	Fault reset source 2	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b4-05	0xB405	Fault reset source 3	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b4-06	0xB406	RFG prohibition source	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b4-07	0xB407	RFG pause source	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b4-08	0xB408	Source of setting RFG reference to 0	0: Activated 1: Invalid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
b5-00	0xB500	Main frequency source	0: Set by b5-01 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-01	0xB501	Digital setting of main frequency	0.00 Hz to A2-17	50.00	Hz	At once

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b5-02	0xB502	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-03	0xB503	Main and auxiliary frequency operation	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (|main frequency|, |auxiliary frequency|) 3: Min. (|main frequency|, |auxiliary frequency|) 4: Main frequency x auxiliary frequency	0	-	Real time
b5-04	0xB504	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-05	0xB505	Main frequency gain coefficient source	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-06	0xB506	Auxiliary frequency gain coefficient source	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b5-07	0xB507	Jogging frequency 1 source	0: Set by b5-08 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-08	0xB508	Digital setting of jogging frequency 1	-50.00 Hz to 50.00 Hz	2.00	Hz	At once
b5-09	0xB509	Jogging frequency 2 source	0: Set by b5-10 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-10	0xB50A	Digital setting of jogging frequency 2	-50.00 Hz to 50.00 Hz	-2.00	Hz	At once
b5-13	0xB50D	Torque reference source	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-14	0xB50E	Torque reference digital setting	-800.0% to 800.0%	0.0	%	Real-time
b5-15	0xB50F	Torque reference gain factor	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-16	0xB510	Torque filter time	0 ms to 10000 ms	0	ms	Real-time
b5-17	0xB511	Torque acceleration time	0.000s to 60.000s	0.000	s	Real-time
b5-18	0xB512	Torque deceleration time	0.000s to 60.000s	0.000	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b5-19	0xB513	Speed limit source in torque mode	0: Digital setting 1: Speed channel	0	-	Real time
b5-20	0xB514	Digital setting of speed limit in torque control mode	-800.0% to 800.0%	0.0	%	Real-time
b5-21	0xB515	Speed limit offset in torque mode	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control	0	-	Real time
b5-22	0xB516	Speed limit offset source in torque mode	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-23	0xB517	Digital setting of speed limit offset in torque mode	0.0% to 800.0%	5.0	%	Real-time
b5-24	0xB518	Supplementary torque reference 1 source	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-25	0xB519	Digital setting of supplementary torque reference 1	-400.0% to 400.0%	0.0	%	Real-time
b5-26	0xB51A	Supplementary torque reference 2 source	0: 0 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b5-27	0xB51B	Supplementary torque reference 2	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b6-00	0xB600	Main frequency source	0: Set by b6-01 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-01	0xB601	Digital setting of main frequency	0.00 Hz to A2-17	50.00	Hz	At once
b6-02	0xB602	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-03	0xB603	Main and auxiliary frequency operation	0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (|main frequency|, |auxiliary frequency|) 3: Min. (|main frequency|, |auxiliary frequency|) 4: Main frequency x auxiliary frequency	0	-	Real time
b6-04	0xB604	Auxiliary frequency source	0: Invalid 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-05	0xB605	Main frequency gain coefficient source	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b6-06	0xB606	Auxiliary frequency gain coefficient source	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-07	0xB607	Jogging frequency 1 source	0: Set by b6-08 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-08	0xB608	Digital setting of jogging frequency 1	-50.00 Hz to 50.00 Hz	2.00	Hz	At once
b6-09	0xB609	Jogging frequency 2 source	0: Set by b6-10 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-10	0xB60A	Digital setting of jogging frequency 2	-50.00 Hz to 50.00 Hz	-2.00	Hz	At once
b6-13	0xB60D	Torque reference source	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-14	0xB60E	Torque reference digital setting	-800.0% to 800.0%	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b6-15	0xB60F	Torque reference gain factor	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-16	0xB610	Torque filter time	0 ms to 10000 ms	0	ms	Real-time
b6-17	0xB611	Torque acceleration time	0.000s to 60.000s	0.000	s	Real-time
b6-18	0xB612	Torque deceleration time	0.000s to 60.000s	0.000	s	Real-time
b6-19	0xB613	Speed limit source in torque mode	0: Digital setting 1: Speed channel	0	-	Real time
b6-20	0xB614	Digital setting of speed limit in torque control mode	-800.0% to 800.0%	0.0	%	Real-time
b6-21	0xB615	Speed limit offset in torque mode	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control	0	-	Real time
b6-22	0xB616	Speed limit offset source in torque mode	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-23	0xB617	Digital setting of speed limit offset in torque mode	0.0% to 800.0%	5.0	%	Real-time
b6-24	0xB618	Supplementary torque reference 1 source	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-25	0xB619	Digital setting of supplementary torque reference 1	-400.0% to 400.0%	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b6-26	0xB61A	Supplementary torque reference 2 source	0: 0 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b6-27	0xB61B	Supplementary torque reference 2	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b7-00	0xB700	Ramp acceleration/ deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	-	Real time
b7-01	0xB701	Ramp acceleration/ deceleration time base frequency	0: Rated frequency 1: Maximum frequency 2: 100 Hz 3: Set frequency	1	-	Real time
b7-02	0xB702	Ramp selection bit 0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b7-03	0xB703	Ramp selection bit 1	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b7-04	0xB704	Ramp 1 acceleration time	0.0s to 6500.0s	20.0	s	Real-time
b7-05	0xB705	RFG 1 deceleration time	0.0s to 6500.0s	20.0	s	Real-time
b7-06	0xB706	Ramp 1 acceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-07	0xB707	Ramp 1 acceleration end arc	0.00s to 650.00s	0.00	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b7-08	0xB708	Ramp 1 deceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-09	0xB709	Ramp 1 deceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-10	0xB70a	Ramp 2 acceleration time	0.0s to 6500.0s	20.0	s	Real-time
b7-11	0xB70B	RFG 2 deceleration time	0.0s to 6500.0s	20.0	s	Real-time
b7-12	0xB70c	Ramp 2 acceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-13	0xB70d	Ramp 2 acceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-14	0xB70e	Ramp 2 deceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-15	0xB70f	Ramp 2 deceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-16	0xB710	Ramp 3 acceleration time	0.00s to 650.00s	20.00	s	Real-time
b7-17	0xB711	RFG 3 deceleration time	0.00s to 650.00s	20.00	s	Real-time
b7-18	0xB712	Ramp 3 acceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-19	0xB713	Ramp 3 acceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-20	0xB714	Ramp 3 deceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-21	0xB715	Ramp 3 deceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-22	0xB716	Ramp 4 acceleration time	0.00s to 650.00s	20.00	s	Real-time
b7-23	0xB717	RFG 4 deceleration time	0.00s to 650.00s	20.00	s	Real-time
b7-24	0xB718	Ramp 4 acceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-25	0xB719	Ramp 4 acceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-26	0xB71a	Ramp 4 deceleration start arc	0.00s to 650.00s	0.00	s	Real-time
b7-27	0xB71B	Ramp 4 deceleration end arc	0.00s to 650.00s	0.00	s	Real-time
b7-28	0xB71c	Ramp 1/2 frequency switchover	0: Disable 1: Enable	0	-	Real time
b7-29	0xB71d	Ramp 1/2 acceleration switchover frequency	0.0 Hz to A2-18	0.0	Hz	At once

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b7-30	0xB71e	Ramp 1/2 deceleration switchover frequency	0.0 Hz to A2-18	0.0	Hz	At once
b7-31	0xB71f	Jogging ramp source	0: Normal running ramp time 1: Jogging ramp time	0	-	Real time
b7-32	0xB720	Ramp acceleration time of jogging	0.00s to 650.00s	20.00	s	Real-time
b7-33	0xB721	Ramp deceleration time of jogging	0.00s to 650.00s	20.00	s	Real-time
b7-34	0xB722	Deceleration time for quick stop	0.00s to 650.00s	1.00	s	Real-time
b7-35	0xB723	Initial arc of quick stop	0.00s to 650.00s	0.00	s	Real-time
b7-36	0xB724	Final arc of quick stop	0.00s to 650.00s	0.00	s	Real-time
b7-37	0xB725	Frequency acceleration time in torque control	0.00s to 650.00s	20.00	s	Real-time
b7-38	0xB726	Frequency deceleration time in torque control	0.00s to 650.00s	20.00	s	Real-time
b7-39	0xB727	Ramp acceleration time gain coefficient	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b7-40	0xB728	Ramp deceleration time gain coefficient	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b7-41	0xB729	Acceleration time gain coefficient at low speed	1.0% to 1000.0%	100.0	%	Real-time
b7-42	0xB72a	Low speed threshold	0.00% to 100.00%	15.00	%	Real-time
b7-43	0xB72B	Ramp arc mode	0: Incontinuous smoothing 1: Continuous smoothing	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b7-44	0xB72c	Ramp output force enable	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b7-45	0xB72d	Ramp output force value	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
b7-46	0xB72e	Ramp tracking enable	0: Disable 1: Enable	0	-	Real time
b7-47	0xB72f	Ramp tracking error	0.0% to 100.0%	10.0	%	Real-time
b8-00	0xB800	Currently effective multi-reference 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	-	Unchangeable
b8-01	0xB801	Currently valid multi-reference output	-3000.0% to 3000.0%	0.0	%	Unchangeable
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.	Address	Name	Value Range	Default	Unit	Change Mode
b8-03	0xB803	Multi-reference bit 0	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b8-04	0xB804	Multi-reference bit 1	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b8-05	0xB805	Multi-reference bit 2	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b8-06	0xB806	Multi-reference bit 3	0: 0 1: 1 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
b8-08	0xB808	Multi-reference 0 setting mode	0: b8-09 1: AI1 2: Reserved 3: Potentiometer MD-BP-M 4: HDI pulse reference 5: PID 6: b5-01/b6-01 (main frequency digital setting) Others: F connector	0	-	Real time
b8-09	0xB809	Multi-reference 0	b8-43 to b8-42	0.0	-	Real time
b8-10	0xB80A	Multi-reference 1	b8-43 to b8-42	0.0	-	Real time
b8-11	0xB80B	Multi-reference 2	b8-43 to b8-42	0.0	-	Real time
b8-12	0xB80C	Multi-reference 3	b8-43 to b8-42	0.0	-	Real time
b8-13	0xB80D	Multi-reference 4	b8-43 to b8-42	0.0	-	Real time
b8-14	0xB80E	Multi-reference 5	b8-43 to b8-42	0.0	-	Real time
b8-15	0xB80F	Multi-reference 6	b8-43 to b8-42	0.0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
b8-16	0xB810	Multi-reference 7	b8-43 to b8-42	0.0	-	Real time
b8-17	0xB811	Multi-reference 8	b8-43 to b8-42	0.0	-	Real time
b8-18	0xB812	Multi-reference 9	b8-43 to b8-42	0.0	-	Real time
b8-19	0xB813	Multi-reference 10	b8-43 to b8-42	0.0	-	Real time
b8-20	0xB814	Multi-reference 11	b8-43 to b8-42	0.0	-	Real time
b8-21	0xB815	Multi-reference 12	b8-43 to b8-42	0.0	-	Real time
b8-22	0xB816	Multi-reference 13	b8-43 to b8-42	0.0	-	Real time
b8-23	0xB817	Multi-reference 14	b8-43 to b8-42	0.0	-	Real time
b8-24	0xB818	Multi-reference 15	b8-43 to b8-42	0.0	-	Real time
b8-41	0xB829	User-defined base value	0.1 to 6553.0	100.0	-	At stop
b8-42	0xB82A	Multi-reference upper limit threshold	0.0 to 3000.0	3000.0	-	Real time
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 Others: B connector	0	-	At stop
b9-01	0xB901	Mode of terminal start/stop module A	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	-	At stop
b9-09	0xB909	Mode of start/stop module B by terminal	0: Disable 1: IN1 is used to start the AC drive. 2: IN1 is used to start the AC drive, and IN2 is used to set the direction. 3: IN1 is used for forward start, and IN2 is used for reverse start. 4: IN1P (rising edge) is used to start the AC drive, and IN2 is used to stop the AC drive. 5: IN1P (rising edge) is used to start the AC drive, IN2 is used to stop the AC drive, and IN3 is used to set the direction. 6: IN1P (rising edge) is used for forward start, IN2P (rising edge) is used for reverse start, and IN3 is used to stop the AC drive.	3	-	At stop

Param.	Address	Name	Value Range	Default	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 11: Synchronous motor with-load auto-tuning 12: No-load dynamic auto-tuning of synchronous motor 13: Static auto-tuning on partial parameters of synchronous motor 14: Auto-tuning on gain difference between U-phase and V-phase	0	-	At stop
C2-03	0xC203	Pre-start self-test configuration	Bit 0: IGBT shoot through self-check before start 0: Disable 1: Enable Bit 1: Self-check on short circuit to ground before start 0: Disable 1: Enable Bit 2: Phase loss self-check before start 0: Disable 1: Enable Bit 3 to bit 15: Reserved	0x0	-	At stop
C2-04	0xC204	Manual self-check	0: No command 1: Self-check preparation	0	-	At stop
C2-06	0xC206	Self-check upon power-on	Bit 0: IGBT shoot through self-check upon power-on 0: Disable 1: Enable Bit 1: Self-check on short circuit to ground upon power-on 0: Disable 1: Enable Bit 2: Phase loss self-check before upon power-on 0: Disable 1: Enable Bit 3: Inter-phase short circuit self-check upon power-on 0: Disable 1: Enable Bit 4 to bit 15: Reserved	0x000A	-	At stop
C2-07	0xC207	Direction selection	0: Default 1: Opposite to the set direction	0	-	At stop
C2-17	0xC211	Auto-tuning acceleration time	0.0s to 600.0s	20.0	s	At stop
C2-18	0xC212	Auto-tuning deceleration time	0.0s to 600.0s	20.0	s	At stop
C2-19	0xC213	Parameter calculation	0: Invalid 1: Motor nameplate parameter calculation	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C2-20	0xC214	Confirmation of nameplate-based parameter calculation	0: Invalid 1: Valid	0	-	At stop
C2-30	0xC21E	No load current vector auto-tuning enable	0: Disable 1: Enable	0	-	At stop
C2-31	0xC21F	No-load current vector auto-tuning reference speed source	0: User-defined 1: Internally-defined	0	-	At stop
C4-00	0xC400	Motor type	0: Asynchronous motor 2: Synchronous motor	0	-	At stop
C4-01	0xC401	Rated motor power	0.1 kW to 1000.0 kW	3.7	kW	At stop
C4-03	0xC403	Rated motor voltage	1 V to 2000 V	380	V	At stop
C4-04	0xC404	Rated motor current	0.01 A to 655.35 A	9.00	A	At stop
C4-06	0xC406	Rated motor frequency	0.01 Hz to 599.00 Hz	50.00	Hz	At stop
C4-07	0xC407	Rated motor speed	1 RPM to 65535 RPM	1460	rmp	At stop
C4-10	0xC40A	Maximum motor frequency	C4-06 to 599.00 Hz	50.00	Hz	At stop
C4-11	0xC40B	Minimum motor frequency	0.00 Hz to C4-10	0.00	Hz	At stop
C4-12	0xC40C	Synchronous motor back EMF	0.0 V to 6553.5 V	300.0	V	Real-time
C4-13	0xC40D	Number of parallel motors	1 to 200	1	-	At stop
C4-14	0xC40E	Number of motor pole pairs (number of pole pairs/2)	0 to 128	0	-	At stop
C4-15	0xC40F	Number of effective motor pole pairs	0 to 128	0	-	Unchangeable
C4-20	0xC414	Stator resistance	0.001 to 65.535	1.204	Ω	At once
C4-22	0xC416	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908	Ω	At once
C4-24	0xC418	Asynchronous motor stator leakage inductance	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-28	0xC41C	Mutual inductance (asynchronous motor)	0.1 mH to 6553.5 mH	156.8	mH	Real time
C4-30	0xC41E	Asynchronous motor no-load current	0.01 A to 655.35 A	4.20	A	Real time
C4-32	0xC420	Synchronous motor shaft D inductance	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-34	0xC422	Synchronous motor shaft Q inductance	0.01 mH to 655.35 mH	5.28	mH	Real time
C4-62	0xC43E	Inertia ratio	0.0% to 6553.5%	120.0	%	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
C4-63	0xC43F	Electromechanical time constant	0.01s to 655.35s	1.00	s	Unchangeable
C4-64	0xC440	System rotation inertia	0.01 kg·m^2 to 655.35 kg·m^2	1.00	kg·m^2	Unchangeable
C5-10	0xC50A	Speed point 1 of friction curve	0 rpm to 30000 rpm	15	rmp	At stop
C5-11	0xC50B	Speed point 2 of friction curve	0 rpm to 30000 rpm	30	rmp	At stop
C5-12	0xC50C	Speed point 3 of friction curve	0 rpm to 30000 rpm	60	rmp	At stop
C5-13	0xC50D	Speed point 4 of friction curve	0 rpm to 30000 rpm	120	rmp	At stop
C5-14	0xC50E	Speed point 5 of friction curve	0 rpm to 30000 rpm	150	rmp	At stop
C5-15	0xC50F	Speed point 6 of friction curve	0 rpm to 30000 rpm	300	rmp	At stop
C5-16	0xC510	Speed point 7 of friction curve	0 rpm to 30000 rpm	600	rmp	At stop
C5-17	0xC511	Speed point 8 of friction curve	0 rpm to 30000 rpm	1200	rmp	At stop
C5-18	0xC512	Speed point 9 of friction curve	0 rpm to 30000 rpm	1500	rmp	At stop
C5-19	0xC513	Speed point 10 of friction curve	0 rpm to 30000 rpm	3000	rmp	At stop
C5-20	0xC514	Torque point 1 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-21	0xC515	Torque point 2 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-22	0xC516	Torque point 3 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-23	0xC517	Torque point 4 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-24	0xC518	Torque point 5 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-25	0xC519	Torque point 6 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-26	0xC51A	Torque point 7 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-27	0xC51B	Torque point 8 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-28	0xC51C	Torque point 9 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
