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MD520 Series General-Purpose AC Drive

Commissioning Guide

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

Data code 19011715C01

Preface

Introduction

The MD520 series is a general-purpose high-performance vector control AC drive for accurate speed and torque control in high-demand applications. It can drive asynchronous AC induction motors (IM), permanent magnet synchronous motors (PMSM), and synchronous reluctance motors (SynRM). It is also equipped with the STO, limp mode upon fault, position control, and tension control functions.

This guide describes the commissioning and trial run of the AC drive, covering commissioning tools, commissioning processes, specific operations, and troubleshooting. For complete information on parameters and fault codes, see *MD520 Series General-Purpose AC Drive Parameter Guide.*

More Data

Document Name	Data Code	Description
MD520 Series General-Purpose AC Drive User Guide	PS00012134	This guide describes product selection, mechanical design, electrical design, installation, communication, commissioning, function application, troubleshooting, and standards.
MD520 Series General-Purpose AC Drive Parameter Guide	19012397	This guide describes parameters and fault codes.
MD520 Series General-Purpose AC Drive Quick Installation and Commissioning Guide	19011712	This guide describes the installation, wiring, commissioning, troubleshooting, and others.
MD520 Series General-Purpose AC Drive Hardware Guide	19011713	This guide describes the system composition, technical specifications, components, dimensions, options (including installation accessories, cables, and peripheral electrical components), expansion cards, routine inspection and maintenance, certifications, and standards of the AC drive.
MD520 Series General-Purpose AC Drive Installation Guide	19011714	This guide describes the installation dimensions, space design, specific installation steps, wiring requirements, routing requirements, option installation requirements, and common EMC troubleshooting suggestions.
MD520 Series General-Purpose AC Drive Commissioning Guide (this guide)	19011715	This guide describes commissioning tools, commissioning flowchart, detailed commissioning steps, and troubleshooting.

Document Name	Data Code	Description
MD520 Series General-Purpose AC Drive Communication Guide	19011716	This guide describes the communication mode, communication networking, and communication configuration of the product.
MD520 Series General-Purpose AC Drive Function Guide	19011717	This guide describes function applications, and troubleshooting of the product.
MD520 Series General-Purpose AC Drive Safety Function Guide	19011795	This guide describes the safety information, instructions for mechanical and electrical installation, commissioning and maintenance guidance, and safety-related parameters of the AC drive.

Revision History

Date	Document Version	Software Version	Revision
September 2024	C01	Version: A13 Version tag: F7-10=U60.07/F7-11=U61.10/F7-15=000.00/F7-16=000.00	**Modified the following content:** • Made minor corrections.
August 2024	C00	Version: A13 Version tag: F7-10=U60.07/F7-11=U61.10/F7-15=000.00/F7-16=000.00	**Modified the following content:** • Updated *"2.1.1 Basic Commissioning Flowchart" on page 37*. • Updated *"2.1.2 Commissioning Flowchart in V/f Control Mode" on page 39*. • Updated *"2.1.3 Commissioning Flowchart in SVC Mode" on page 41*. • Updated *"2.1.4 Commissioning Flowchart in FVC Mode" on page 43*. • Updated *"2.2.1 Check Before Power-on" on page 44*. • Made minor corrections. • Deleted the PMVVC function. For complete information on parameters and fault codes, see *MD520 Series General-Purpose AC Drive Parameter Guide*.

Date	Document Version	Software Version	Revision
February 2024	B01	Version: A12 Version tag: F7-10=U60.07/F7-11=U61.10/F7-15=000.00/F7-16=000.00	**Deleted the following content:** • Deleted 3.2 List of Fault Codes and 3.3 List of Fault Attributes. Added *"3.2 List of Faults and Alarms" on page 103*. For details on fault codes, see the parameter guide. • Deleted 4 Parameter List. For complete information on parameters and fault codes, see *MD520 Series General-Purpose AC Drive Parameter Guide.*
November 2023	B00	Version: A10 Version tag: F7-10=U60.07/F7-11=U61.08/F7-15=000.00/F7-16=000.00	**Modified the following content:** • Updated *"1.1 LED Operating Panel" on page 13*. • Updated *"1.8 Driving the Motor with the Operating Panel" on page 30*. • Updated section 3.2 List of Fault Codes. • Updated section 3.3 List of Fault Attributes. • Updated the Parameter List. • Made minor corrections.
January 2022	A00	–	First issue

Access to the Guide

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

- Do keyword search under Service and Support at http://www.inovance.com.
- 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. Maintenance will be charged after the warranty expires.