C5-29	0xC51D	Torque point 10 of friction curve	-320.00 N·m to 320.00 N·m	0.00	N·m	At stop
d0-00	0xD000	Motor control mode	0: SVC 2: V/f	2	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d0-01	0xD001	Motor control method	0: Speed control 1: Torque control 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	At stop
d0-02	0xD002	Start mode	0: Direct start 1: Flying start	0	-	Real time
d0-03	0xD003	Flying start mode	0: Start from the frequency at stop 1: Start from the mains frequency 2: Start from the maximum frequency 4: Magnetic field directional flying start	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) stop mode	0: Coast to stop	0	-	Unchangeable
d0-06	0xD006	OFF3 (quick stop) stop mode	0: Quick stop 1: Stop at maximum capability	0	-	Real time
d0-07	0xD007	Stop mode during running	0: OFF1 stop mode 1: OFF2 (coast to stop) 2: OFF3 (quick stop)	1	-	Real time
d0-08	0xD008	Stop mode for torque control	0: Coast to stop forcibly 1: Switch to speed control mode and then stop 2: Maintain torque control mode until zero speed and then block	1	-	At stop
d0-09	0xD009	Zero-speed threshold (actual speed)	0.1% to 200.0%	2.0	%	Real-time
d0-10	0xD00A	Delay of stop at zero speed (actual speed)	0.00s to 10.00s	0.10	s	At stop
d0-11	0xD00B	Zero speed threshold (set speed)	0.0% to 200.0%	0.0	%	Real-time
d0-12	0xD00C	Delay of stop at zero speed (set speed)	0.00s to 655.35s	0.00	s	At stop
d0-13	0xD00D	Start/Stop frequency following	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
d0-14	0xD00E	Motor running direction selection	0: Default 1: Opposite to the set direction	0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d0-17	0xD011	Pre-excitation mode	0: Pre-excitation based on time 1: Pre-excitation based on the current reference 2: Pre-excitation based on the maximum current	1	-	At stop
d0-18	0xD012	Pre-excitation time	1 ms to 30000 ms	1000	ms	Real-time
d0-19	0xD013	Pre-excitation current	1% to 200%	100	%	Real-time
d0-20	0xD014	Demagnetization time	0.00s to 5.00s	0.50	s	Real-time
d0-23	0xD017	Startup frequency	0.00 Hz to 10.00 Hz	0.00	Hz	At once
d0-24	0xD018	(Startup frequency holding time)	0.0s to 1000.0s	0.0	s	At stop
d0-25	0xD019	DC injection braking time	0.0s to 100.0s	0.0	s	At stop
d0-26	0xD01A	DC braking current upon start	0% to 100%	50	%	At stop
d0-27	0xD01B	Starting frequency for DC braking at stop	0.0 Hz to 600.0 Hz	0.0	Hz	At once
d0-28	0xD01C	DC braking waiting time for stop	0.0s to 100.0s	0.0	s	Real-time
d0-29	0xD01D	DC braking time at stop	0.0s to 100.0s	0.0	s	Real-time
d0-30	0xD01E	DC braking current at stop	0% to 300%	50	%	Real-time
d0-31	0xD01F	Kp adjustment of DC braking current loop	0.1 to 2.0	1.0	-	Real time
d0-32	0xD020	Ki adjustment of DC braking current loop	0.1 to 2.0	1.0	-	Real time
d0-39	0xD027	Overexcitation selection (vector)	0: Inactive 1: Active	0	-	Real time
d0-40	0xD028	Overexciting current (vector)	0% to 150%	100	%	Real-time
d0-41	0xD029	Overexcitation gain (V/f)	0% to 200%	90	%	Real-time
d0-43	0xD02B	Flying start speed	1 to 100	20	-	Real time
d0-46	0xD02E	Flying start current	30% to 200%	80	%	At stop
d0-70	0xD046	Initial position detection of synchronous motor before start	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 start	0: Pulse 1: High-frequency injection 2: Adaptive mode 3: Pre-positioning	2	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d0-72	0xD048	Pre-startup auto-tuning configuration	Bit 0: Reserved Bit 1: Quick auto-tuning of stator resistance 0: Disable 1: Enable Bit 2: Reserved Bit 3: Reserved Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved Bit 8: Reserved Bit 9: Reserved Bit 10: Reserved Bit 11: Reserved Bit 12: Reserved Bit 13: Reserved Bit 14: Reserved Bit 15: Reserved	0x0	-	At stop
d0-75	0xD04B	Initial position detection current of synchronous motor	50% to 180%	80	%	At stop
d0-85	0xD055	Low speed handling mode	Ones: Low speed processing for synchronous motor in V/f mode (reserved) 0: None 1: Speed open-loop Tens: Low speed processing for synchronous motor in SVC mode 0: None 1: Speed open loop 2: Reserved Hundreds: Low speed processing for synchronous motor in TLC mode (reserved) 0: None 1: Speed open loop 2: Reserved Thousands: Low speed processing for asynchronous motor in SVC mode (reserved) 0: None 1: Speed open loop	0x0101	-	At stop
d0-86	0xD056	Speed open loop current	0% to 250%	100	%	Real-time
d0-87	0xD057	Speed open loop switchover frequency	0.0% to 100.0%	10.0	%	Real-time
d0-88	0xD058	Speed open loop switchover hysteresis	0.0% to 100.0%	2.5	%	Real-time
d0-89	0xD059	Waiting time for SVC speed open-loop control	0.00s to 5.00s	0.50	s	Real-time
d1-00	0xD100	Maximum motor current	0.0% to 1000.0%	1000.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d1-01	0xD101	Positive speed	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
d1-02	0xD102	Negative speed	0: Prohibited 1: Allowed 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1	-	Real time
d1-03	0xD103	Digital setting of positive frequency upper limit 1	d1-07 to 800.0%	800.0	%	At stop
d1-04	0xD104	Digital setting of reverse frequency upper limit 1	-800.0% to d1-08	-800.0	%	At stop
d1-05	0xD105	Source of forward frequency upper limit 2	0: 800% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
d1-06	0xD106	Source of negative frequency upper limit 2	0: -800% 1: Opposite to positive frequency upper limit 2 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
d1-07	0xD107	Digital setting of forward frequency lower limit 1	0.0% to d1-03	0.0	%	At stop
d1-08	0xD108	Digital setting of reverse frequency lower limit 1	d1-04 to 0.0%	0.0	%	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d1-09	0xD109	Digital setting of torque upper limit 1	0.0% to 800.0%	180.0	%	Real-time
d1-10	0xD10A	Digital setting of torque lower limit 1	-800.0% to 0.0%	-180.0	%	Real-time
d1-11	0xD10B	Source of torque upper limit 2	0: 800% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
d1-12	0xD10C	Source of torque lower limit 2	0: -800% 1: Opposite torque upper limit 2 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	1	-	Real time
d1-13	0xD10D	Motoring power limit 1	0.0% to 1000.0%	400.0	%	Real-time
d1-14	0xD10E	Generating power limit 1	0.0% to 1000.0%	400.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d1-33	0xD121	Motor protection	Bit 0: Reserved 0: Disable 1: Enable Bit 1: Current control error detection 0: Disable 1: Enable Bit 2: Motor step loss detection 0: Disable 1: Enable Bit 3: Reserved Bit 4: Synchronous motor instantaneous overcurrent protection 0: Disable 1: Enable Bit 5: Runaway protection 0: Disable 1: Enable Bit 6: Speed direction inversion protection 0: Disable 1: Enable Bit 7: Reserved 0: Disable 1: Enable Bit 8: Motor parameter error check 0: Disable 1: Enable Bit 9: Reserved Bit 10: Reserved Bit 11: Reserved Bit 12: Reserved Bit 13: Reserved Bit 14: Reserved Bit 15: Reserved	0x0080	-	Real-time
d1-35	0xD123	Overspeed protection	0: Disable 1: Enable	1	-	Real time
d1-36	0xD124	Overspeed protection time	0.0s to 60.0s	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 protection	0: Disable 1: Enable	1	-	Real time
d1-39	0xD127	Time for excessive speed deviation protection	0.0s to 60.0s	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	0.20 to 10.00	1.00	-	Real time
d1-47	0xD12F	Motor overload warning coefficient	50% to 100%	100	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d1-54	0xD136	Overvoltage suppression	0: Disable 1: Enable	1	-	Real time
d1-55	0xD137	Overvoltage suppression action voltage	330.0 V to 800.0 V	770.0	V	Real-time
d1-56	0xD138	Overvoltage suppression actual effective action voltage	330.0 V to 800.0 V	770.0	V	Unchangeable
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
d1-63	0xD13F	Undervoltage action	0: No action 1: Undervoltage suppression; normal operation continues after voltage recovery 2: Reserved	0	-	Real time
d1-64	0xD140	Undervoltage suppression action voltage	190.0 V to 500.0 V	430.0	V	Real-time
d1-65	0xD141	Undervoltage suppression actual effective action voltage	190.0 V to 500.0 V	430.0	V	Unchangeable
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
d1-78	0xD14E	Three-phase loss protection	0: Disable 1: Enable	1	-	Real time
d1-81	0xD151	Three-phase output phase loss detection time	0.0s to 5.0s	1.0	s	Real-time
d1-82	0xD152	Current threshold of three-phase output phase loss	0.0% to 100.0%	10.0	%	Real-time
d2-00	0xD200	V/f curve type	0: Linear V/f 1: Multi-point V/f 10: V/f separation	0	-	At stop
d2-01	0xD201	Multi-point curve source	0: Three-point curve	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d2-02	0xD202	Frequency point 1 on a multi-point V/f curve	0.0 Hz to d2-03	0.0	Hz	At once
d2-03	0xD203	Frequency point 2 on a multi-point V/f curve	d2-02 to d2-04	0.0	Hz	At once
d2-04	0xD204	Frequency point 3 on a multi-point V/f curve	d2-03 to 600.0 Hz	0.0	Hz	At once
d2-08	0xD208	Voltage point 1 on a multi-point V/f curve.	0.0 V to 1000.0 V	0.0	V	Real-time
d2-09	0xD209	Voltage point 2 on a multi-point V/f curve.	0.0 V to 1000.0 V	0.0	V	Real-time
d2-10	0xD20A	Voltage point 3 on a multi-point V/f curve.	0.0 V to 1000.0 V	0.0	V	Real-time
d2-14	0xD20E	Manual torque boost value	0.0% to 100.0%	3.0	%	Real-time
d2-15	0xD20F	Cut-off frequency of torque boost	0.0% to 400.0%	100.0	%	Real-time
d2-16	0xD210	Torque boost mode	0: Manual boost 1: Automatic boost 2: Manual boost +automatic boost	2	-	Real time
d2-22	0xD216	V/f oscillation suppression	0: Disable 1: Enable	1	-	Real time
d2-23	0xD217	V/f oscillation suppression gain	0% to 400%	100	%	Real-time
d2-26	0xD21A	Overcurrent suppression	0: Disable 1: Enable	1	-	At stop
d2-27	0xD21B	Overcurrent suppression point	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
d2-35	0xD223	Energy-saving in V/f control mode	0: Disable 1: Enable	0	-	Real time
d2-36	0xD224	Cut-off frequency of V/f energy-saving control	20% to 100%	30	%	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	0.1s to 10.0s	0.5	s	At stop
d2-47	0xD22F	Upper limit of V/f separation voltage	50.0% to 200.0%	100.0	%	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d2-48	0xD230	Voltage source of V/f separation	0: Set by d2-49 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
d2-49	0xD231	Digital setting of V/f separation voltage	0 V to C4-03	0	V	Real-time
d2-50	0xD232	Voltage acceleration time of V/f separation	0.0s to 1000.0s	0.0	s	Real-time
d2-51	0xD233	Voltage deceleration time of V/f separation	0.0s to 1000.0s	0.0	s	Real-time
d2-52	0xD234	Frequency RFG time of V/f separation	0: RFG time forced to 0 1: Preset RFG time	0	-	At stop
d2-53	0xD235	Stop mode selection of V/f separation	0: Frequency and voltage decline to 0 independently 1: Frequency declines to 0 after voltage declines to 0 2: Coast to stop	0	-	Real time
d3-02	0xD302	Speed loop Kp in SVC mode	0.00 to 100.00	5.00	-	Real time
d3-06	0xD306	Zero speed switchover frequency	0.0% to d3-09	1.0	%	Real-time
d3-07	0xD307	Zero speed Kp correction factor	0.0% to 1000.0%	100.0	%	Real-time
d3-08	0xD308	Zero speed Ti correction 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 correction factor	0.0% to 1000.0%	100.0	%	Real-time
d3-11	0xD30B	Low speed Ti correction factor	0.0% to 1000.0%	100.0	%	Real-time
d3-12	0xD30C	High speed switchover frequency	d3-09 to 400.0%	20.0	%	Real-time
d3-13	0xD30D	High speed Kp correction factor	0.0% to 1000.0%	100.0	%	Real-time
d3-14	0xD30E	High speed Ti correction factor	0.0% to 1000.0%	100.0	%	Real-time
d3-21	0xD315	Defines the lower limit of speed loop adaptive switchover.	0.0% to 1000.0%	40.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d3-22	0xD316	Defines the upper limit of speed loop adaptive switchover.	0.0% to 1000.0%	100.0	%	Real-time
d3-23	0xD317	Speed loop adaption correction upper limit	0.0% to 1000.0%	100.0	%	Real-time
d3-24	0xD318	Lower limit of speed loop adaptive correction	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 adjustment output 3: Speed adjustment integral component	1	-	At stop
d3-29	0xD31D	Droop coefficient	0.0% to 50.0%	0.0	%	Real-time
d3-33	0xD321	Integral force enable	0: Disable 1: Enable Others: B connector	0	-	Real time
d3-34	0xD322	Integral force source	0: Digital setting 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
d3-35	0xD323	Digital setting of integral force	–800.0% to 800.0%	0.0	%	Real-time
d3-38	0xD326	Acceleration feedforward torque	0: Disable 1: Enable	0	-	Real time
d3-39	0xD327	Acceleration feedforward torque coefficient	0.0% to 6553.0%	100.0	%	Real-time
d3-40	0xD328	Feedforward acceleration speed source	0: RFG reference 1: Automatic calculation Others: F connector	0	-	Real time
d3-46	0xD32E	Frequency reference filter time	0.0 ms to 100.0 ms	0.0	ms	At stop
d3-47	0xD32F	Feedback frequency filter time	0.0 ms to 100.0 ms	0.0	ms	At stop
d3-48	0xD330	Current low-pass filter time for torque reference	0.0 ms to 100.0 ms	0.0	ms	At stop
d3-55	0xD337	Anti-load disturbance	0: Disable 1: Enable	0	-	At stop
d3-57	0xD339	Anti-load disturbance bandwidth	0.00 Hz to 300.00 Hz	0.00	Hz	At once

Param.	Address	Name	Value Range	Default	Unit	Change Mode
d3-58	0xD33A	Anti-load disturbance coefficient	0.0% to 1000.0%	100.0	%	Real-time
d4-00	0xD400	Current loop D-axis Kp coefficient	1% to 1000%	100	%	Real-time
d4-01	0xD401	Current loop D-axis Ki coefficient	1% to 1000%	100	%	Real-time
d4-02	0xD402	Current loop Q-axis Kp coefficient	1% to 1000%	100	%	Real-time
d4-03	0xD403	Current loop Q-axis Ki coefficient	1% to 1000%	100	%	Real-time
d5-03	0xD503	Rated flux adjustment factor	50.0% to 200.0%	100.0	%	Real-time
d5-17	0xD511	Demagnetization current limit	0% to 500%	300	%	Real-time
d5-25	0xD519	Asynchronous motor energy-saving control	0: Disable 1: Enable	0	-	Real time
d5-28	0xD51C	Flux lower limit in energy-saving control of asynchronous motor	10.0% to 100.0%	50.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-00	0xE000	DI1 function selection	0: No function 1: Terminal start/stop module A_IN1 2: Terminal start/stop module A_IN2 3: Terminal start/stop module A_IN3 4: Terminal start/stop module A jog 1 (JOG1) 5: Terminal start/stop module A jog 2 (JOG2) 6: Function as UP key for frequency adjustment 7: Function as DOWN key for frequency adjustment 8: Coast to stop 9: Fault reset (RESET) 10: Running 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 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 21: Acceleration/Deceleration inhibited 22: PID pause 23: Simple PLC state reset 29: Torque control inhibited 30: Pulse frequency input (available only for DI4) 32: Immediate DC braking 33: Normally closed (NC) input of external fault 34: Frequency modification enable 35: Opposite to the PID action direction 36: External stop terminal 1 38: PID integral pause 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2	1	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-00	0xE000	DI1 function selection	46: Speed control/torque control selection 47: Emergency stop 49: Decelerate to DC braking 50: Clear current operating time 61: Terminal start/stop module B_IN1 62: Terminal start/stop module B_IN2 63: Terminal start/stop module B_IN3 64: Terminal start/stop module B jog 1 (JOG1) 65: Terminal start/stop module B jog 2 (JOG2) 66: Forced local control 67: Forced terminal control 68: Forced communication control 69: Forced custom control 70: Control channel selection 71: Set channel selection 72: Terminal module A/B selection 77: Running enable (all modes) 78: Forward running allowed 79: Reverse running allowed 80: RFG input set to zero	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	9	-	At stop
E0-03	0xE003	DI4 function selection	Same as E0-00	12	-	At stop
E0-04	0xE004	DI5 function selection (for MD600A)	Same as E0-00	0	-	At stop
E0-10	0xE00A	VDI1 function selection	Same as E0-00	0	-	At stop
E0-11	0xE00B	VDI1 function selection	Same as E0-00	0	-	At stop
E0-12	0xE00C	VDI1 function selection	Same as E0-00	0	-	At stop
E0-13	0xE00D	VDI1 function selection	Same as E0-00	0	-	At stop
E0-14	0xE00E	VDI5 function	Same as E0-00	0	-	At stop
E0-15	0xE00F	VDI1 function selection	Same as E0-00	0	-	At stop
E0-16	0xE010	DI input filter time 1	0.000s to 1.000s	0.010	s	Real-time
E0-17	0xE011	DI input filter time 2	0.000s to 1.000s	0.010	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-18	0xE012	DI input filter time selection	Bit 0: DI1 filter time 0: Filter time 1 1: Filter time 2 Bit 1: DI2 filter time 0: Filter time 1 1: Filter time 2 Bit 2: DI3 filter time 0: Filter time 1 1: Filter time 2 Bit 3: DI4 filter time 0: Filter time 1 1: Filter time 2 Bit 4: DI5 filter time (MD600A) 0: Filter time 1 1: Filter time 2 Bit 5 to bit 15: Reserved	0x0	-	Real-time
E0-19	0xE013	Step value of terminal functioning as UP/ DOWN keys	0.001 Hz/s to 65.535 Hz/s	1.000	Hz/s	Real time
E0-20	0xE014	DI1 switch-on delay time	0.0s to 3600.0s	0.0	s	At stop
E0-21	0xE015	DI1 switch-off delay time	0.0s to 3600.0s	0.0	s	At stop
E0-22	0xE016	DI2 switch-on delay time	0.0s to 3600.0s	0.0	s	At stop
E0-23	0xE017	DI2 switch-off delay time	0.0s to 3600.0s	0.0	s	At stop
E0-24	0xE018	DI3 switch-on delay time	0.0s to 3600.0s	0.0	s	At stop
E0-25	0xE019	DI3 switch-off delay time	0.0s to 3600.0s	0.0	s	At stop
E0-26	0xE01A	DI4 switch-on delay time	0.0s to 3600.0s	0.0	s	At stop
E0-27	0xE01B	DI4 switch-off delay time	0.0s to 3600.0s	0.0	s	At stop
E0-28	0xE01C	DI5 switch-on delay time (MD600A)	0.0s to 3600.0s	0.0	s	At stop
E0-29	0xE01D	DI5 switch-off delay time (MD600A)	0.0s to 3600.0s	0.0	s	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-40	0xE028	DI force enable	Bit 0: DI1 0: Hardware 1: Forced value Bit 1: DI2 0: Hardware 1: Forced value Bit 2: DI3 0: Hardware 1: Forced value Bit 3: DI4 0: Hardware 1: Forced value Bit 4: DI5 (MD600A) 0: Hardware 1: Forced value Bit 5 to bit 15: Reserved	0x0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-56	0xE038	DI forced data	Bit 0: DI1 setting 0: Invalid level 1: Valid level Bit 1: DI2 setting 0: Invalid level 1: Valid level Bit 2: DI3 setting 0: Invalid level 1: Valid level Bit 3: DI4/HDI setting 0: Invalid level 1: Valid level Bit 4: DI5 setting (MD600A) 0: Invalid level 1: Valid level Bit 5: Reserved 0: Invalid level 1: Valid level Bit 6: Reserved 0: 0: Invalid level 1: Valid level Bit 7: Reserved 0: Invalid level 1: Valid level Bit 8: Reserved 0: Invalid level 1: Valid level Bit 9: Reserved 0: Invalid level 1: Valid level Bit 10: VDI1 setting 0: Invalid level 1: Valid level Bit 11: VDI2 setting 0: Invalid level 1: Valid level Bit 12: VDI3 setting 0: Invalid level 1: Valid level Bit 13: VDI4 setting 0: Invalid level 1: Valid level Bit 14: VDI5 setting 0: Invalid level 1: Valid level Bit 15: VDI6 setting 0: Invalid level 1: Valid level	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E0-57	0xE039	DI active mode selection	Bit 0: DI1 active mode 0: Active high 1: Active low Bit 1: DI2 active mode 0: Active high 1: Active low Bit 2: DI3 active mode 0: Active high 1: Active low Bit 3: DI4 active mode 0: Active high 1: Active low Bit 4: DI5 active mode (MD600A) 0: Active high 1: Active low Bit 5: Reserved 0: Active high 1: Active low Bit 6: Reserved 0: Active high 1: Active low Bit 7: Reserved 0: Active high 1: Active low Bit 8: Reserved 0: Active high 1: Active low Bit 9: Reserved 0: Active high 1: Active low Bit 10: VDI1 active mode 0: Active high 1: Active low Bit 11: VDI2 active mode 0: Active high 1: Active low Bit 12: VDI3 active mode 0: Active high 1: Active low Bit 13: VDI4 active mode 0: Active high 1: Active low Bit 14: VDI5 active mode 0: Active high 1: Active low Bit 15: VDI6 active mode 0: Active high 1: Active low	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-00	0xE100	RO1 output function selection	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Cumulative running time reach 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 43: Output upon minor fault or warning Others: B connector	2	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-04	0xE104	DO1 function selection (for MD600A)	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Cumulative running time reach 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 43: Output upon minor fault or warning Others: B connector	1	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-05	0xE105	DO2 function selection (for MD600A)	0: No output 1: AC drive running 2: Fault output 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 11: Simple PLC cycle completed 12: Cumulative running time reach 14: Torque limited 15: Ready to run 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (output at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Output upon frequency 1 reach 27: Output upon frequency 2 reach 28: Output upon current 1 reach 29: Output upon current 2 reach 30: Output upon expiration of scheduled time 31: AI1 input limit exceeded 32: Three-phase loss 33: Reverse running 34: Zero current state 35: Module temperature reach 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon fault, minor fault, or warning 40: Current running time reach 41: Output upon fault (excluding undervoltage) 43: Output upon minor fault or warning Others: B connector	4	-	Real time
E1-16	0xE110	RO1 switch-on delay time	0.0s to 3600.0s	0.0	s	Real-time
E1-17	0xE111	RO1 switch-off delay time	0.0s to 3600.0s	0.0	s	Real-time
E1-24	0xE118	DO1 switch-on delay time (MD600A)	0.0s to 3600.0s	0.0	s	Real-time
E1-25	0xE119	DO1 switch-off delay time (MD600A)	0.0s to 3600.0s	0.0	s	Real-time
E1-26	0xE11A	DO2 switch-on delay time (MD600A)	0.0s to 3600.0s	0.0	s	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-27	0xE11B	DO2 switch-off delay time (MD600A)	0.0s to 3600.0s	0.0	s	Real-time
E1-36	0xE124	DO/RO/VDO output source	Bit 0: RO1 source 0: Output function setting 1: Forced value Bit 1: Reserved 0: Output function setting 1: Forced value Bit 2: Reserved 0: Output function setting 1: Forced value Bit 3: Reserved 0: Output function setting 1: Forced value Bit 4: DO1 source (MD600A) 0: Output function setting 1: Forced value Bit 5: DO2 source (MD600A) 0: Output function settingv 1: Forced value Bit 6: Reserved 0: Output function setting 1: Forced value Bit 7: Reserved 0: Output function setting 1: Forced value Bit 8: Reserved 0: Output function setting 1: Forced value Bit 9: Reserved 0: Output function setting 1: Forced value Bit 10: VDO1 source 0: Output function setting 1: Forced value Bit 11: VDO2 source 0: Output function setting 1: Forced value Bit 12: VDO3 source 0: Output function setting 1: Forced value Bit 13: VDO4 source 0: Output function setting 1: Forced value Bit 14: VDO5 source 0: Output function setting 1: Forced value Bit 15: VDO6 source 0: Output function setting 1: Forced value	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-37	0xE125	DO/RO/VDO forced data	Bit 0: RO1 setting 0: Low level 1: High level Bit 1: Reserved 0: Low level 1: High level Bit 2: Reserved 0: Low level 1: High level Bit 3: Reserved 0: Low level 1: High level Bit 4: DO1 setting (MD600A) 0: Low level 1: High level Bit 5: DO2 setting (MD600A) 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDO1 setting 0: Low level 1: High level Bit 11: VDO2 setting 0: Low level 1: High level Bit 12: VDO3 setting 0: Low level 1: High level Bit 13: VDO4 setting 0: Low level 1: High level Bit 14: VDO5 setting 0: Low level 1: High level Bit 15: VDO6 setting 0: Low level 1: High level	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E1-38	0xE126	DO/RO/VDO polarity selection	Bit 0: RO1 0: Positive logic 1: Negative logic Bit 1: Reserved 0: Positive logic 1: Negative logic Bit 2: Reserved 0: Positive logic 1: Negative logic Bit 3: Reserved 0: Positive logic 1: Negative logic Bit 4: DO1 (MD600A) 0: Positive logic 1: Negative logic Bit 5: DO2 (MD600A) 0: Positive logic 1: Negative logic Bit 6: Reserved 0: Positive logic 1: Negative logic Bit 7: Reserved 0: Positive logic 1: Negative logic Bit 8: Reserved 0: Positive logic 1: Negative logic Bit 9: Reserved 0: Positive logic 1: Negative logic Bit 10: VDO1 0: Positive logic 1: Negative logic Bit 11: VDO2 0: Positive logic 1: Negative logic Bit 12: VDO3 0: Positive logic 1: Negative logic Bit 13: VDO4 0: Positive logic 1: Negative logic Bit 14: VDO5 0: Positive logic 1: Negative logic Bit 15: VDO6 0: Positive logic 1: Negative logic	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E2-00	0xE200	AI hardware source selection	Ones: AI1 source 0: Hardware sampling 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	At stop
E2-01	0xE201	AI1 forced value	-10.00 V to 10.00 V	0.00	V	Real-time
E2-07	0xE207	AI1 gain	-10.00 to 10.00	1.00	-	Real time
E2-08	0xE208	AI1 offset	-10.00 V to 10.00 V	0.00	V	Real-time
E2-09	0xE209	AI1 denoising threshold	0.0% to 100.0%	0.0	%	Real-time
E2-10	0xE20A	AI1 filter time	0.00s to 10.00s	0.10	s	Real-time
E2-11	0xE20B	AI1 zero-crossing threshold	0.0% to 100.0%	0.0	%	Real-time
E2-12	0xE20C	AI1 jump point	-800.0% to 800.0%	0.0	%	Real-time
E2-13	0xE20D	AI1 jump amplitude	0.0% to 100.0%	0.1	%	Real-time
E2-14	0xE20E	AI1 input upper limit	E2-15 to 10.00 V	8.00	V	Real-time
E2-15	0xE20F	AI1 input lower limit	0.00 V to E2-14	2.00	V	Real-time
E2-34	0xE222	AI input protection time	0.00S to 1.00s	0.01	s	Real-time
E2-35	0xE223	High level judgment threshold when AI uses as DI	5.5 V to 9.0 V	7.0	V	Real-time
E2-36	0xE224	Low level judgment threshold when AI uses as DI	1.0 V to 4.5 V	3.0	V	Real-time
E2-37	0xE225	AI polarity selection	Ones: AI1 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E2-38	0xE226	AI curve selection	Ones: AI1 curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Tens: Reversed 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Hundreds: Potentiometer MD-BP-M curve selection 1: Curve 1 (2 points, see E2-40 to E2-43) 2: Curve 2 (2 points, see E2-44 to E2-47) 3: Curve 3 (2 points, see E2-48 to E2-51) 4: Curve 4 (4 points, see E2-52 to E2-59) 5: Curve 5 (4 points, see E2-60 to E2-67) Thousands position: Reserved	0x0111	-	Real-time
E2-39	0xE227	Selection when AI value < minimum input value	Ones: Setting for AI1 less than minimum input 0: Reference corresponding to minimum input 1: 0.0% Tens: Reserved 0: Reference corresponding to minimum input 1: 0.0% Hundreds: Setting for MD-BP-M potentiometer less than minimum input 0: Reference corresponding to minimum input 1: 0.0% Thousands position: Reserved	0x0	-	Real-time
E2-40	0xE228	Minimum input of AI curve 1	-10.00 V to E2-42	0.00	V	Real-time
E2-41	0xE229	Percentage corresponding to minimum input of AI curve 1	-800.0% to 800.0%	0.0	%	Real-time
E2-42	0xE22A	Maximum input of AI curve 1	E2-40 to 10.00 V	10.00	V	Real-time
E2-43	0xE22B	Percentage corresponding to maximum input of AI curve 1	-800.0% to 800.0%	100.0	%	Real-time
E2-44	0xE22C	Minimum input of AI curve 2	-10.00 V to E2-46	0.00	V	Real-time
E2-45	0xE22D	Percentage corresponding to minimum input of AI curve 2	-800.0% to 800.0%	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E2-46	0xE22E	Maximum input of AI curve 2	E2-44 to 10.00 V	10.00	V	Real-time
E2-47	0xE22F	Percentage corresponding to maximum input of AI curve 2	-800.0% to 800.0%	100.0	%	Real-time
E2-48	0xE230	Minimum input of AI curve 3	-10.00 V to E2-50	0.00	V	Real-time
E2-49	0xE231	Percentage corresponding to minimum input of AI curve 3	-800.0% to 800.0%	0.0	%	Real-time
E2-50	0xE232	Maximum input of AI curve 3	E2-48 to 10.00 V	10.00	V	Real-time
E2-51	0xE233	Percentage corresponding to maximum input of AI curve 3	-800.0% to 800.0%	100.0	%	Real-time
E2-52	0xE234	Minimum input of AI curve 4	-10.00 V to E2-54	0.00	V	Real-time
E2-53	0xE235	Percentage corresponding to minimum input of AI curve 4	-800.0% to 800.0%	0.0	%	Real-time
E2-54	0xE236	Inflection point 1 input of AI curve 4	E2-52 to E2-56	3.00	V	Real-time
E2-55	0xE237	Percentage corresponding to inflection point 1 input of AI curve 4	-800.0% to 800.0%	30.0	%	Real-time
E2-56	0xE238	Inflection point 2 input of AI curve 4	E2-54 to E2-58	6.00	V	Real-time
E2-57	0xE239	Percentage corresponding to inflection 2 input of AI curve 4	-800.0% to 800.0%	60.0	%	Real-time
E2-58	0xE23A	Maximum input of AI curve 4	E2-56 to 10.00 V	10.00	V	Real-time
E2-59	0xE23B	Percentage corresponding to maximum input of AI curve 4	-800.0% to 800.0%	100.0	%	Real-time
E2-60	0xE23C	Minimum input of AI curve 5	-10.00 V to E2-62	-10.00	V	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E2-61	0xE23D	Percentage corresponding to minimum input of AI curve 5	-800.0% to 800.0%	-100.0	%	Real-time
E2-62	0xE23E	Inflection point 1 input of AI curve 5	E2-60 to E2-64	-3.00	V	Real-time
E2-63	0xE23F	Percentage corresponding to inflection point 1 input of AI curve 5	-800.0% to 800.0%	-30.0	%	Real-time
E2-64	0xE240	Inflection point 2 input of AI curve 5	E2-62 to E2-66	3.00	V	Real-time
E2-65	0xE241	Percentage corresponding to inflection 2 input of AI curve 5	-800.0% to 800.0%	30.0	%	Real-time
E2-66	0xE242	Maximum input of AI curve 5	E2-64 to 10.00 V	10.00	V	Real-time
E2-67	0xE243	Percentage corresponding to maximum input of AI curve 5	-800.0% to 800.0%	100.0	%	Real-time
E2-68	0xE244	AI automatic adjustment curve	Ones: Point selection (for settings) 0: Disable 1: Point 1 2: Point 2 3: Point 3 4: Point 4 Tens: AI channel selection (for settings) 0: Disable 1: AI1 Hundreds position: Control function (for settings) 0: Disable 1: Enable Thousands: X-point curve (for display) 0: The control function is disabled or the channel is not selected. 2: 2-point curve 4: 4-point curve Ten thousands: Reserved	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E3-00	0xE300	AO1 output function selection	0: Running frequency 1: Frequency reference 2: Output current 3: Output torque (absolute value) 4: Output power 5: Output voltage 6: HDI input 7: AI1 12: Communication setting 13: Motor speed 14: Output current (100% corresponding to 1000 A) 15: Bus voltage (100% corresponding to 1000 A) 16: Output torque (actual value) Others: F connector	0	-	Real time
E3-03	0xE303	AO polarity selection	Ones: AO1 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E3-04	0xE304	AO curve selection	Ones: AO1 curve 0: Two-point curve 1: Gain+Offset Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E3-05	0xE305	Minimum input of AO1 curve	-800.00% to E3-07	0.0	%	Real-time
E3-06	0xE306	Setting corresponding to AO1 curve minimum input	0.00 V to 10.00 V	0.00	V	Real-time
E3-07	0xE307	Maximum input of AO1 curve	E3-05 to 800.0%	100.0	%	Real-time
E3-08	0xE308	Setting corresponding to AO1 curve maximum input	0.00 V to 10.00 V	10.00	V	Real time
E3-17	0xE311	AO1 zero offset coefficient	–100.0% to 100.0%	0.0	%	Real-time
E3-18	0xE312	AO1 gain	-10.00 to 10.00	1.00	-	Real time
E3-23	0xE317	AO1 output offset	-10.00 V to 10.00 V	0.00	V	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E3-26	0xE31A	AO hardware source selection	Ones: AO1 source 0: Output function 1: Forced value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E3-27	0xE31B	AO1 forced value	0.00 V to 10.00 V	0.00	V	Real-time
E4-00	0xE400	DI4/HDI terminal type selection	0: HDI 1: DI	1	-	Unchangeable
E4-02	0xE402	HDI hardware source selection	0: Hardware sampling 1: Forced value	0	-	Real time
E4-03	0xE403	HDI forced setpoint	0.00 kHz to 100.00 kHz	1.00	kHz	Real time
E4-07	0xE407	HDI curve setting	Ones: HDI curve selection 0: Two-point curve 1: Four-point curve Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E4-08	0xE408	Minimum input of two-point HDI curve	0.00 kHz to E4-10	0.00	kHz	Real time
E4-09	0xE409	Percentage corresponding to minimum input of two-point HDI curve	-800.0% to 800.0%	0.0	%	Real-time
E4-10	0xE40A	Maximum input of two-point HDI curve	E4-08 to 20.00 kHz	20.00	kHz	Real time
E4-11	0xE40B	Percentage corresponding to maximum input of two-point HDI curve	-800.0% to 800.0%	100.0	%	Real-time
E4-12	0xE40C	Minimum input of four-point HDI curve	0.00 kHz to E4-14	0.00	kHz	Real time
E4-13	0xE40D	Percentage corresponding to minimum input of four-point HDI curve	-800.0% to 800.0%	-100.0	%	Real-time
E4-14	0xE40E	Inflection point 1 input of four-point HDI curve	E4-12 to E4-16	5.00	kHz	Real time
E4-15	0xE40F	Percentage corresponding to inflection point 1 input of four-point HDI curve	-800.0% to 800.0%	-30.0	%	Real-time
E4-16	0xE410	Inflection point 2 input of four-point HDI curve	E4-14 to E4-18	10.00	kHz	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
E4-17	0xE411	Percentage corresponding to inflection point 2 input of four-point HDI curve	-800.0% to 800.0%	30.0	%	Real-time
E4-18	0xE412	Maximum input of four-point HDI curve	E4-16 to 20.00 kHz	20.00	kHz	Real time
E4-19	0xE413	Percentage corresponding to maximum input of four-point HDI curve	-800.0% to 800.0%	100.0	%	Real-time
E4-32	0xE420	HDI filter time	0.00s to 10.00s	0.10	s	Real-time
E4-33	0xE421	HDI polarity selection	Ones: HDI 0: Normal value 1: Absolute value 2: Opposite to normal value 3: Opposite to absolute value Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E4-34	0xE422	HDI denoising threshold	0.0% to 10.0%	0.0	%	Real-time
E4-35	0xE423	HDI curve upper/lower limit	Ones: HDI 0: Limited 1: Not limited Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
E4-36	0xE424	HDI impulse noise	0 ms to 1000 ms	0	ms	Real-time
EE-00	0xEE00	AI1 measured voltage 1	-10.000 V to 10.000 V	2.000	V	At stop
EE-01	0xEE01	Displayed AI1 voltage 1	-10.000 V to 10.000 V	2.000	V	At stop
EE-02	0xEE02	AI1 measured voltage 2	-10.000 V to 10.000 V	8.000	V	At stop
EE-03	0xEE03	Displayed AI1 voltage 2	-10.000 V to 10.000 V	8.000	V	At stop
EE-04	0xEE04	Measured voltage 1 of potentiometer MD-BP-M	-10.000 V to 10.000 V	2.000	V	At stop
EE-05	0xEE05	Displayed voltage 1 of potentiometer MD-BP-M	-10.000 V to 10.000 V	2.000	V	At stop
EE-06	0xEE06	Measured voltage 2 of potentiometer MD-BP-M	-10.000 V to 10.000 V	8.000	V	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
EE-07	0xEE07	Displayed voltage 2 of potentiometer MD-BP-M	-10.000 V to 10.000 V	8.000	V	At stop
EE-12	0xEE0C	AO1 target voltage 1	-10.000 V to 10.000 V	2.000	V	At stop
EE-13	0xEE0D	AO1 measured voltage 1	-10.000 V to 10.000 V	2.000	V	At stop
EE-14	0xEE0E	AO1 target voltage 2	-10.000 V to 10.000 V	8.000	V	At stop
EE-15	0xEE0F	AO1 measured voltage 2	-10.000 V to 10.000 V	8.000	V	At stop
H1-00	0x8100	Fault protection action selection 0	Ones: Overcurrent (E002) 0: Coast to stop Tens: Overvoltage (E005) 0: Coast to stop Hundreds: Buffer fault (E008) 0: Coast to stop Thousands: Undervoltage (E009) 0: Coast to stop	0x0	-	Real-time