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

- 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.

Table of Contents

Fundamental Safety Instructions

Safety Precautions

- This chapter presents essential safety instructions for a proper use of the equipment. Before using this product, read the user guide thoroughly and correctly understand the related safety precautions. Failure to observe the safety precautions may result in serious injuries or death of personnel or device damage.
- "Danger", "Warning", and "Caution" items in this guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall take no responsibility for any personal injuries or property damage caused by improper 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 injury.

Indicates that failure to comply with the notice may result in minor or moderate personal injury 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 injuries on the surface of the equipment and equipment accessories before unpacking.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation

- Large-scale or heavy equipment must be 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 three months. Long-term storage requires stricter protection and necessary inspections.
- 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

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

- 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, cut off all the power supplies of the equipment, and wait for at least the time designated on the equipment warning label before further operations because residual voltage still exists after power-off. After waiting for the designated time, measure the DC voltage in the main circuit to ensure the DC voltage is within the safe voltage range. Failure to comply will result in an electric shock.
- Do not perform wiring, remove the equipment cover, or touch the circuit board with 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

- 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 a fire.
- Do not open the cabinet door or protective cover of the product, contact any wiring terminal of the product, or remove any part of the product at power-on. Failure to comply will result in an electric shock.

- 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 accident.
- 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

- 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.

- 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

- 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 an electric shock.
- Before maintenance, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
- In case of a permanent magnet motor, do not touch the motor terminals immediately after power-off because the motor terminals will generate induced voltage during rotation even after the equipment power supply is off. Failure to comply will result in an electric shock.

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

Repair
DANGER • Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. • Do not repair the equipment with power ON. Failure to comply can result in an electric shock. • Before inspection and repair, cut off all the power supplies of the equipment and wait for at least the time designated on the equipment warning label.
WARNING • Submit the repair request according to the 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
T12 models and below	T13 models	
		• 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 (for T12 models and below) or 15 min (for T13 models) after power-off. Failure to comply will result in an electric shock.

1 Commissioning Tools

1.1 LED Operating Panel

Dimension

The following figures show the outline and installation dimensions of the LED operating panel.

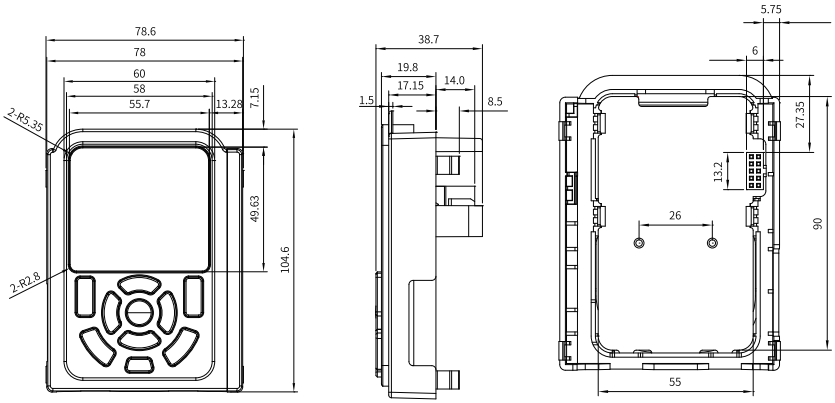


Figure 1-1 Outline and installation dimensions of LED operating panel for T1 to T4 models (mm)

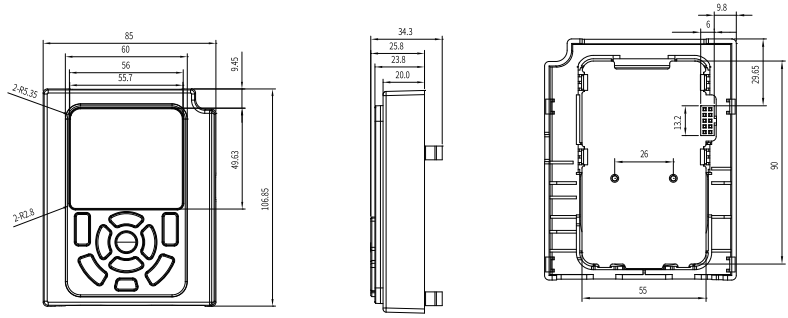


Figure 1-2 Outline and installation dimensions of LED operating panel for T5 to T12 models (mm)

Components

The LED operating panel can be used to view the operating status and fault information, set parameters, and so on. The following figure shows the operating panel.