H1-01	0x8101	Fault protection action selection 1	Ones: Inverter overload (E010) 0: Coast to stop Tens: Motor overload (E011) 0: Coast to stop Hundreds: Input phase loss (E012) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: Output phase loss (E013) 0: Coast to stop	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-02	0x8102	Fault protection action selection 2	Ones: Module overtemperature (E014) 0: Coast to stop Tens: External fault (E015) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Current sampling error (E018) 0: Coast to stop	0x0	-	Real-time
H1-03	0x8103	Fault protection action selection 3	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 capacity 2: Quick stop 3: Decelerate to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-04	0x8104	Fault protection action selection 4	Ones: Output short circuit to ground (E023) 0: Coast to stop Tens: Cumulative running time reached (E026) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: User-defined fault (E027) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: User-defined warning (E028) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0xD000	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-05	0x8105	Fault protection action selection 5	Ones: Cumulative power-on time reached (E029) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Tens: Three phase loss (E030) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: PID fault (E031) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: Parameter error (E032) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0xD000	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-06	0x8106	Fault protection action selection 6	Ones: Reserved 0: Coast to stop Tens: Excessive speed deviation (E042) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: Motor overspeed (E043) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: Reserved 0: Coast to stop	0x00D0	-	Real-time
H1-07	0x8107	Fault protection action selection 7	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Magnetic pole position auto-tuning error (E051) 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-08	0x8108	Fault protection action selection 8	Ones: Self-check fault 1 (E056) 0: Coast to stop Tens: Self-check fault 2 (E057) 0: Coast to stop Hundreds: Self-check fault 3 (E058) 0: Coast to stop Thousands: Self-check fault 4 (E059) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0x0	-	Real-time
H1-09	0x8109	Fault protection action selection 9	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Reserved 0: Coast to stop Thousands: Fan fault (E080) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0xF000	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-10	0x810A	Fault protection action selection 10	Ones: Reserved 0: Coast to stop Tens: Reserved 0: Coast to stop Hundreds: Time sequence fault (E085) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: Motor control error 1 (E093) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0xF00	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-11	0x810B	Fault protection action selection 11	Ones: Motor control error 2 (E094) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Tens: AC drive pre-overload (E110) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: Motor pre-overload (E111) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Thousands: Module pre-overtemperature (E114) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0xDDDD	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-12	0x810C	Fault protection action selection 12	Ones: Reserved 0: Coast to stop Tens: AI/HDI disconnection fault (E154) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: Fault automatic reset failure (Err159) 0: Coast to stop Thousands: Modbus communication timeout fault (E160) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore	0x30F0	-	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-13	0x810D	Fault protection action selection 13	Ones: CANopen fault (E161) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Tens: CANlink fault (E162) 0: Coast to stop 1: Stop at maximum capacity 2: Quick stop 3: Decelerate to stop 9: Run at limited speed 10: Run at limited power 11: Run at limited current 12: Run at limited torque 13: Warning 14: Prompt 15: Ignore Hundreds: Reserved 0: Coast to stop Thousands: Reserved 0: Coast to stop	0x0033	-	Real-time
H1-30	0x811E	Setting of error codes in group 1	0.0 to 255.9	0.0	-	At stop
H1-31	0x811F	Setting of error code level in group 1	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-32	0x8120	Setting of error codes in group 2	0.0 to 255.9	0.0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-33	0x8121	Setting of error code level in group 2	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-34	0x8122	Setting of error codes in group 3	0.0 to 255.9	0.0	-	At stop
H1-35	0x8123	Setting of error code level in group 3	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-36	0x8124	Setting of error codes in group 4	0.0 to 255.9	0.0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-37	0x8125	Setting of error code level in group 4	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-38	0x8126	Setting of error codes in group 5	0.0 to 255.9	0.0	-	At stop
H1-39	0x8127	Setting of error code level in group 5	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-40	0x8128	Setting of error codes in group 6	0.0 to 255.9	0.0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-41	0x8129	Setting of error code level in group 6	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-42	0x812A	Setting of error codes in group 7	0.0 to 255.9	0.0	-	At stop
H1-43	0x812B	Setting of error code level in group 7	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-44	0x812C	Setting of error codes in group 8	0.0 to 255.9	0.0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-45	0x812D	Setting of error code level in group 8	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-46	0x812E	Setting of error codes in group 9	0.0 to 255.9	0.0	-	At stop
H1-47	0x812F	Setting of error code level in group 9	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-48	0x8130	Setting of error codes in group 10	0.0 to 255.9	0.0	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H1-49	0x8131	Setting of error code level in group 10	0000H: Coast to stop 0001H: Stop at maximum capacity 0002H: Quick stop 0003H: Decelerate to stop 0004H: Reserved 0005H: Reserved 0006H: Reserved 0007H: Reserved 0008H: Reserved 0009H: Run at limited speed 000AH: Run at limited power 000BH: Run at limited current 000CH: Run at limited torque 000DH: Warning 000EH: Prompt 000FH: Ignore	0x000F	-	At stop
H1-60	0x813C	Limited running	0: Run at limited frequency 1: Run at operating frequency upon fault 2: Run at specified safety frequency 3: Run at frequency reference 4: Run at frequency upper limit in the current direction 5: Run at frequency lower limit in the current direction	1	-	Real time
H1-61	0x813D	Specified safety frequency	0.0% to 800.0%	0.0	%	Real-time
H1-62	0x813E	Maximum forward frequency in limited operation mode	0.0% to 800.0%	100.0	%	Real-time
H1-63	0x813F	Maximum reverse frequency in limited operation mode	0.0% to 800.0%	100.0	%	Real-time
H1-64	0x8140	Maximum motoring power in limited operation mode	0.0% to 400.0%	50.0	%	Real-time
H1-65	0x8141	Maximum regenerative power in limited operation mode	0.0% to 400.0%	50.0	%	Real-time
H1-66	0x8142	Maximum forward torque limit	0.0% to 400.0%	50.0	%	Real-time
H1-67	0x8143	Maximum reverse 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	Source of external fault 1 (NO)	0: Inactive 1: Active Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H2-01	0x8201	Source of external fault 2 (NC)	0: Inactive 1: Active Others: B connector	1	-	Real time
H2-02	0x8202	Source of user-defined fault 1	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-03	0x8203	Source of user-defined fault 2	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-04	0x8204	Source of user-defined fault 3	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-05	0x8205	Source of user-defined fault 4	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-06	0x8206	Source of user-defined fault 5	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-07	0x8207	Source of user-defined fault 6	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-08	0x8208	Source of user-defined fault 7	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-09	0x8209	Source of user-defined fault 8	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-10	0x820A	Source of user-defined alarm 1	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-11	0x820B	Source of user-defined alarm 2	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-12	0x820C	Source of user-defined alarm 3	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-13	0x820D	Source of user-defined alarm 4	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-14	0x820E	Source of user-defined alarm 5	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-15	0x820F	Source of user-defined alarm 6	0: Inactive 1: Active Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H2-16	0x8210	Source of user-defined alarm 7	0: Inactive 1: Active Others: B connector	0	-	Real time
H2-17	0x8211	Source of user-defined alarm 8	0: Inactive 1: Active Others: B connector	0	-	Real time
H3-00	0x8300	Fault auto reset enabling	0: Disable 1: Enable	1	-	Real time
H3-01	0x8301	Fault auto reset times	0 to 100	0	-	Real time
H3-02	0x8302	Time interval between fault self-resetting triggers	0.1s to 600.0s	1.0	s	Real-time
H3-03	0x8303	Auto reset terminated upon manual reset	0: Yes 1: No	1	-	Real time
H3-04	0x8304	Time to clear auto reset attempts	0 min to 6000 min	10	min	Real time
H3-05	0x8305	Active fault reset attempt count	0 to 65535	0	-	Unchangeable
H3-06	0x8306	Clearing upon fault reset count reach	0: Cleared 1: Not cleared	0	-	Real time
H3-07	0x8307	Fault flag output selection	0: No output during automatic fault reset 1: Output during automatic fault reset	0	-	Real time
H3-13	0x830D	Fault code 1 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-14	0x830E	Fault code 2 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-15	0x830F	Fault code 3 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-16	0x8310	Fault code 4 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-17	0x8311	Fault code 5 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-18	0x8312	Fault code 6 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-19	0x8313	Fault code 7 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-20	0x8314	Fault code 8 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H3-21	0x8315	Fault code 9 inhibited from automatic fault reset	0.0 to 255.9	0.0	-	Real time
H3-22	0x8316	Fault code 10 inhibited from automatic fault 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	0.0s to 600.0s	0.5	S	Real time
H3-30	0x831E	Forced flying start after automatic fault reset	0: Disable 1: Enable	0	-	Real time
H3-31	0x831F	Method of allowing restart after automatic fault reset	0: Whitelist 1: Blacklist	1	-	Real time
H3-34	0x8322	Designated fault code 1	0.0 to 255.9	0.0	-	Real time
H3-35	0x8323	Designated fault code 2	0.0 to 255.9	0.0	-	Real time
H3-36	0x8324	Designated fault code 3	0.0 to 255.9	0.0	-	Real time
H3-37	0x8325	Designated fault code 4	0.0 to 255.9	0.0	-	Real time
H3-38	0x8326	Designated fault code 5	0.0 to 255.9	0.0	-	Real time
H3-39	0x8327	Designated fault code 6	0.0 to 255.9	0.0	-	Real time
H6-00	0x8600	Active fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
H6-06	0x8606	Active fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
H6-12	0x860C	Active fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
H6-18	0x8612	Active fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
H6-24	0x8618	Active fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
H6-30	0x861E	Active fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
H6-36	0x8624	Frequency upon the active fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
H6-37	0x8625	Current upon the active fault	0.00 A to 655.35 A	0.00	A	Unchangeable
H6-38	0x8626	Bus voltage upon the active fault	0.0 V to 6553.5 V	0.0	V	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-39	0x8627	Input terminal state upon the active fault	Bit 0: DI1 state 0: Low level 1: High level Bit 1: DI2 state 0: Low level 1: High level Bit 2: DI3 state 0: Low level 1: High level Bit 3: DI4/HDI state 0: Low level 1: High level Bit 4: DI5 state (MD600 A) 0: Low level 1: High level Bit 5: Reserved 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-40	0x8628	Output terminal state upon the active fault	Bit 0: RO1 state 0: Low level 1: High level Bit 1: Reserved 0: Low level 1: High level Bit 2: Reserved 0: Low level 1: High level Bit 3: Reserved 0: Low level 1: High level Bit 4: DO1 state (MD600A) 0: Low level 1: High level Bit 5: DO2 state (MD600A) 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDO1 state 0: Low level 1: High level Bit 11: VDO2 state 0: Low level 1: High level Bit 12: VDO3 state 0: Low level 1: High level Bit 13: VDO4 state 0: Low level 1: High level Bit 14: VDO5 state 0: Low level 1: High level Bit 15: VDO6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-41	0x8629	AC drive state upon the active fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
H6-42	0x862A	Power-on duration upon the active fault	0 min to 65535 min	0	min	Unchangeable
H6-43	0x862B	Running duration upon the active fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-44	0x862C	Status word 1 upon the active fault	Bit 0: Ready to start 0: Invalid 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-45	0x862D	Status word 2 upon the active fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-46	0x862E	Command word upon the active fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H6-47	0x862F	RFG status word upon the active fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved Bit 8 to bit 9: Last acceleration/deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 to bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12: Reserved Bit 13: Reserved Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable
H7-00	0x8700	Latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
H7-06	0x8706	Latest fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
H7-12	0x870C	Latest fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
H7-18	0x8712	Latest fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
H7-24	0x8718	Latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
H7-30	0x871E	Latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
H7-36	0x8724	Frequency upon the latest fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
H7-37	0x8725	Current upon the latest fault	0.00 A to 655.35 A	0.00	A	Unchangeable
H7-38	0x8726	Bus voltage upon the latest fault	0.0 V to 6553.5 V	0.0	V	Unchangeable
H7-39	0x8727	Input terminal state upon the latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable
H7-40	0x8728	Output terminal state upon the latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-41	0x8729	AC drive state upon the latest fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
H7-42	0x872A	Power-on duration upon the latest fault	0 min to 65535 min	0	min	Unchangeable
H7-43	0x872B	Running duration upon the latest fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-44	0x872C	Status word 1 upon the latest fault	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-45	0x872D	Status word 2 upon the latest fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-46	0x872E	Command word upon the latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H7-47	0x872F	RFG status word upon the latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12 to bit 15: Reserved	0x0	-	Unchangeable
H8-00	0x8800	Second latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
H8-06	0x8806	Second latest fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
H8-12	0x880C	Second latest fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
H8-18	0x8812	Second latest fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
H8-24	0x8818	Second latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
H8-30	0x881E	Second latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
H8-36	0x8824	Frequency upon the second latest fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
H8-37	0x8825	Current upon the second latest fault	0.00 A to 655.35 A	0.00	A	Unchangeable
H8-38	0x8826	Bus voltage upon the second latest fault	0.0 V to 6553.5 V	0.0	V	Unchangeable
H8-39	0x8827	Input terminal state upon the second latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable
H8-40	0x8828	Output terminal state upon the second latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H8-41	0x8829	AC drive state upon the second latest fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
H8-42	0x882A	Power-on duration upon the second latest fault	0 min to 65535 min	0	min	Unchangeable
H8-43	0x882B	Running duration upon the second latest fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H8-44	0x882C	Status word 1 upon the second latest fault	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H8-45	0x882D	Status word 2 upon the second latest fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H8-46	0x882E	Command word upon the second latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H8-47	0x882F	RFG status word upon the second latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12 to bit 15: Reserved	0x0	-	Unchangeable
H9-00	0x8900	Third latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
H9-06	0x8906	Third latest fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
H9-12	0x890C	Third latest fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
H9-18	0x8912	Third latest fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
H9-24	0x8918	Third latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
H9-30	0x891E	Third latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
H9-36	0x8924	Frequency upon the third latest fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
H9-37	0x8925	Current upon the third latest fault	0.00 A to 655.35 A	0.00	A	Unchangeable
H9-38	0x8926	Bus voltage upon the third latest fault	0.0 V to 6553.5 V	0.0	V	Unchangeable
H9-39	0x8927	Input terminal state upon the third latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable
H9-40	0x8928	Output terminal state upon the third latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-41	0x8929	AC drive state upon the third latest fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
H9-42	0x892A	Power-on duration upon the third latest fault	0 min to 65535 min	0	min	Unchangeable
H9-43	0x892B	Running duration upon the third latest fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-44	0x892C	Status word 1 upon the third latest fault	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-45	0x892D	Status word 2 upon the third latest fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable 0x0	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-46	0x892E	Command word upon the third latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
H9-47	0x892F	RFG status word upon the third latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12 to bit 15: Reserved	0x0	-	Unchangeable
HA-00	0x8A00	Fourth latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
HA-06	0x8A06	Fourth latest fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
HA-12	0x8A0C	Fourth latest fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
HA-18	0x8A12	Fourth latest fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
HA-24	0x8A18	Fourth latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
HA-30	0x8A1E	Fourth latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
HA-36	0x8A24	Frequency upon the fourth latest fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
HA-37	0x8A25	Current upon the fourth latest fault	0.00 A to 655.35 A	0.00	A	Unchangeable
HA-38	0x8A26	Bus voltage upon the fourth latest fault	0.0 V to 6553.5 V	0.0	V	Unchangeable
HA-39	0x8A27	Input terminal state upon the fourth latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable
HA-40	0x8A28	Output terminal state upon the fourth latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-41	0x8A29	AC drive state upon the fourth latest fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
HA-42	0x8A2A	Power-on duration upon the fourth latest fault	0 min to 65535 min	0	min	Unchangeable
HA-43	0x8A2B	Running duration upon the fourth latest fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-44	0x8A2C	Status word 1 upon the fourth latest fault	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-45	0x8A2D	Status word 2 upon the fourth latest fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-46	0x8A2E	Command word upon the fourth latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
HA-47	0x8A2F	RFG status word upon the fourth latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12 to bit 15: Reserved	0x0	-	Unchangeable
Hb-00	0x8B00	Fifth latest fault code 1	0.0 to 6553.5	0.0	-	Unchangeable
Hb-06	0x8B06	Fifth latest fault code 2	0.0 to 6553.5	0.0	-	Unchangeable
Hb-12	0x8B0C	Fifth latest fault code 3	0.0 to 6553.5	0.0	-	Unchangeable
Hb-18	0x8B12	Fifth latest fault code 4	0.0 to 6553.5	0.0	-	Unchangeable
Hb-24	0x8B18	Fifth latest fault code 5	0.0 to 6553.5	0.0	-	Unchangeable
Hb-30	0x8B1E	Fifth latest fault code 6	0.0 to 6553.5	0.0	-	Unchangeable
Hb-36	0x8B24	Frequency upon the fifth latest fault	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
Hb-37	0x8B25	Current upon the fifth latest fault	0.00 A to 655.35 A	0.00	A	Unchangeable
Hb-38	0x8B26	Bus voltage upon the fifth latest fault	0.0 V to 6553.5 V	0.0	V	Unchangeable
Hb-39	0x8B27	Input terminal state upon the fifth latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable
Hb-40	0x8B28	Output terminal state upon the fifth latest fault	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-41	0x8B29	AC drive state upon the fifth latest fault	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
Hb-42	0x8B2A	Power-on duration upon the fifth latest fault	0 min to 65535 min	0	min	Unchangeable
Hb-43	0x8B2B	Running duration upon the fifth latest fault	0.0 min to 6553.5 min	0.0	min	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-44	0x8B2C	Status word 1 upon the fifth latest fault	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-45	0x8B2D	Status word 2 upon the fifth latest fault	Bit 0: Self-check 0: Disable 1: Enable Bit 1: Parameter auto-tuning 0: Disable 1: Enable Bit 2: Minor fault state 0: Disable 1: Enable Bit 3: Warning state 0: Disable 1: Enable Bit 4: Speed mode 0: Disable 1: Enable Bit 5: Torque mode 0: Disable 1: Enable Bit 6: Position mode 0: Disable 1: Enable Bit 7: RFG enable 0: Disable 1: Enable Bit 8: RFG running 0: Disable 1: Enable Bit 9: Stop at fault 0: Disable 1: Enable Bit 10: Normal running 0: Disable 1: Enable Bit 11: Jog running 0: Disable 1: Enable Bit 12: Decelerate to stop 0: Disable 1: Enable Bit 13: Reserved Bit 14: Terminal control 0: Disable 1: Enable bit 15: User-defined state 1 0: Disable 1: Enable	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-46	0x8B2E	Command word upon the fifth latest fault	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Hb-47	0x8B2F	RFG status word upon the fifth latest fault	Bit 0 to bit 1: Acceleration/Deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 to bit 3: Acceleration/Deceleration arc state 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4 to bit 7: Reserved Bit 8 to bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and bit 11: Last arc state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 12 to bit 15: Reserved	0x0	-	Unchangeable
n0-10	0x200A	Communication software version	0.00 to 655.35	0.00	-	Unchangeable
n0-11	0x200B	Communication status	1: CANopen initializing 2: CANopen pre-operational 8: CANopen communication in progress 9: CANopen stopped 10: CANlink initializing 20: CANlink pre-operational 80: CANlink communication in progress	0	-	Unchangeable
n0-12	0x200C	Compatibility with legacy communication address	0: Not compatible 1: Compatible	1	-	At stop
n0-13	0x200D	1000H speed reference selection	0: Percentage (corresponds to the rated frequency/one decimal place) 1: Percentage (corresponds to the rated frequency/two decimal places) 2: Percentage (corresponds to the maximum frequency/two decimal places)	2	-	At stop
n0-14	0x200E	7310H speed reference selection	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.	Address	Name	Value Range	Default	Unit	Change Mode
n0-15	0x200F	Save parameters written through communication (group AE)	0: Invalid 1: Valid	0	-	Real time
n0-16	0x2010	Communication fault automatic reset	0: Invalid 1: Valid	1	-	Real time
n0-18	0x2012	Communication fault detection	0: Inactive 1: Active Others: B connector	1	-	Real time
n1-00	0x2100	Commissioning baud rate	9: 115200 bps	9	-	Unchangeable
n1-02	0x2102	Commissioning address	1 to 127	1	-	At stop
n1-03	0x2103	Commissioning interface function selection	0: Commissioning 1: Modbus RTU communication	0	-	Real time
n1-04	0x2104	Modbus RTU data format (RJ45 interface)	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	0	-	Real time
n1-05	0x2105	Modbus RTU response delay (RJ45 interface)	0 ms to 20 ms	2	ms	Real-time
n1-06	0x2106	Modbus RTU communication timeout time (RJ45 interface)	0.0s to 60.0s	0.0	s	Real-time
n1-07	0x2107	Modbus RTU communication baud rate (RJ45 interface)	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	At stop
n1-08	0x2108	Modbus RTU communication address (RJ45 interface)	1 to 247	1	-	At stop

Param.	Address	Name	Value Range	Default	Unit	Change Mode
n2-00	0x2200	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	-	At stop
n2-01	0x2201	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: No check (8-N-1)	0	-	Real time
n2-02	0x2202	Modbus local address	1 to 247	1	-	At stop
n2-03	0x2203	Modbus response delay	0 ms to 20 ms	2	ms	Real-time
n2-04	0x2204	Modbus communication timeout time	0.0s to 60.0s	0.0	s	Real-time
n3-00	0x2300	CAN baud rate	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	5	-	At stop
n3-01	0x2301	CAN communication enable	0: Disable 1: Enable	1	-	At stop
n3-02	0x2302	CAN station number	1 to 247	1	-	At stop
n3-10	0x230A	CAN communication protocol selection	1: CANopen 2: CANlink	2	-	Real time
n3-14	0x230E	CANopen mode	0: Default mode 1: Expert mode	0	-	Real time
n3-15	0x230F	CANopen prohibition time	0 to 65535	0	-	At stop
n3-16	0x2310	CANopen event time	0 to 65535	0	-	At stop
n3-26	0x231A	CAN communication enable	0: Not supported by the current device 1: Effective	0	-	Unchangeable
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

Param.	Address	Name	Value Range	Default	Unit	Change Mode
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
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

Param.	Address	Name	Value Range	Default	Unit	Change Mode
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	-	Unchangeable
nE-67	0x2E43	Number of valid TPDOs	0x0 to 0xFFFF	0x0	-	Unchangeable
o6-00	0x5600	Logic AND/OR module A function selection	0: Disabled 1: AND 2: OR	0	-	Real time
o6-01	0x5601	Logic AND/OR module A input 1	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-02	0x5602	Logic AND/OR module A input 2	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o6-03	0x5603	Logic AND/OR module A input 3	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-04	0x5604	Logic AND/OR module A input 4	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-05	0x5605	Logic AND/OR module B function selection	0: Disabled 1: AND 2: OR	0	-	Real time
o6-06	0x5606	Logic AND/OR module B input 1	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-07	0x5607	Logic AND/OR module B input 2	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-08	0x5608	Logic AND/OR module B input 3	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o6-09	0x5609	Logic AND/OR module B input 4	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-80	0x5650	Input of logic NOT module A	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o6-81	0x5651	Input of logic NOT module B	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o7-00	0x5700	Logic XOR/XNOR module A function selection	0: Disabled 1: XOR 2: XNOR	0	-	Real time
o7-01	0x5701	Logic XOR/XNOR module A input 1	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o7-02	0x5702	Logic XOR/XNOR module A input 2	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
o7-03	0x5703	Logic XOR/XNOR module B function selection	0: Disabled 1: XOR 2: XNOR	0	-	Real time
o7-04	0x5704	Logic XOR/XNOR module B input 1	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
o7-05	0x5705	Logic XOR/XNOR module B input 2	0: Disable 1: Logic 1 2: Logic 0 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	Real time
P0-05	0x6005	Jump frequency during acceleration/ deceleration	0: Disable 1: Enable	0	-	At stop
P0-06	0x6006	Jump frequency 1	0.0 Hz to 800.0 Hz	0.0	Hz	At once
P0-07	0x6007	Jump frequency 2	0.0 Hz to 800.0 Hz	0.0	Hz	At once
P0-08	0x6008	Jump frequency 3	0.0 Hz to 800.0 Hz	0.0	Hz	At once
P0-09	0x6009	Jump frequency 4	0.0 Hz to 800.0 Hz	0.0	Hz	At once
P0-10	0x600A	Jump frequency amplitude	0.0 Hz to 5.0 Hz	0.0	Hz	At once
P0-11	0x600B	Operation mode when the frequency reference is less than the minimum motor frequency	0: Run at the minimum motor frequency 1: Stop 2: Run at zero speed 3: Coast to stop	0	-	Real time
P0-13	0x600D	Timing function	0: Disable 1: Enable	0	-	At stop
P0-14	0x600E	Timing operation time setting source	0: P0-15 setting 1: AI1 Others: F connector	0	-	At stop
P0-15	0x600F	Timing operation time	0.0 min to 6500.0 min	0.0	min	At stop
P0-16	0x6010	Power-on time reach (hour)	0h to 65535h	0	h	Real time
P0-17	0x6011	Running time threshold (hour)	0h to 65535h	0	h	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P0-18	0x6012	Power-on time reach (second)	0s to 3599s	0	s	Real-time
P0-19	0x6013	Running time threshold (second)	0s to 3599s	0	s	Real-time
P0-20	0x6014	Present running time reach settings	0.0 min to 6500.0 min	0.0	min	At stop
P0-21	0x6015	Protection upon start	0: Disable 1: Enable	1	-	Real time
P0-22	0x6016	Wakeup frequency	P0-24 to A2-17	0.00	Hz	At once
P0-23	0x6017	Wakeup delay	0.0s to 6500.0s	0.0	s	Real-time
P0-24	0x6018	Hibernation frequency	0.00 Hz to P0-22	0.00	Hz	At once
P0-25	0x6019	Hibernation delay	0.0s to 6500.0s	0.0	s	Real-time
P0-26	0x601A	Dead zone time of forward/reverse run switchover	0.0s to 3000.0s	0.0	s	Real-time
P0-33	0x6021	AC drive overtemperature threshold reached (threshold)	0°C to 100°C	75	°C	Real time
P0-34	0x6022	Frequency detection value (FDT1)	0.00 Hz to A2-17	50.00	Hz	At once
P0-35	0x6023	Frequency detection hysteresis (FDT1)	0.0% to 100.0%	5.0	%	Real-time
P0-36	0x6024	Detection frequency (FDT2)	0.00 Hz to A2-17	50.00	Hz	At once
P0-37	0x6025	Frequency detection hysteresis (FDT2)	0.0% to 100.0%	5.0	%	Real-time
P0-38	0x6026	Measured width when frequency reached	0.0% to 100.0%	0.0	%	Real-time
P0-39	0x6027	Detection frequency 1	0.00 Hz to A2-17	50.00	Hz	At once
P0-40	0x6028	Detection frequency amplitude 1	0.1% to 100.0%	0.1	%	Real-time
P0-41	0x6029	Detection value 2 of frequency	0.00 Hz to A2-17	50.00	Hz	At once
P0-42	0x602A	Frequency reach detection width 2	0.1% to 100.0%	0.1	%	Real-time
P0-43	0x602B	Detection current 1	0.0% to 300.0%	100.0	%	Real-time
P0-44	0x602C	Detection current amplitude 1	0.0% to 300.0%	0.0	%	Real-time
P0-45	0x602D	Detection current 2	0.0% to 300.0%	100.0	%	Real-time
P0-46	0x602E	Detection current amplitude 2	0.0% to 300.0%	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P0-47	0x602F	Zero current detection level	0.0% to 300.0%	5.0	%	Real-time
P0-48	0x6030	Zero current detection delay	0.01s to 600.00s	0.10	s	Real-time
P0-49	0x6031	Output current overlimit threshold	0.0% to 300.0%	200.0	%	Real-time
P0-50	0x6032	Output current overlimit detection delay	0.00s to 600.00s	0.00	s	Real-time
P0-51	0x6033	Measured width when target speed reached	0.0% to 600.0%	3.0	%	Real-time
P0-52	0x6034	Target speed reach time	0.00s to 100.00s	3.00	s	Real-time
P0-53	0x6035	Speed comparison reach threshold 1	0.0% to 600.0%	100.0	%	Real-time
P0-54	0x6036	Speed comparison reach hysteresis 1	0.0% to 600.0%	3.0	%	Real-time
P0-55	0x6037	Speed comparison reach time 1	0.00s to 100.00s	3.00	s	Real-time
P0-56	0x6038	Speed comparison reach threshold 2	0.0% to 600.0%	100.0	%	Real-time
P0-57	0x6039	Speed comparison reach hysteresis 2	0.0% to 600.0%	3.0	%	Real-time
P0-58	0x603A	Speed comparison reach time 2	0.00s to 100.00s	3.00	s	Real-time
P0-59	0x603B	Main status word 1	0: Invalid 1: Set to 1 Others: B connector	0	-	Real time
P0-60	0x603C	Main status word 2	0: Invalid 1: Set to 1 Others: B connector	0	-	Real time
P0-61	0x603D	Undervoltage percentage for storage upon undervoltage	70% to 120%	100	%	Real-time
P0-64	0x6040	Output power correction coefficient	0.0% to 200.0%	100.0	%	Real-time
P0-65	0x6041	Load speed display coefficient	0.0001 to 6.5000	1.0000	-	Real time
P0-66	0x6042	Load monitoring signal selection	0: Disable monitoring 1: Monitor the output current 2: Monitor the output torque 3: Monitor the output power Others: F connector	0	-	Real time
P0-67	0x6043	Load monitoring signal status	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P0-68	0x6044	Load monitoring overload action	0: No warning/fault 1: Warning 2: Fault 3: Warning/Fault	0	-	Real time
P0-69	0x6045	Load monitoring load loss action	0: No warning/fault 1: Warning 2: Fault 3: Warning/Fault	0	-	Real time
P0-70	0x6046	Load monitoring abscissa point 1	0.0% to 600.0%	0.0	%	Real-time
P0-71	0x6047	Load monitoring abscissa point 2	0.0% to 600.0%	0.0	%	Real-time
P0-72	0x6048	Load monitoring abscissa point 3	0.0% to 600.0%	0.0	%	Real-time
P0-73	0x6049	Load monitoring abscissa point 4	0.0% to 600.0%	0.0	%	Real-time
P0-74	0x604A	Load monitoring abscissa point 5	0.0% to 600.0%	0.0	%	Real-time
P0-75	0x604B	Load monitoring curve upper limit 1	0.0% to 400.0%	0.0	%	Real-time
P0-76	0x604C	Load monitoring curve upper limit 2	0.0% to 400.0%	0.0	%	Real-time
P0-77	0x604D	Load monitoring curve upper limit 3	0.0% to 400.0%	0.0	%	Real-time
P0-78	0x604E	Load monitoring curve upper limit 4	0.0% to 400.0%	0.0	%	Real-time
P0-79	0x604F	Load monitoring curve upper limit 5	0.0% to 400.0%	0.0	%	Real-time
P0-80	0x6050	Load monitoring curve lower limit 1	0.0% to 400.0%	0.0	%	Real-time
P0-81	0x6051	Load monitoring curve lower limit 2	0.0% to 400.0%	0.0	%	Real-time
P0-82	0x6052	Load monitoring curve lower limit 3	0.0% to 400.0%	0.0	%	Real-time
P0-83	0x6053	Load monitoring curve lower limit 4	0.0% to 400.0%	0.0	%	Real-time
P0-84	0x6054	Load monitoring curve lower limit 5	0.0% to 400.0%	0.0	%	Real-time
P0-85	0x6055	Permissible overload time	0.0s to 6553.5s	20.0	s	Real-time
P0-86	0x6056	Permissible load loss time	0.0s to 6553.5s	20.0	s	Real-time
P0-87	0x6057	UPDOWN reference during running	0: Running frequency 1: Frequency reference	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P0-88	0x6058	UPDOWN retention selection upon stop	0: Disable 1: Enable	0	-	Real time
P0-89	0x6059	UPDOWN retention selection upon power failure	0: Disable 1: Enable	0	-	Real time