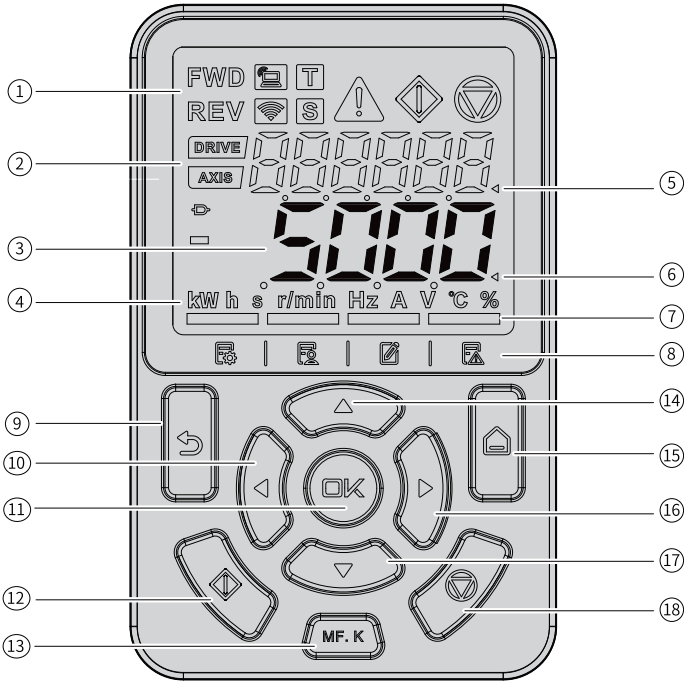


Figure 1-3 Components

Table 1–1 Description of the operating panel

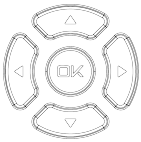
No.	Name	Description
①	Status indicators	/
②	Secondary display area	It displays the following information: • Information on key test and motor parameter auto-tuning • Fault and system status monitoring • Station number, motoring status, and STO status.
③	Primary display area	It displays parameter information.
④	Unit indicators	/
⑤	Cursor in the secondary display area	/
⑥	Cursor in the primary display area	/
⑦	Menu indicator	It indicates the current menu and can be switched via the menu key. Only one indicator can become on simultaneously.

No.	Name	Description
⑧	Menu identification	From left to right, the icons indicate the basic menu, user-defined parameter, modified parameter (with default values changed), and fault list.
⑨	Program/Back key	/
⑩	Left shift key	/
⑪	OK key	/
⑫	RUN key	/
⑬	Multi-function key	/
⑭	UP key	/
⑮	Menu key	/
⑯	Right shift key	/
⑰	DOWN key	/
⑱	Stop key	/

Key Descriptions

Table 1–2 Key descriptions

Key	Name	Function
	Menu key	Long press the key to switch between the primary display area and the secondary display area. In the primary display area, press the key to switch among different menus, including the basic menu, user-defined parameter, modified parameter (with default values changed), and fault list.
	Program/Back key	Return to the previous interface; Enter level 1 menu
	OK key	Press the key to enter the settings interface or confirm settings.

Key	Name	Function
	Navigation key	In the secondary display area, press the right or left navigation key to switch the display status. Primary display area: • Basic menu, user menu, and calibration menu: On the monitoring interface, the down key is used as the potentiometer and the left and right keys are used to switch between monitored variables. On the parameter interface, the up and down keys are used to adjust the setpoint, the left and right keys are used to select the bit to set, and the OK key is used to confirm the setpoint. • Fault history menu: Press the left or right key to switch the fault history records.
	Multi-function key	You can allocate different functions, such as command source switch, forward run and reverse run switch, or jog to this key.
	RUNkey	In the operating panel control mode, press the key to operate the drive.
	Stop/Fault reset key	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.