P1-00	0x6100	Simple PLC module	0: Disable 1: Enable	0	-	At stop
P1-01	0x6101	Simple PLC calculation enablement source	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	1126	-	At stop
P1-02	0x6102	Simple PLC running mode	0: Keep multi-reference value 0 after running for one cycle 1: Keep final values after running for one cycle 2: Repeat after running for one cycle 3: Output 0 after running 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 stage when calculation is invalid and perform recalculation when calculation is valid 1: Keep the current stage when calculation is invalid and continue to run when calculation is valid Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	0	-	Real time
P1-04	0x6104	Simple PLC status reset	0: Invalid 1: Valid 3: DI1 4: DI2 5: DI3 6: DI4 7: DI5 (MD600A) Others: B connector	0	-	At stop
P1-05	0x6105	Current STEP of simple PLC	0 to 65535	0	-	Unchangeable
P1-06	0x6106	Current STEP running time (hour) of simple PLC	0 to 65535	0	-	Unchangeable
P1-07	0x6107	Current STEP running time (seconds) of simple PLC	0.0 to 3599.9	0.0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-08	0x6108	Time unit of simple PLC	0: second (s) 1: hour (h)	0	-	Real time
P1-09	0x6109	Running time of multi-reference 0 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-10	0x610A	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-11	0x610B	Running time of simple PLC reference 1	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-12	0x610C	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-13	0x610D	Running time of simple PLC reference 2	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-14	0x610E	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-15	0x610F	Running time of simple PLC reference 3	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-16	0x6110	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-17	0x6111	Running time of simple PLC reference 4	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-18	0x6112	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-19	0x6113	Running time of multi-reference 5 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-20	0x6114	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-21	0x6115	Running time of simple PLC reference 6	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-22	0x6116	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-23	0x6117	Running time of simple PLC reference 7	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-24	0x6118	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-25	0x6119	Running time of simple PLC reference 8	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-26	0x611A	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-27	0x611B	Running time of simple PLC reference 9	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-28	0x611C	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-29	0x611D	Running time of multi-reference 10 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-30	0x611E	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-31	0x611F	Running time of simple PLC reference 11	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-32	0x6120	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-33	0x6121	Running time of simple PLC reference 12	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P1-34	0x6122	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-35	0x6123	Running time of simple PLC reference 13	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-36	0x6124	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-37	0x6125	Running time of simple PLC reference 14	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-38	0x6126	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P1-39	0x6127	Running time of multi-reference 15 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0	s (h)	Real time
P1-40	0x6128	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0: Ramp 1 acceleration/deceleration time (b7-04/b7-05) 1: Ramp 2 acceleration/deceleration time (b7-10/b7-11) 2: Ramp 3 acceleration/deceleration time (b7-16/b7-17) 3: Ramp 4 acceleration/deceleration time (b7-22/b7-23)	0	-	Real time
P2-00	0x6200	Process PID	0: Disable 1: Enable Others: B connector	0	-	Real time
P2-01	0x6201	PID action direction	0: Forward 1: Reverse Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P2-02	0x6202	PID reference source	0: PID digital reference 1: AI1 3: MD-BP-M potentiometer 4: HDI pulse reference 5: Multi-reference 6: Simple PLC 8: Communication Others: F connector	0	-	Real time
P2-03	0x6203	PID reference	0.0% to 800.0%	50.0	%	Real-time
P2-04	0x6204	PID feedback source	0: AI1 3: MD-BP-M potentiometer 4: HDI pulse reference 5: Multi-reference Others: F connector	0	-	Real time
P2-05	0x6205	PID reference and feedback range	0 to 65535	1000	-	Real time
P2-06	0x6206	PID reference change time	0.00s to 650.00s	0.00	s	Real-time
P2-07	0x6207	PID feedback filter time	0.00s to 60.00s	0.00	s	Real-time
P2-08	0x6208	PID output filter time	0.00s to 60.00s	0.00	s	Real-time
P2-09	0x6209	PID reverse cut-off frequency	0.00 Hz to A2-17	2.00	Hz	At once
P2-11	0x620B	PID parameter switchover condition	0: No switchover and default to PID parameter 1 1: Switchover by DI 2: Automatic switchover based on deviation 3: Automatic switchover based on running 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	PID parameter 1 proportional gain Kp1	0.0 to 1000.0	20.0	-	Real time
P2-15	0x620F	PID parameter 1 integral time Ti1	0.01s to 10.00s	2.00	s	Real-time
P2-16	0x6210	PID parameter 1 derivative time Td1	0.000s to 10.000s	0.000	s	Real-time
P2-17	0x6211	PID parameter 2 proportional gain Kp2	0.0 to 1000.0	20.0	-	Real time
P2-18	0x6212	PID parameter 2 integral time Ti2	0.01s to 10.00s	2.00	s	Real-time
P2-19	0x6213	PID parameter 2 derivative time Td2	0.000s to 10.000s	0.000	s	Real-time
P2-20	0x6214	PID initial value	0.0% to 800.0%	0.0	%	Real-time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P2-21	0x6215	Active time of PID initial value	0.00s to 650.00s	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 differential limit	0.00% to 600.00%	0.10	%	Real-time
P2-26	0x621A	Source of maximum output	0: 100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
P2-27	0x621B	Source of minimum output	0: -100% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
P2-28	0x621C	Forced output value	0: 0% 2: AI1 5: HDI pulse reference 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Potentiometer MD-BP-M Others: F connector	0	-	Real time
P2-29	0x621D	Forced output assignment	0: Disabled 1: Enabled Others: B connector	0	-	Real time
P2-30	0x621E	PID feedback loss detection upper limit	0.0% to 800.0%	100.0	%	Real-time
P2-31	0x621F	PID feedback loss detection lower limit	0.0% to 800.0%	0.0	%	Real-time
P2-32	0x6220	Detection time of PID feedback loss	0.0s to 20.0s	0.0	s	Real-time
P2-33	0x6221	Selection of PID operation at stop	0: Disable at stop 1: Enable at stop Others: B connector	0	-	Real time

Param.	Address	Name	Value Range	Default	Unit	Change Mode
P2-34	0x6222	PID integral	Ones: Integral operation pause/separation 0: Invalid 1: Valid Tens: Whether to stop integral operation when the output reaches a limit 0: Continue integral operation 1: Stop integral operation Hundreds: Reserved Thousands: Reserved Ten thousands: Reserved	10	-	Real time
L0-32	0x9020	DI1	0 to 65535	0	-	Unchangeable
L0-33	0x9021	DI2	0 to 65535	0	-	Unchangeable
L0-34	0x9022	DI3	0 to 65535	0	-	Unchangeable
L0-35	0x9023	DI4	0 to 65535	0	-	Unchangeable
L0-36	0x9024	DI5 (MD600A)	0 to 65535	0	-	Unchangeable
L0-42	0x902A	VDI1	0 to 65535	0	-	Unchangeable
L0-43	0x902B	VDI2	0 to 65535	0	-	Unchangeable
L0-44	0x902C	VDI3	0 to 65535	0	-	Unchangeable
L0-45	0x902D	VDI4	0 to 65535	0	-	Unchangeable
L0-46	0x902E	VDI5	0 to 65535	0	-	Unchangeable
L0-47	0x902F	VDI6	0 to 65535	0	-	Unchangeable
L0-48	0x9030	DI1 inversion	0 to 65535	0	-	Unchangeable
L0-49	0x9031	DI2 reversal	0 to 65535	0	-	Unchangeable
L0-50	0x9032	DI3 reversal	0 to 65535	0	-	Unchangeable
L0-51	0x9033	DI4 reversal	0 to 65535	0	-	Unchangeable
L0-52	0x9034	DI5 reversal (MD600A)	0 to 65535	0	-	Unchangeable
L0-58	0x903A	VDI1 reversal	0 to 65535	0	-	Unchangeable
L0-59	0x903B	VDI2 reversal	0 to 65535	0	-	Unchangeable
L0-60	0x903C	VDI3 reversal	0 to 65535	0	-	Unchangeable
L0-61	0x903D	VDI4 reversal	0 to 65535	0	-	Unchangeable
L0-62	0x903E	VDI5 reversal	0 to 65535	0	-	Unchangeable
L0-63	0x903F	VDI6 reversal	0 to 65535	0	-	Unchangeable
L0-64	0x9040	RO1 raw value	0 to 65535	0	-	Unchangeable
L0-68	0x9044	DO1 raw value (MD600A)	0 to 65535	0	-	Unchangeable
L0-69	0x9045	DO2 raw value (MD600A)	0 to 65535	0	-	Unchangeable
L0-80	0x9050	RO1	0 to 65535	0	-	Unchangeable
L0-84	0x9054	DO1(MD600A)	0 to 65535	0	-	Unchangeable
L0-85	0x9055	DO2(MD600A)	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L0-90	0x905A	VDO1	0 to 65535	0	-	Unchangeable
L0-91	0x905B	VDO2	0 to 65535	0	-	Unchangeable
L0-92	0x905C	VDO3	0 to 65535	0	-	Unchangeable
L0-93	0x905D	VDO4	0 to 65535	0	-	Unchangeable
L0-94	0x905E	VDO5	0 to 65535	0	-	Unchangeable
L0-95	0x905F	VDO6	0 to 65535	0	-	Unchangeable
L0-96	0x9060	AI1 input limit exceeded	0 to 65535	0	-	Unchangeable
L0-98	0x9062	AI1 as DI	0 to 65535	0	-	Unchangeable
L0-99	0x9063	HDI input wire breakage	0 to 65535	0	-	Unchangeable
L1-11	0x910B	AC Drive overtemperature threshold reached (flag)	0 to 65535	0	-	Unchangeable
L1-12	0x910C	Ready to switch on	0: Not ready to switch on 1: Ready to switch on	0	-	Unchangeable
L1-13	0x910D	Ready to run	0：Not ready to run 1：Ready to run	0	-	Unchangeable
L1-14	0x910E	Running	0: Not in operation 1: In operation	0	-	Unchangeable
L1-15	0x910F	Fault	0: Not faulty 1: Faulty	0	-	Unchangeable
L1-16	0x9110	OFF2 (Coast to stop)	0: Valid 1: Invalid	0	-	Unchangeable
L1-17	0x9111	OFF3 stop mode	0: Valid 1: Invalid	0	-	Unchangeable
L1-18	0x9112	Switch-on blocked	0: Switch-on allowed 1: Switch-on inhibited	0	-	Unchangeable
L1-19	0x9113	Alarm/Minor fault activated	0: No alarm/minor fault 1: Alarms/minor faults occur.	0	-	Unchangeable
L1-20	0x9114	Actual speed following speed reference	0: There is no deviation between the reference and actual value. 1: The deviation between the reference and actual value is in the allowed range.	0	-	Unchangeable
L1-21	0x9115	Local/remote	0: Local 1: Remote	0	-	Unchangeable
L1-22	0x9116	Target speed reached	0: Not reached 1: Reached	0	-	Unchangeable
L1-23	0x9117	Torque limit reach	0: Torque/Current limit reached 1: Torque/Current limit not reached	0	-	Unchangeable
L1-24	0x9118	Forward speed	0 to 65535	0	-	Unchangeable
L1-25	0x9119	Reverse speed	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L1-26	0x911A	Motor running flag	0: Stopped 1: Running (pulse output)	0	-	Unchangeable
L1-27	0x911B	User setting 0	0 to 65535	0	-	Unchangeable
L1-28	0x911C	Self-test	0: Invalid 1: Self-check in progress	0	-	Unchangeable
L1-29	0x911D	Auto-tuning	0: Invalid 1: Auto-tuning in progress	0	-	Unchangeable
L1-30	0x911E	Limit (running with limits) activation	0: Invalid 1: Minor fault	0	-	Unchangeable
L1-31	0x911F	Alarm activated	0: Invalid 1: Valid	0	-	Unchangeable
L1-32	0x9120	Speed control mode	0: Invalid 1: Valid	0	-	Unchangeable
L1-33	0x9121	Torque control mode	0: Invalid 1: Valid	0	-	Unchangeable
L1-35	0x9123	RFG selection	0: Disable 1: Enable	0	-	Unchangeable
L1-36	0x9124	RFG running	0: Stopped 1: Operating	0	-	Unchangeable
L1-37	0x9125	Stop at fault	0: Invalid 1: Valid	0	-	Unchangeable
L1-38	0x9126	Normal running	0: Invalid 1: Normal operation	0	-	Unchangeable
L1-39	0x9127	Jog	0: Normal operation 1: Jogging	0	-	Unchangeable
L1-40	0x9128	Decelerate to stop	0: Disable 1: Deceleration to stop	0	-	Unchangeable
L1-42	0x912A	Terminal control flag	0: Invalid 1: Valid	0	-	Unchangeable
L1-43	0x912B	User setting 1	0 to 65535	0	-	Unchangeable
L1-44	0x912C	Control channel selection	0: Control channel 1 1: Control channel 2	0	-	Unchangeable
L1-45	0x912D	Reference channel selection	0: Set channel 1 1: Set channel 2	0	-	Unchangeable
L1-48	0x9130	Error output (fault+warning+non-undervoltage)	0: No error is reported. 1: Errors are reported.	0	-	Unchangeable
L1-49	0x9131	EEPROM idle	0 to 65535	0	-	Unchangeable
L1-50	0x9132	Communication control	0: Invalid 1: Valid	0	-	Unchangeable
L1-51	0x9133	Fault output	0: A fault occurs and the relay is invalid during automatic reset. 1: A fault occurs and the relay is valid during automatic reset.	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L1-55	0x9137	The bus voltage is abnormal.	0: Abnormal bus voltage 1: Normal bus voltage	0	-	Unchangeable
L1-60	0x913C	Excessive speed deviation	0: Invalid 1: Excessive motor speed deviation	0	-	Unchangeable
L1-61	0x913D	Overspeed	0: Invalid 1: Motor overspeed	0	-	Unchangeable
L1-62	0x913E	Target speed reached	0: Not reached 1: Reached	0	-	Unchangeable
L1-63	0x913F	Speed comparison reach 1	0: Not reached 1: Reached	0	-	Unchangeable
L1-64	0x9140	Speed comparison reach 2	0: Not reached 1: Reached	0	-	Unchangeable
L1-65	0x9141	Motor speed positive	0: Reverse 1: Forward	0	-	Unchangeable
L1-66	0x9142	Motor speed negative	0: Forward 1: Reverse	0	-	Unchangeable
L1-68	0x9144	Torque limited	0: Unlimited 1: Limited	0	-	Unchangeable
L1-69	0x9145	Frequency upper limit reached	0: Not reached 1: Reached	0	-	Unchangeable
L1-70	0x9146	Frequency lower limit reach (invalid at stop)	0: Not reached 1: Reached	0	-	Unchangeable
L1-71	0x9147	Reverse running	0: Invalid 1: Reverse run	0	-	Unchangeable
L1-72	0x9148	Frequency lower limit reach (valid at stop)	0: Not reached 1: Reached	0	-	Unchangeable
L1-73	0x9149	Running frequency reached	0: Not reached 1: Reached	0	-	Unchangeable
L1-74	0x914A	Frequency reach 1	0: Not reached 1: Reached	0	-	Unchangeable
L1-75	0x914B	Frequency reach 2	0: Not reached 1: Reached	0	-	Unchangeable
L3-36	0x9324	Logic AND/OR module A output	0: Invalid 1: Valid	0	-	Unchangeable
L3-37	0x9325	Logic AND/OR module B output	0: Invalid 1: Valid	0	-	Unchangeable
L3-52	0x9334	Output of logic NOT module A	0: Invalid 1: Valid	0	-	Unchangeable
L3-53	0x9335	Output of logic NOT module B	0: Invalid 1: Valid	0	-	Unchangeable
L3-68	0x9344	Logic XOR/XNOR module A output	0: Invalid 1: Valid	0	-	Unchangeable
L3-69	0x9345	Logic XOR/XNOR module B output	0: Invalid 1: Valid	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L4-71	0x9447	Simple PLC stop after running for one cycle	0: Inactive 1: Active	0	-	Unchangeable
L4-72	0x9448	Power-on time reach	0: Not reached 1: Reached	0	-	Unchangeable
L4-73	0x9449	Operating time reached	0: Not reached 1: Reached	0	-	Unchangeable
L4-74	0x944A	Timing duration reach	0: Not reached 1: Reached	0	-	Unchangeable
L4-75	0x944B	Current operating time reached	0: Not reached 1: Reached	0	-	Unchangeable
L4-77	0x944D	Simple PLC mode after running for one cycle	0: Not completed 1: Completed	0	-	Unchangeable
L4-80	0x9450	Operating at zero speed (inactive at stop)	0: Invalid 1: Valid	0	-	Unchangeable
L4-81	0x9451	Operating at zero speed (active upon stop)	0: Invalid 1: Valid	0	-	Unchangeable
L4-82	0x9452	Frequency level detection 1	0: Invalid 1: Valid	0	-	Unchangeable
L4-83	0x9453	Frequency level detection 2	0: Invalid 1: Valid	0	-	Unchangeable
L4-85	0x9455	Simple PLC cycle completed	0: Not completed 1: Completed	0	-	Unchangeable
L4-86	0x9456	Communication setpoint	0 to 65535	0	-	Unchangeable
L4-88	0x9458	Current 1 reached	0: Not reached 1: Reached	0	-	Unchangeable
L4-89	0x9459	Current 2 reached	0: Not reached 1: Reached	0	-	Unchangeable
L4-90	0x945A	Zero current state	0: Invalid 1: Valid	0	-	Unchangeable
L4-91	0x945B	Output current overlimit	0: Invalid 1: Valid	0	-	Unchangeable
L4-92	0x945C	Motor pre-overload	0: Invalid 1: Motor pre-overload activated	0	-	Unchangeable
L4-93	0x945D	Inverter pre-overload	0: Invalid 1: Drive pre-overload activated	0	-	Unchangeable
L4-94	0x945E	Bus undervoltage	0: Invalid 1: Bus undervoltage	0	-	Unchangeable
L4-95	0x945F	Output three-phase loss	0: Invalid 1: Output three-phase loss activated	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-00	0x9500	System status word 1	Bit 0: Ready to start 0: Invalid; 1: Valid Bit 1: Ready to run 0: Invalid 1: Valid Bit 2: Running 0: Invalid 1: Valid Bit 3: Fault 0: Invalid 1: Valid Bit 4: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 5: OFF3 (quick stop) 0: Invalid 1: Valid Bit 6: Power-on blocked 0: Invalid 1: Valid Bit 7: Warning/Limit running 0: Invalid 1: Valid Bit 8: No speed deviation 0: Invalid 1: Valid Bit 9: Local/Remote 0: Local 1: Remote Bit 10: Target speed reached 0: Invalid 1: Valid Bit 11: Torque limit 0: Invalid 1: Valid Bit 12: Forward speed 0: Invalid 1: Valid Bit 13: Negative speed 0: Invalid 1: Valid Bit 14: Running (wave generation) 0: Invalid 1: Valid Bit 15: User-defined state 0 0: Invalid 1: Valid	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-06	0x9506	Current state machine	0: Initializing 1: Switch-on prohibited 2: Switch-on allowed 3: Running allowed 4: Started 5: Running 6: Stopped 7: Self-check 8: Auto-tuning	0	-	Unchangeable
L5-07	0x9507	Switchover command of system status machine	Bit 0: Active at startup 0: Invalid 1: Valid Bit 1: Active at stop 0: Invalid 1: Valid Bit 2: Active at OFF2 (coast to stop) 0: Invalid 1: Valid Bit 3: Active at OFF3 (quick stop) 0: Invalid 1: Valid Bit 4: Active (non-hibernating state) at running allowed 0: Invalid 1: Valid Bit 5: Running inhibited 0: Invalid 1: Valid Bit 6: Stop fault active 0: Invalid 1: Valid Bit 7 to Bit 15: Reserved	0	-	Unchangeable
L5-09	0x9509	Current stop mode	0: Coast to stop 1: Stop at maximum capability 2: Quick stop 3: Decelerate to stop	0	-	Unchangeable