Status Indicator

Table 1–3 Status indicator

Status indicator		Status
	FWD indicator steady on	Forward run/Positive direction
	REV indicator steady on	Reverse run/Negative direction
	FWD/REV indicator blinking	The AC drive is switching between forward running and reverse running.
	Local/Remote indicator off	Local control
	Local/Remote indicator on	Terminal control
	Local/Remote indicator blinking slowly	Communication control
	Local/Remote indicator blinking quickly	User-defined control mode

Status indicator		Status
	Torque control indicator steady on	Torque control
	Speed control indicator steady on	Speed control
	Fault indicator steady on	Fault occurred
	Fault indicator off	No fault
	RUN indicator steady on	Running
	Stop indicator steady on	Stop
	Station number indicator steady on	The station number is displayed in the auxiliary display area.
	Station number indicator off	The value displayed in the auxiliary display area is not the station number.
	AXIS indicator steady on	The axis number is displayed in the auxiliary display area.
	AXIS indicator off	The value display in the auxiliary display area is not the axis number.
	Connector indicator steady on	The connector variable is displayed in the main display area.
	Connector indicator off	The variable displayed in the main display area is not the connector variable.
	Minus sign indicator steady on	The value displayed in the main display area is negative.
	Minus sign indicator off	The value displayed in the primary display area is positive.

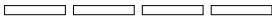
Status indicator		Status
	Cursor indicator in the primary display area steady on	The operating area is the primary display area.
	Cursor indicator in the secondary display area steady on	The operating area is the secondary display area.
kW h s r/min Hz A V ℃ %	Unit indicator steady on	The unit corresponding to the data displayed in the main display area is the unit with the indicator on. *"Table 1–4 " on page 18*
	 Indicator steady on	The primary display area displays the basic menu.
	 Indicator steady on	The primary display area displays the user-defined parameter menu.
	 Indicator steady on	The primary display area displays the modified parameter (with the default value changed) menu.
	 Indicator steady on	The primary display area displays the fault menu.

Table 1–4 Unit description

Unit	Description
kW	Power unit
h	Time unit
kWh	Energy unit
s	Time unit
rpm	Rotational speed unit
Hz	Frequency unit
A	Current unit
V	Voltage unit
°C	Temperature unit
%	Percentage

Data Display

The operating panel provides two data display areas: the 6-digit LED secondary display area and the 5-digit LED primary display area.

The auxiliary display area displays the station No., axis No., current state, warning/fault, etc.

The primary display area displays the frequency reference, output frequency, and various monitoring data.

Table 1–5 LED display and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
	0		9		h		r
	1		A		c		t
	2		B		J		U
	3		C		L		y
	4		D		n		T
	5		E		N		u
	6		F		o		/
	7		H		P	/	/
	8		G		q	/	/

1.2 Related Parameters

Table 1–6 Parameters related to the operating panel

Parameter Code	Parameter Name	Default	Value Range	Description
F7-01	MF.K key function	0	0: MF.K key disabled 1: Forcibly change to operating panel control 2: Switchover between forward run and reverse run 3: Forward jog 4: Reverse jog	The MF.K key is a multi-functional key. This parameter is used to set the function of the MF.K key. 0: MF.K key disabled The MF.K key is invalid. 1: Forcibly change to operating panel control If F0-02 is set to 0 (operating panel), the MF.K key is unavailable. If F0-02 is set to 1 (terminal), 2 (communication), or 3 (self-defined control mode), pressing the MF.K key forcibly changes the control mode to the operating panel control mode. 2: Switchover between forward run and reverse run You can change the direction of the frequency reference by using the MF.K key. This function is valid only when the command source is set to the operating panel. 3: Forward jog Pressing the MF.K key implements forward jogging (FJOG). This function is valid only when the command source is set to the operating panel. 4: Reverse jog Pressing the MF.K key implements reverse jogging (RJOG). This function is valid only when the command source is set to the operating panel.

Parameter Code	Parameter Name	Default	Value Range	Description
F7-02	STOP/RES key function	0	0: Valid only in the operating panel control mode 1: Valid in any control mode and OFF1 command-based stop 2: Valid in any control mode and OFF2 command-based stop 3: Valid in any control mode and OFF3 command-based stop	This parameter is used to set the function of the STOP/RESET key on the operating panel. 0: Valid only in the operating panel control mode The STOP/RES key is valid only in the operating panel control mode. 1: Valid in any control mode and OFF1 command-based stop The STOP/RES key is valid in any operating mode, and the AC drive stops according to the OFF1 stop mode. 2: Valid in any control mode and OFF2 command-based stop The STOP/RES key is valid in any operating mode, and the AC drive stops according to the OFF2 stop mode. 3: Valid in any control mode and OFF3 command-based stop The STOP/RES key is valid in any operating mode, and the AC drive stops according to the OFF3 stop mode.
F7-03	Parameter 1 displayed on LED operating panel during operation	31	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: AI2 voltage (V) Bit 11: AI3 voltage (V) Bit 12: Counting value Bit 13: Length value Bit 14: Load speed Bit 15: PID reference	This parameter defines the parameters displayed on the LED operating panel when the AC drive is running. You can view the parameters corresponding to each bit by pressing the left and right shift keys. 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. Each parameter is displayed in the hexadecimal format.

Parameter Code	Parameter Name	Default	Value Range	Description
F7-04	Parameter 2 displayed on LED operating panel during operation	0	Bit 0: PID feedback Bit 1: PLC stage Bit 2: 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: Pulse input frequency (Hz) Bit 12: Communication setting value Bit 13: Encoder feedback speed Bit 14: Main frequency X Bit 15: Auxiliary frequency Y	This parameter defines the parameters displayed on the LED operating panel when the AC drive is running. You can view the parameters corresponding to each bit by pressing the left and right shift keys. 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. Each parameter is displayed in the hexadecimal format.
F7-05	Parameter displayed at stop	51	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: AI2 voltage (V) Bit 6: AI3 voltage (V) Bit 7: Counting value Bit 8: Length value Bit 9: PLC stage Bit 10: Load speed Bit 11: PID reference Bit 12: Pulse input frequency (kHz) Bit 13: Reserved Bit 14: Free mapping 0 Bit 15: Free mapping 1	This parameter defines the parameters displayed on the LED operating panel when the AC drive is in stop state. You can view the parameters corresponding to each bit by pressing the left and right shift keys. 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. Each parameter is displayed in the hexadecimal format.

Parameter Code	Parameter Name	Default	Value Range	Description
FP-01	Parameter initialization	1	0: No action 1: Restore parameters (excluding motor parameters) to factory settings 2: Clear records 4: Back up current user parameters 501: Restore user parameters from backup 503: Restore parameters (including motor parameters) to factory settings	This parameter is used to select the parameter initialization mode. 0: The AC drive does not perform any operation. 1: Most of the AC drive parameters are restored to factory settings. However, motor parameters, frequency reference decimal (F0-22), maximum frequency (F0-10), frequency upper limit (F0-12), fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), cumulative power consumption (F7-14), and drive unit heatsink temperature (F7-07) are not restored. 2: The fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), and cumulative power consumption (F7-14) are cleared. 4: The current user-set parameters are backed up. 501: Parameters backed up by setting FP-01 to 4 are restored. 503: All AC drive parameters except FP-00, FP-01, and the parameters in group FF are restored to factory settings.
FP-02	Display of function parameter groups	63	Bit 0: Group U 0: Hidden 1: Displayed Bit 1: Group A 0: Hidden 1: Displayed Bit 2: Group B 0: Hidden 1: Displayed Bit 3: Group C 0: Hidden 1: Displayed Bit 4: Group H 0: Hidden 1: Displayed Bit 5: Group L 0: Hidden 1: Displayed	This parameter is used to determine whether the parameter groups U, A, B, C, H, and L are displayed on the operating panel by each bit.

Parameter Code	Parameter Name	Default	Value Range	Description
FP-03	Display of user parameters	111	Ones: 0: Hide user mode 1: Show user mode Tens: 0: Hide calibration mode 1: Show calibration mode Hundreds: 0: Hide error menu 1: Show error menu	This parameter is used to determine whether the user-defined parameter group, user-modified parameter group, and error menu are displayed on the operating panel through the ones, tens, and hundreds places.