L5-10	0x950A	Decelerate to stop/DC braking	0: Decelerate to stop 1: Short circuit braking 2: DC injection braking 3: Empty	0	-	Unchangeable
L5-15	0x950F	Commissioning software/APP control flag	0: Commissioning software not enabled 1: Commissioning software controlled	0	-	Unchangeable
L5-17	0x9511	Bus voltage	0.0 V to 6553.5 V	0.0	V	Unchangeable
L5-18	0x9512	AC drive version	0: CAN version 1: 0: CAN version 1: Reserved 2: Reserved 3: Reserved 4: Modbus version	0	-	Unchangeable
L5-20	0x9514	Module temperature	0.0°C to 6553.5°C	0.0	°C	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-21	0x9515	LED control word	Bit 0: Start 0: Invalid 1: Valid Bit 1: Stop 0: Invalid 1: Valid Bit 2: Jog 1 0: Invalid 1: Valid Bit 3: Local control 0: Invalid 1: Valid Bit 4: Reset 0: Invalid 1: Valid Bit 5: Jog 2 0: Invalid 1: Valid Bit 6: Direction switchover 0: Invalid 1: Valid Bit 7 to Bit 15: Reserved	0x0	-	Unchangeable
L5-22	0x9516	IDS control word	Bit 0: Start 0: Invalid 1: Valid Bit 1: Stop 0: Invalid 1: Valid Bit 2: Jog 1 0: Invalid 1: Valid Bit 3: Jog 2 0: Invalid 1: Valid Bit 4: Reset 0: Invalid 1: Valid Bit 5: Forward direction 0: Invalid 1: Valid Bit 6: Reverse direction 0: Invalid 1: Valid Bit 7: Auto-tuning 0: Invalid 1: Valid Bit 8: Auto-check 0: Invalid 1: Valid Bit 9 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-23	0x9517	SOP control word	Bit 0: Start 0: Invalid 1: Valid Bit 1: Stop 0: Invalid 1: Valid Bit 2: Jog 1 0: Invalid 1: Valid Bit 3: Jog 2 0: Invalid 1: Valid Bit 4: Reset 0: Invalid 1: Valid Bit 5: Forward direction 0: Invalid 1: Valid Bit 6: Reverse direction 0: Invalid 1: Valid Bit 7: Auto-tuning 0: Invalid 1: Valid Bit 8: Auto-check 0: Invalid 1: Valid Bit 9 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-24	0x9518	Command channel system command	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Activated 1: Normal Bit 2: OFF3 (quick stop) 0: Activated 1: Normal Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: RFG output forced to 0 0 0: Normal 1: RFG output forced to 0 Bit 5: RFG paused 0: Normal 1: RFG pause Bit 6: RFG input forced to 0 Reserved 0 0: Normal 1: RFG input forced to 0 Bit 7: Fault reset 0: Disable 1: Enable Bit 8: Jog 1 (JOG1) 0: Disable 1: Enable Bit 9: Jog 2 (JOG2) 0: Disable 1: Enable Bit 10: Remote control reserved 0: Disable 1: Enable Bit 11: Opposite to the speed 0: Not reversed 1: Reversed Bit 12: Start signal 0: Invalid 1: Valid Bit 13: Internal start command 0: Invalid 1: Valid Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable
L5-25	0x9519	LED command clear flag	0: Invalid 1: Valid	0	-	Unchangeable
L5-26	0x951A	SOP command clear flag	0: Invalid 1: Valid	0	-	Unchangeable
L5-27	0x951B	IDS command clear flag	0: Invalid 1: Valid	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-28	0x951C	Terminal module command	Bit 0: ON_OFF1 (start/stop) 0: Stop 1: Running Bit 1: OFF2 (coast to stop) 0: Stop 1: Normal Bit 2: OFF3 (quick stop) 0: Stop 1: Running Bit 3: Running allowed 0: Not allowed 1: Allowed Bit 4: Reset command 0: Disable 1: Enable Bit 5: JOG1 0: Disable 1: Enable Bit 6: JOG2 0: Disable 1: Enable Bit 7: Opposite to the speed 0: Not reversed 1: reversed Bit 8 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-29	0x951D	Input state of terminal module A	Bit 0: ON_OFF1 (start/stop) 0: Invalid 1: Valid Bit 1: Reverse running (Rev) 0: Invalid 1: Valid Bit 2: Running allowed (Enable) 0: Invalid 1: Valid Bit 3: Reset command 0: Invalid 1: Valid Bit 4: Jog 1 (JOG1) 0: Invalid 1: Valid Bit 5: Jog 2 (JOG2) 0: Invalid 1: Valid Bit 6: Reserved 0: Invalid 1: Valid Bit 7: Reserved Bit 8: Terminal function input IN1 0: Invalid 1: Valid Bit 9: Terminal function input IN2 0: Invalid 1: Valid Bit 10: Terminal function input IN3 0: Invalid 1: Valid Bit 11 to Bit 15: Reserved	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-30	0x951E	Input state of terminal module B	Bit 0: ON_OFF1 (start/stop) 0: Invalid 1: Valid Bit 1: Reverse running (Rev) 0: Invalid 1: Valid Bit 2: Running allowed (Enable) 0: Invalid 1: Valid Bit 3: Reset command 0: Invalid 1: Valid Bit 4: Jog 1 (JOG1) 0: Invalid 1: Valid Bit 5: Jog 2 (JOG2) 0: Invalid 1: Valid Bit 6: Reserved 0: Invalid 1: Valid Bit 7: Reserved Bit 8: Terminal function input IN1 0: Invalid 1: Valid Bit 9: Terminal function input IN2 0: Invalid 1: Valid Bit 10: Terminal function input IN3 0: Invalid 1: Valid Bit 11 to Bit 15: Reserved	0x0	-	Unchangeable
L5-31	0x951F	Running mode (normal/jogging)	0: Normal operation 1: Jogging	0	-	Unchangeable
L5-32	0x9520	Jogging source 1/2	0: Jogging source 1 1: Jogging source 2	0	-	Unchangeable
L5-33	0x9521	Control target	0: Speed control 1: Torque control 2: Reserved	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-34	0x9522	RFG state word	Bit 0 and Bit 1: Acceleration or deceleration status 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 2 and bit 3: Acceleration or deceleration arc status 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 4: Reserved Bit 5: Reserved Bit 6: Reserved Bit 7: Reserved Bit 8 to Bit 9: Last acceleration or deceleration state 0: Reserved 1: Constant speed 2: Acceleration 3: Deceleration Bit 10 and Bit 11: Arc status of the previous cycle 0: Constant speed 1: Start segment 2: Constant acceleration 3: End segment Bit 12: Reserved Bit 13: Reserved Bit 14: Reserved Bit 15: Reserved	0x0	-	Unchangeable
L5-35	0x9523	RFG command word	Bit 0: Calculation enable 0: Disable 1: Enable Bit 1: Output forced enable 0: Disable 1: Enable Bit 2: Calculation pause 0: Disable 1: Enable Bit 3: Bypass enable 0: Disable 1: Bypass Bit 4: Reserved Bit 5: Arc type 0: Continuous arc 1: Non-continuous arcs Bit 6 to Bit 15: Reserved	0x0	-	Unchangeable
L5-38	0x9526	V/f separation time set to 0	0 to 65535	0	-	Unchangeable
L5-39	0x9527	V/f separation	0: Disable V/f separation 1: Enable V/f separation	0	-	Unchangeable
L5-40	0x9528	AI1 raw sampling value	-32.767 V to 32.767 V	0.000	V	Unchangeable
L5-43	0x952B	AI1 sampling value after correction	-327.67 V to 327.67 V	0.00	V	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-46	0x952E	Input value of AI1 curve	-327.67 V to 327.67 V	0.00	V	Unchangeable
L5-49	0x9531	AO1 output before correction	-327.67 V to 327.67 V	0.00	V	Unchangeable
L5-51	0x9533	AO1 output after correction	-32.767 V to 32.767 V	0.000	V	Unchangeable
L5-53	0x9535	HDI input frequency	0.00 kHz to 655.35 kHz	0.00	kHz	Unchangeable
L5-56	0x9538	Displays the communication reference command word.	Bit 0: ON_OFF1 (start/stop) 0: Invalid 1: Valid Bit 1: OFF2 (Coast to stop) 0: Invalid 1: Valid Bit 2: OFF3 (Quick stop) 0: Invalid 1: Valid Bit 3: Running allowed 0: Activated 1: Normal Bit 4: Reset 0: Activated 1: Normal Bit 5: Jog 1 (JOG1) 0: Invalid 1: Valid Bit 6: Jog 2 (JOG2) 0: Invalid 1: Valid Bit 7: Opposite to the speed 0: Not reversed 1: Reversed Bit 8 to Bit 15: Reserved	0x0	-	Unchangeable
L5-58	0x953A	Communication command clear flag	0 to 65535	0	-	Unchangeable
L5-59	0x953B	RFG performance forcing enable	0 to 65535	0	-	Unchangeable
L5-61	0x953D	Deceleration time 4 forced flag	0 to 65535	0	-	Unchangeable
L5-62	0x953E	DI immediate DC braking command	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-63	0x953F	Drive sampling DI state	Bit 0: DI1 state 0: Low level 1: High level Bit 1: DI2 state 0: Low level 1: High level Bit 2: DI3 state 0: Low level 1: High level Bit 3: DI4/HDI state 0: Low level 1: High level Bit 4: DI5 state (MD600 A) 0: Low level 1: High level Bit 5: Reserved 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-64	0x9540	Drive output DI state	Bit 0: DI1 state 0: Low level 1: High level Bit 1: DI2 state 0: Low level 1: High level Bit 2: DI3 state 0: Low level 1: High level Bit 3: DI4/HDI state 0: Low level 1: High level Bit 4: DI5 state (MD600 A) 0: Low level 1: High level Bit 5: Reserved 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-65	0x9541	Final output DI state	Bit 0: DI1 state 0: Low level 1: High level Bit 1: DI2 state 0: Low level 1: High level Bit 2: DI3 state 0: Low level 1: High level Bit 3: DI4/HDI state 0: Low level 1: High level Bit 4: DI5 state (MD600 A) 0: Low level 1: High level Bit 5: Reserved 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-68	0x9544	Final output DO status	Bit 0: RO1 state 0: Low level 1: High level Bit 1: Reserved 0: Low level 1: High level Bit 2: Reserved 0: Low level 1: High level Bit 3: Reserved 0: Low level 1: High level Bit 4: DO1 state (MD600A) 0: Low level 1: High level Bit 5: DO2 state (MD600A) 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDO1 state 0: Low level 1: High level Bit 11: VDO2 state 0: Low level 1: High level Bit 12: VDO3 state 0: Low level 1: High level Bit 13: VDO4 state 0: Low level 1: High level Bit 14: VDO5 state 0: Low level 1: High level Bit 15: VDO6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-69	0x9545	I/O monitoring state	Bit 0: AI1 disconnection limit exceeded 0: Not exceeded 1: Exceeded Bit 1: Reserved 0: Low level 1: High level Bit 2: AI-as-DI output status 0: Low level 1: High level Bit 3: HDI input disconnection status 0: Not disconnected 1: Disconnected Bit 15: Module temperature reached 0: Not reached 1: Reached	0x0	-	Unchangeable
L5-70	0x9546	Main speed	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
L5-71	0x9547	Auxiliary speed	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
L5-78	0x954E	Flag indicating whether mapping write data is 32-bit	0 to 65535	0	-	Unchangeable
L5-79	0x954F	External communication data low-order 16 bits 1	0 to 65535	0	-	Unchangeable
L5-80	0x9550	External communication data low-order 16 bits 2	0 to 65535	0	-	Unchangeable
L5-81	0x9551	External communication data low-order 16 bits 3	0 to 65535	0	-	Unchangeable
L5-82	0x9552	External communication data low-order 16 bits 4	0 to 65535	0	-	Unchangeable
L5-83	0x9553	External communication data low-order 16 bits 5	0 to 65535	0	-	Unchangeable
L5-84	0x9554	External communication data low-order 16 bits 6	0 to 65535	0	-	Unchangeable
L5-85	0x9555	External communication data low-order 16 bits 7	0 to 65535	0	-	Unchangeable
L5-86	0x9556	External communication data low-order 16 bits 8	0 to 65535	0	-	Unchangeable
L5-87	0x9557	External communication data low-order 16 bits 9	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L5-88	0x9558	External communication data low-order 16 bits 10	0 to 65535	0	-	Unchangeable
L5-89	0x9559	External communication data high-order 16 bits 1	0 to 65535	0	-	Unchangeable
L5-90	0x955A	External communication data high-order 16 bits 2	0 to 65535	0	-	Unchangeable
L5-91	0x955B	External communication data high-order 16 bits 3	0 to 65535	0	-	Unchangeable
L5-92	0x955C	External communication data high-order 16 bits 4	0 to 65535	0	-	Unchangeable
L5-93	0x955D	External communication data high-order 16 bits 5	0 to 65535	0	-	Unchangeable
L5-94	0x955E	External communication data high-order 16 bits 6	0 to 65535	0	-	Unchangeable
L5-95	0x955F	External communication data high-order 16 bits 7	0 to 65535	0	-	Unchangeable
L5-96	0x9560	External communication data high-order 16 bits 8	0 to 65535	0	-	Unchangeable
L5-97	0x9561	External communication data high-order 16 bits 9	0 to 65535	0	-	Unchangeable
L5-98	0x9562	External communication data high-order 16 bits 10	0 to 65535	0	-	Unchangeable
L6-00	0x9600	Rated motor speed	0 RPM to 65535 RPM	0	rmp	Unchangeable
L6-01	0x9601	Rated motor frequency	0.0 Hz to 6553.5 Hz	0.0	Hz	Unchangeable
L6-02	0x9602	Rated voltage	0.0 V to 6553.5 V	0.0	V	Unchangeable
L6-03	0x9603	Rated current	0.0 A to 6553.5 A	0.0	A	Unchangeable
L6-04	0x9604	Rated power	0.00 kW to 655.35 kW	0.00	kW	Unchangeable
L6-08	0x9608	Torque control frequency offset mode	0: Bidirectional offset 1: Unidirectional offset 2: Overspeed control	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L6-09	0x9609	RFG acceleration/ deceleration state	0: Reserved 1: Constant-speed segment 2: Acceleration segment 3: Deceleration segment	0	-	Unchangeable
L6-10	0x960A	RFG arc state	0: Constant-speed segment 1: Start segment 2: Constant-acceleration segment 3: End segment	0	-	Unchangeable
L6-27	0x961B	Flag for power-related decimal place change	0 to 65535	0	-	Unchangeable
L6-33	0x9621	Control mode activated	0: Speed control 1: Torque control 2: Reserved	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L6-35	0x9623	System main status word 4	Bit 0: Zero-speed running (inactive at stop) 0: Invalid 1: Valid Bit 1: Zero speed (valid at stop) 0: Invalid 1: Valid Bit 2: Frequency level detection 1 0: Invalid 1: Valid Bit 3: Frequency level detection 2 0: Invalid 1: Valid Bit 4: Reserved Bit 5: Simple PLC cycle completed 0: Invalid 1: Valid Bit 6: Communication setpoint 0: Invalid 1: Valid Bit 7: Reserved Bit 8: Current 1 reached 0: Invalid 1: Valid Bit 9: Current 2 reached 0: Invalid 1: Valid Bit 10: Zero current state 0: Invalid 1: Valid Bit 11: Output current overlimit 0: Invalid 1: Valid Bit 12: Motor overload pre-warning 0: Invalid 1: Valid Bit 13: AC drive overload pre-warning 0: Invalid 1: Valid Bit 14: Undervoltage 0: Invalid 1: Valid Bit 15: Three-phase phase loss 0: Invalid 1: Valid	0x0	-	Unchangeable
L6-36	0x9624	Undervoltage fault flag	0 to 65535	0	-	Unchangeable
L6-37	0x9625	Fault restart clear command	0: Do not restart upon fault 1: Restart upon fault	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
L6-40	0x9628	Effective external command source	0: Operating panel 1: Terminal 2: Communication 3: Self-defined	0	-	Unchangeable
L6-46	0x962E	Active carrier frequency	0.000 kHz to 65.535 kHz	0.000	kHz	Unchangeable
L6-47	0x962F	HDI final input frequency	0.00 kHz to 100.00 kHz	0.00	kHz	Unchangeable
L7-61	0x973D	User load curve setting error glag	0 to 65535	0	-	Unchangeable
Lb-00	0x9B00	AI1 input setting proportion	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-01	0x9B01	MD-BP-M potentiometer per-unit value	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-03	0x9B03	HDI input setting proportion	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-05	0x9B05	Per-unit value of speed reference set through communication	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-07	0x9B07	Maximum forward frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-08	0x9B08	Minimum forward frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-09	0x9B09	Maximum reverse frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-10	0x9B0A	Minimum reverse frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-11	0x9B0B	Forward frequency limit with the supplementary frequency applied	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-12	0x9B0C	Reverse frequency limit with the supplementary frequency applied	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-13	0x9B0D	Main frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-14	0x9B0E	Auxiliary frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-15	0x9B0F	Channel target frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-16	0x9B10	Channel supplementary frequency	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Lb-17	0x9B11	Supplementary frequency reference	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-18	0x9B12	Frequency reference - Raw	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-19	0x9B13	Frequency reference - Processed with running limits	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-20	0x9B14	Frequency reference (UPDOWN)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-21	0x9B15	Frequency reference - Processed with direction limits	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-22	0x9B16	Frequency reference - Processed with positive and negative limits	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-23	0x9B17	Frequency reference - Processed with jump frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-24	0x9B18	Frequency reference - Processed with ramping	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-25	0x9B19	Jog 1 frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-26	0x9B1A	Jog 2 frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-27	0x9B1B	Offset of frequency adjusted by UP/DOWN key	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-28	0x9B1C	Upper limit of frequency adjusted by UP/DOWN key	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-29	0x9B1D	UP/DOWN lower limit	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-30	0x9B1E	Max. forward torque	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-31	0x9B1F	Max. reverse torque	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-32	0x9B20	Torque reference	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-33	0x9B21	Supplementary torque	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-34	0x9B22	Filtered torque reference	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-35	0x9B23	Target torque setpoint	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-36	0x9B24	Speed limit in torque control	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-37	0x9B25	Torque control frequency offset	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Lb-38	0x9B26	Target voltage upon separated V/f	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-39	0x9B27	V/f separation voltage output	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-40	0x9B28	RFG setting input	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-41	0x9B29	RFG calculation input	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-42	0x9B2A	RFG actual target	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-43	0x9B2B	RFG calculation output	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-45	0x9B2D	RFG final output (rated per-unit value)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-46	0x9B2E	RFG acceleration rate	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-47	0x9B2F	RFG forced value of startup frequency function	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-48	0x9B30	Operating frequency	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-49	0x9B31	Frequency reference	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-50	0x9B32	AO1 input proportion	-3276.8% to 3276.7%	0.0	%	Unchangeable