1.3 Parameter Settings

The operating panel provides three levels of menus for parameter settings. You can press  ,  ,  , and  to modify the blinking bit on a menu of the operating panel. The three levels of menus are described as follows:

- Level-1 menu: parameter groups
- Level-2 menu: parameters
- Level-3 menu: parameter values

For example, to change the value of F3-02 from 10.00 Hz to 15.00 Hz, perform settings according to the following figure.

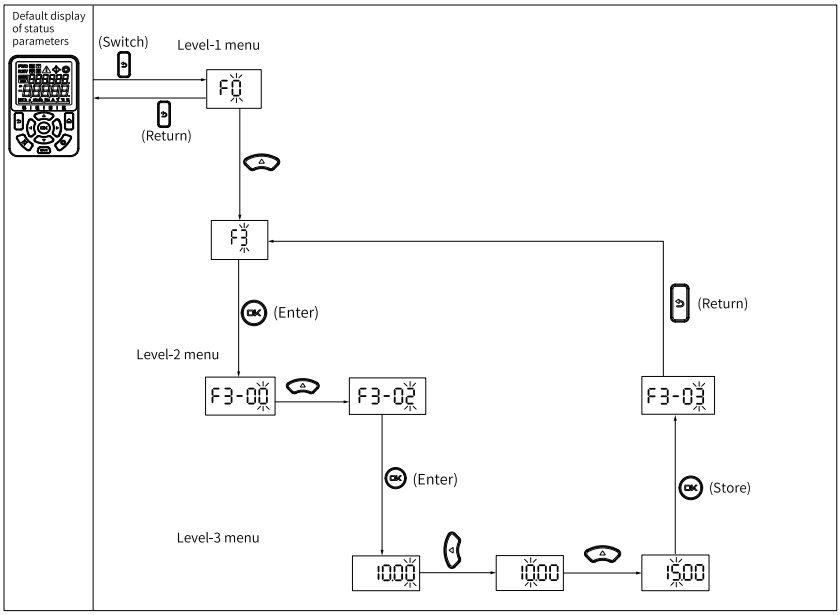


Figure 1-4 Modifying a parameter

Press  or  to return to a level-2 menu when operating a level-3 menu. The difference between the two keys is as follows:

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

If a parameter does not have a blinking bit in level-3 menu, the parameter cannot be modified. The reasons include 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.

1.4 Parameter View

Set FP-02 to 11 and FP-03 to 11 to view all parameters through the operating panel. The operation procedure is shown in the following figure.