Lb-52	0x9B34	Result of forward frequency upper limit selection	0.0% to 6553.5%	100.0	%	Unchangeable
Lb-53	0x9B35	Result of reverse frequency upper limit selection	-3276.8% to 3276.7%	-100.0	%	Unchangeable
Lb-60	0x9B3C	Operating frequency (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-62	0x9B3E	Output voltage (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-63	0x9B3F	Output voltage (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-64	0x9B40	Output power (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-65	0x9B41	Output torque (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
Lb-66	0x9B42	Actual motor speed (percentage)	0.0% to 6553.5%	0.0	%	Unchangeable
LC-00	0x9C00	Final frequency setpoint control	0.0% to 6553.5%	0.0	%	Unchangeable
LC-06	0x9C06	Control torque setpoint	0.0% to 6553.5%	0.0	%	Unchangeable
LC-07	0x9C07	Control final flux setpoint	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
LC-08	0x9C08	Excitation current reference	0.0% to 6553.5%	0.0	%	Unchangeable
LC-09	0x9C09	Torque current setpoint	0.0% to 6553.5%	0.0	%	Unchangeable
LC-10	0x9C0A	Rotor speed	0.0% to 6553.5%	0.0	%	Unchangeable
LC-12	0x9C0C	Output torque	0.0% to 6553.5%	0.0	%	Unchangeable
LC-13	0x9C0D	Flux amplitude	0.0% to 6553.5%	0.0	%	Unchangeable
LC-14	0x9C0E	Flux angle	0.0% to 6553.5%	0.0	%	Unchangeable
LC-18	0x9C12	Output voltage amplitude	0.0% to 6553.5%	0.0	%	Unchangeable
LC-20	0x9C14	Actual excitation current of motor	0.0% to 6553.5%	0.0	%	Unchangeable
LC-21	0x9C15	Actual torque current of the motor	0.0% to 6553.5%	0.0	%	Unchangeable
LC-22	0x9C16	Output electric power	0.0% to 6553.5%	0.0	%	Unchangeable
LC-26	0x9C1A	IU	0.0% to 6553.5%	0.0	%	Unchangeable
LC-27	0x9C1B	IV	0.0% to 6553.5%	0.0	%	Unchangeable
LC-28	0x9C1C	IW	0.0% to 6553.5%	0.0	%	Unchangeable
LC-29	0x9C1D	Defines the hold time of motor stop.	0.0s to 6553.5s	0.0	s	Unchangeable
LC-30	0x9C1E	Defines the duration of motor operation.	0.0s to 6553.5s	0.0	s	Unchangeable
LC-31	0x9C1F	Displays the bus voltage of the drive.	0.0 V to 6553.5 V	0.0	V	Unchangeable
LC-32	0x9C20	Drive overload accumulative value	0.0% to 6553.5%	0.0	%	Unchangeable
LC-33	0x9C21	Motor overload accumulation	0.0% to 6553.5%	0.0	%	Unchangeable
LC-36	0x9C24	General PID output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-37	0x9C25	General PID error	0.0% to 6553.5%	0.0	%	Unchangeable
LC-38	0x9C26	General PID reference	0.0% to 6553.5%	0.0	%	Unchangeable
LC-39	0x9C27	General PID feedback	0.0% to 6553.5%	0.0	%	Unchangeable
LC-40	0x9C28	General PID proportional output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-41	0x9C29	General PID integral output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-42	0x9C2A	General PID derivative output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-47	0x9C2F	Active carrier frequency	0.0% to 6553.5%	0.0	%	Unchangeable
LC-59	0x9C3B	Monitoring variable 0	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
LC-60	0x9C3C	Monitoring variable 1	0.0% to 6553.5%	0.0	%	Unchangeable
LC-61	0x9C3D	Monitoring variable 2	0.0% to 6553.5%	0.0	%	Unchangeable
LC-62	0x9C3E	Monitoring variable 3	0.0% to 6553.5%	0.0	%	Unchangeable
LC-63	0x9C3F	Monitoring variable 4	0.0% to 6553.5%	0.0	%	Unchangeable
LC-64	0x9C40	Monitoring variable 5	0.0% to 6553.5%	0.0	%	Unchangeable
LC-65	0x9C41	Monitoring variable 6	0.0% to 6553.5%	0.0	%	Unchangeable
LC-66	0x9C42	Monitoring variable 7	0.0% to 6553.5%	0.0	%	Unchangeable
LC-67	0x9C43	Monitoring variable 8	0.0% to 6553.5%	0.0	%	Unchangeable
LC-68	0x9C44	Monitoring variable 9	0.0% to 6553.5%	0.0	%	Unchangeable
LC-77	0x9C4D	Speed loop active Kp	0.0% to 6553.5%	0.0	%	Unchangeable
LC-78	0x9C4E	Speed loop active Ti	0.0% to 6553.5%	0.0	%	Unchangeable
LC-79	0x9C4F	Speed loop output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-80	0x9C50	Speed loop Kp output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-81	0x9C51	Speed loop Ti output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-82	0x9C52	Forward torque limit value	0.0% to 6553.5%	0.0	%	Unchangeable
LC-83	0x9C53	Reverse torque limit value	0.0% to 6553.5%	0.0	%	Unchangeable
LC-84	0x9C54	Forward torque\ current limit	0.0% to 6553.5%	0.0	%	Unchangeable
LC-85	0x9C55	Reverse torque\ current limit	0.0% to 6553.5%	0.0	%	Unchangeable
LC-86	0x9C56	Unlimited speed loop output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-87	0x9C57	Torque feedforward output	0.0% to 6553.5%	0.0	%	Unchangeable
LC-88	0x9C58	Torque of load observer	0.0% to 6553.5%	0.0	%	Unchangeable
LC-89	0x9C59	Total additional torque	0.0% to 6553.5%	0.0	%	Unchangeable
LC-92	0x9C5C	Indicates variable connector output view 1	0.0% to 6553.5%	0.0	%	Unchangeable
LC-93	0x9C5D	Indicates variable connector output view 2	0.0% to 6553.5%	0.0	%	Unchangeable
LC-94	0x9C5E	Indicates variable connector output view 3	0.0% to 6553.5%	0.0	%	Unchangeable
LC-95	0x9C5F	Indicates variable connector output view 4	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
LC-96	0x9C60	Indicates variable connector output view 5	0.0% to 6553.5%	0.0	%	Unchangeable
LC-97	0x9C61	Indicates variable connector output view 6	0.0% to 6553.5%	0.0	%	Unchangeable
LC-98	0x9C62	Indicates variable connector output view 7	0.0% to 6553.5%	0.0	%	Unchangeable
LC-99	0x9C63	Indicates variable connector output view 8	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-48	0x9D30	Multi-step reference selection output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-49	0x9D31	Multi-reference 0 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-50	0x9D32	Multi-reference 1 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-51	0x9D33	Multi-reference 2 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-52	0x9D34	Multi-reference 3 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-53	0x9D35	Multi-reference 4 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-54	0x9D36	Multi-reference 5 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-55	0x9D37	Multi-reference 6 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-56	0x9D38	Multi-reference 7 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-57	0x9D39	Multi-reference 8 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-58	0x9D3A	Multi-reference 9 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-59	0x9D3B	Multi-reference 10 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-60	0x9D3C	Multi-reference 11 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-61	0x9D3D	Multi-reference 12 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-62	0x9D3E	Multi-reference 13 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-63	0x9D3F	Multi-reference 14 output	0.0% to 6553.5%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
Ld-64	0x9D40	Multi-reference 15 output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-89	0x9D59	AO1 value percentage written via communication	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-92	0x9D5C	Per-unit current value based on the maximum 1000 A	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-93	0x9D5D	Per-unit voltage value based on the maximum 1000 V	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-94	0x9D5E	AO output torque absolute output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-95	0x9D5F	AO output torque (–200.0% to +200.0%)	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-96	0x9D60	Simple PLC target velocity	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-98	0x9D62	PID reverse cut-off output	0.0% to 6553.5%	0.0	%	Unchangeable
Ld-99	0x9D63	Communication setting	0.0% to 6553.5%	0.0	%	Unchangeable
U0-00	0x7000	Operating frequency	0.00 Hz to 600.00 Hz	0.00	Hz	Unchangeable
U0-01	0x7001	Frequency reference	0.00 Hz to 600.00 Hz	0.00	Hz	Unchangeable
U0-02	0x7002	Bus voltage	0.0 V to 6553.5 V	0.0	V	Unchangeable
U0-03	0x7003	Output voltage	0 V to 65535 V	0	V	Unchangeable
U0-04	0x7004	Output current	0.00 A to 655.35 A	0.00	A	Unchangeable
U0-05	0x7005	Output power	-3276.8 kW to 3276.7 kW	0.0	kW	Unchangeable
U0-06	0x7006	Output torque	-3276.8% to 3276.7%	0.0	%	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-07	0x7007	DI input state	Bit 0: DI1 state 0: Low level 1: High level Bit 1: DI2 state 0: Low level 1: High level Bit 2: DI3 state 0: Low level 1: High level Bit 3: DI4/HDI state 0: Low level 1: High level Bit 4: DI5 state (MD600 A) 0: Low level 1: High level Bit 5: Reserved 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDI1 state 0: Low level 1: High level Bit 11: VDI2 state 0: Low level 1: High level Bit 12: VDI3 state 0: Low level 1: High level Bit 13: VDI4 state 0: Low level 1: High level Bit 14: VDI5 state 0: Low level 1: High level Bit 15: VDI6 state 0: Low level 1: High level	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-08	0x7008	DO output state	Bit 0: RO1 state 0: Low level 1: High level Bit 1: Reserved 0: Low level 1: High level Bit 2: Reserved 0: Low level 1: High level Bit 3: Reserved 0: Low level 1: High level Bit 4: DO1 state (MD600A) 0: Low level 1: High level Bit 5: DO2 state (MD600A) 0: Low level 1: High level Bit 6: Reserved 0: Low level 1: High level Bit 7: Reserved 0: Low level 1: High level Bit 8: Reserved 0: Low level 1: High level Bit 9: Reserved 0: Low level 1: High level Bit 10: VDO1 state 0: Low level 1: High level Bit 11: VDO2 state 0: Low level 1: High level Bit 12: VDO3 state 0: Low level 1: High level Bit 13: VDO4 state 0: Low level 1: High level Bit 14: VDO5 state 0: Low level 1: High level Bit 15: VDO6 state 0: Low level 1: High level	0x0	-	Unchangeable
U0-09	0x7009	AI1 voltage	-10.57 V to 10.57 V	0.00	V	Unchangeable
U0-14	0x700E	Load speed display	0 RPM to 65535 RPM	0	rmp	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-15	0x700F	PID reference	0 to 65535	0	-	Unchangeable
U0-16	0x7010	PID feedback	0 to 65535	0	-	Unchangeable
U0-17	0x7011	PLC stage	0 to 65535	0	-	Unchangeable
U0-18	0x7012	HDI input pulse frequency	0.00 kHz to 20.00 kHz	0.00	kHz	Unchangeable
U0-19	0x7013	Actual motor frequency	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
U0-20	0x7014	Remaining running time	0.0 min to 6553.5 min	0.0	min	Unchangeable
U0-21	0x7015	AI1 voltage before calibration	-10.570 V to 10.570 V	0.000	V	Unchangeable
U0-24	0x7018	Motor speed actual value	0 rpm to 65535 rpm	0	rmp	Unchangeable
U0-25	0x7019	Current power-on time	0 min to 65535 min	0	min	Unchangeable
U0-26	0x701A	Current running time	0.0 min to 6553.5 min	0.0	min	Unchangeable
U0-27	0x701B	HDI input pulse frequency	0 Hz to 20000 Hz	0	Hz	Unchangeable
U0-28	0x701C	Communication setpoint	-327.68% to 327.67%	0.00	%	Unchangeable
U0-30	0x701E	Digital setting of main frequency	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
U0-31	0x701F	Digital setting of auxiliary frequency	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
U0-35	0x7023	Target torque	-200.0% to 200.0%	0.0	%	Unchangeable
U0-37	0x7025	Power factor angle	-3276.8° to 3276.7°	0.0	°	Unchangeable
U0-39	0x7027	Target voltage upon separated V/f	0 V to 65535 V	0	V	Unchangeable
U0-40	0x7028	Output voltage upon separated V/f	0 V to 65535 V	0	V	Unchangeable
U0-45	0x702D	Fault Code	0.0 to 6553.5	0.0	-	Unchangeable
U0-46	0x702E	Minor fault code	0.0 to 6553.5	0.0	-	Unchangeable
U0-47	0x702F	Alarm code	0.0 to 6553.5	0.0	-	Unchangeable
U0-48	0x7030	Prompt code	0.0 to 6553.5	0.0	-	Unchangeable
U0-49	0x7031	Set fan speed	0rpm to 65535rpm	0	rmp	Unchangeable
U0-50	0x7032	Actual fan speed	-32768 rpm to +32767 rpm	0	rmp	Unchangeable
U0-51	0x7033	Adjustment of UP/ DOWN key or terminal functioning as UP/ DOWN key	-327.68 Hz to 327.67 Hz	0.00	Hz	Unchangeable
U0-52	0x7034	Fan initialization flag	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U0-56	0x7038	Output per-unit value of potentiometer MD-BP-M	0.00% to 655.35%	0.00	%	Unchangeable
U0-57	0x7039	Voltage of potentiometer MD-BP-M	-10.57 V to 10.57 V	0.00	V	Unchangeable
U0-59	0x703B	Frequency reference (percentage)	-3276.8% to 3276.7%	0.0	%	Unchangeable
U0-60	0x703C	Operating frequency (percentage)	-3276.8% to 3276.7%	0.0	%	Unchangeable
U0-61	0x703D	Drive state 1	1: Forward running 2: Reverse running 3: Stopped 4: Auto-tuning 5: Faulty	0	-	Unchangeable
U0-65	0x7041	Torque upper limit	-2000.0% to 2000.0%	0.0	%	Unchangeable
U0-68	0x7044	Drive state 2	0x0 to 0xFFFF	0x0	-	Unchangeable
U0-69	0x7045	Actual motor frequency (signed)	-327.67 Hz to 327.67 Hz	0.00	Hz	Unchangeable
U0-70	0x7046	actual motor speed (signed)	-32768 rpm to +32767 rpm	0	rmp	Unchangeable
U0-71	0x7047	Output current (one decimal place)	0.0 A to 6553.5 A	0.0	A	Unchangeable
U0-75	0x704B	Actual motor frequency (unsigned)	0.00 Hz to 655.35 Hz	0.00	Hz	Unchangeable
U0-76	0x704C	Low-order bits of cumulative power consumption	0.0 kWh to 6553.5 kWh	0.0	kWh	Unchangeable
U0-77	0x704D	High-order bits of cumulative power consumption	0 kWh to 65535 kWh	0	kWh	Unchangeable
U2-01	0x7201	Current control channel	0: Control channel 1 1: Control channel 2	0	-	Unchangeable
U2-02	0x7202	Current set channel	0: Set channel 1 1: Set channel 2	0	-	Unchangeable
U2-03	0x7203	Jump frequency flag	0 to 65535	0	-	Unchangeable
U2-04	0x7204	Local/remote control	0: Remote 1: Local	0	-	Unchangeable
U2-05	0x7205	Current multi-reference selection	0 to 65535	0	-	Unchangeable
U2-06	0x7206	Current multi-reference effective value	-3276.7% to 3276.7%	0.0	%	Unchangeable
U2-08	0x7208	Power-off time	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U2-13	0x720D	Fault and limit severity	0: Invalid 1: Coast to stop 2: Stop at maximum capacity 4: Quick stop 8: Decelerate to stop 512: Running with restriction 1024: Alarm 2048: Prompt	0	-	Unchangeable
U2-14	0x720E	Fault automatic reset and restart step	0: Automatic fault reset and initialization 1: Confirm whether automatic fault reset is enabled 2: Obtain the number of automatic fault reset times 3: Automatic fault reset interval 4: Counting of time interval for automatic fault reset 5: Return to fault 6: Fault waiting 7: Check fault 8: Wait for running 9: Restart 10: Wait for running after restart 11: Cancel fault 12: Automatic reset failed	0	-	Unchangeable
U2-23	0x7217	Parameter setting error	0 to 65535	0	-	Unchangeable
U2-24	0x7218	Macro parameter backup error	0 to 65535	0	-	Unchangeable
U2-25	0x7219	Remaining running time view	0.0 min to 6553.5 min	0.0	min	Unchangeable
U2-63	0x723F	Communication warning flag	0 to 65535	0	-	Unchangeable
U2-68	0x7244	Module temperature	0.0°C to 6553.5°C	0.0	°C	Unchangeable
U2-69	0x7245	AI1 input setting proportion	0.0% to 6553.5%	0.0	%	Unchangeable
U2-72	0x7248	HDI input setting proportion	0.0% to 6553.5%	0.0	%	Unchangeable
U2-73	0x7249	AO1 input proportion	-3276.8% to 3276.7%	0.0	%	Unchangeable
U2-75	0x724B	AO1 output before correction	-327.67 V to 327.67 V	0.00	V	Unchangeable
U2-77	0x724D	AO1 output after correction	-32.767 V to 32.767 V	0.000	V	Unchangeable
U3-00	0x7300	LCD command word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-01	0x7301	Remote call	0 to 65535	0	-	Unchangeable
U3-02	0x7302	IDS command word	0x0 to 0xFFFF	0x0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U3-03	0x7303	Command used by commissioning software to obtain control permission	0 to 65535	0	-	Unchangeable
U3-07	0x7307	LED control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-08	0x7308	Control word of the commissioning software	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-09	0x7309	SOP control word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-16	0x7310	Communication speed setting value 2 (0x7310)	0 to 65535	0	-	Unchangeable
U3-17	0x7311	Control word 2 set through communication (0x7311)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-18	0x7312	DO state setting (DO function setting source: communication)	0 to 65535	0	-	Unchangeable
U3-19	0x7313	AO1 output (AO1 function setting source: communication)	0% to 65535%	0	%	Unchangeable
U3-23	0x7317	Monitoring of communication speed setting value 1 (0x1000)	-32768 to 32767	0	-	Unchangeable
U3-28	0x731C	Communication status word	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-33	0x7321	Control word 1 set through communication (0x7321)	0x0 to 0xFFFF	0x0	-	Unchangeable
U3-50	0x7332	Fault code reading	0 to 65535	0	-	Unchangeable
U3-51	0x7333	Fault sub-code reading	0 to 65535	0	-	Unchangeable
U3-52	0x7334	Minor fault code reading	0 to 65535	0	-	Unchangeable
U3-53	0x7335	Minor fault sub-code reading	0 to 65535	0	-	Unchangeable
U3-54	0x7336	Warning code reading	0 to 65535	0	-	Unchangeable
U3-55	0x7337	Alarm subcode reading	0 to 65535	0	-	Unchangeable

Param.	Address	Name	Value Range	Default	Unit	Change Mode
U3-56	0x7338	Prompt code reading	0 to 65535	0	-	Unchangeable
U3-57	0x7339	Prompt sub-code reading	0 to 65535	0	-	Unchangeable

For complete information on parameters, see MD600 Series Compact AC Drive Parameter Guide.

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