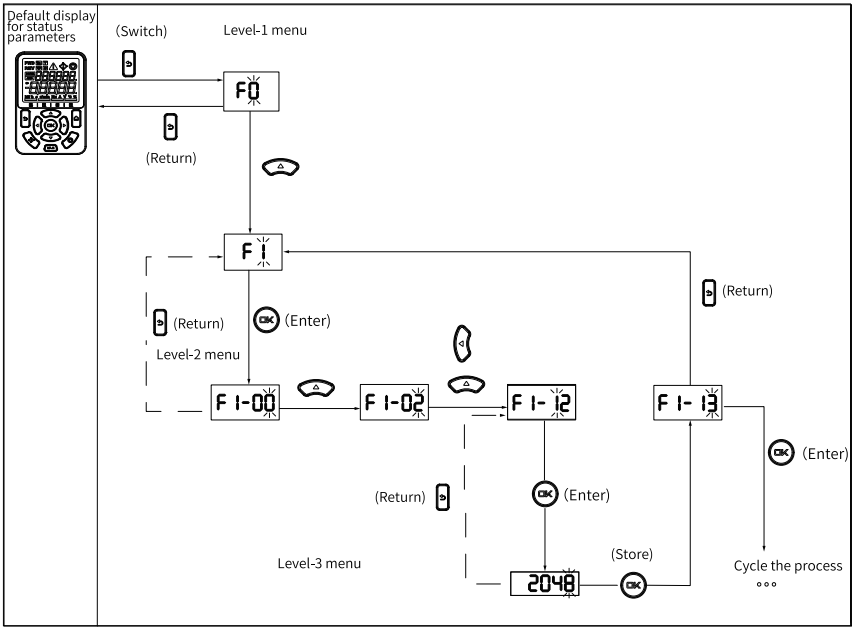


Figure 1-5 Parameter view

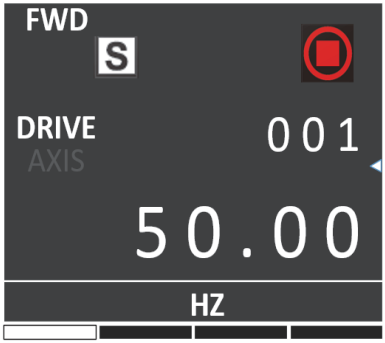
1.5 Status Parameter Display

The primary display area and the secondary display area are independent of each other. They have their own separate menus. The main display area is displayed by default.

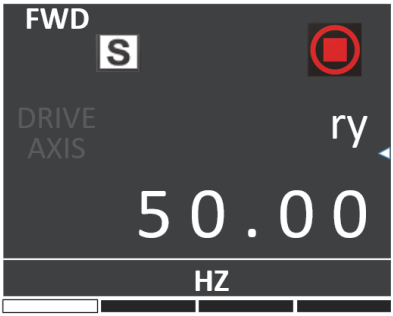
To switch between the main display area and auxiliary display area, press and hold  . You can view the operating cursor corresponding to the display area in the current operation area.

1. Parameter display in the auxiliary display area

- Station number interface (displayed by default): It displays the current station number, which is 001.



- Status interface: On the station number interface, press the left/right key to view the current device status. In this case, the DRIVE and AXIS indicators are both OFF, as shown below.



The following states can be displayed:

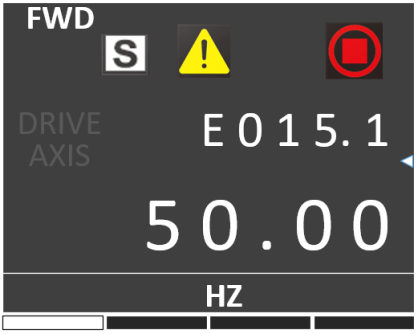
- reset (initialization): Initializing after power-on
- nr (not ready): Main circuit not powered on
- ry (ready): Wait for the operation command
- rn (in operation): In operation

When one of the following states appears, the corresponding display pops up. When the state ends, the corresponding display is cleared.

- STO: Displayed when the STO function is activated
- -JOG: Displayed during jogging
- HErE: Displayed upon the Here command
- CALL: Remote call
- busy: Displayed during parameter downloading or restoring parameters to default settings
- TUNE: Displayed upon auto-tuning

- Fault code interface E indicates faults, L indicates minor faults, and A indicates alarms. When a fault or an alarm occurs, the secondary display area displays the fault

by default. In this case, pressing the up/down key can switch among different faults, whereas pressing the left/right key can switch among different menus.



2. Parameter display in the main display area

During operation, you can press the left shift key or right shift key to view status parameters. By default, the following status parameters are displayed: operating frequency, frequency reference, bus voltage, output voltage, and output current. To view more status parameters, see descriptions of F7-03 and F7-04 in "Related Parameters".

When the drive stops, you can press the left shift key or right shift key to view status parameters. The following status parameters are displayed by default: frequency reference, bus voltage, AI1 voltage, and AI2 voltage. To view more status parameters, see descriptions of F7-05 in *"1.2 Related Parameters" on page 20*.

1.6 Fault and Alarm Display

When a fault occurs on the AC drive, the fault indicator turns on, and the secondary display area displays a fault code, as shown in the following figure.

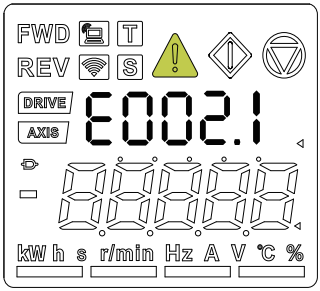


Figure 1-6 Fault code display

When the fault indicator blinks, the AC drive immediately stops output, and the contact of the faulty relay closes. In this case, see the *parameter guide* for troubleshooting or contact Inovance for technical support. Find the fault cause and rectify the fault based on the fault code displayed on the operating panel. Then reset the device.

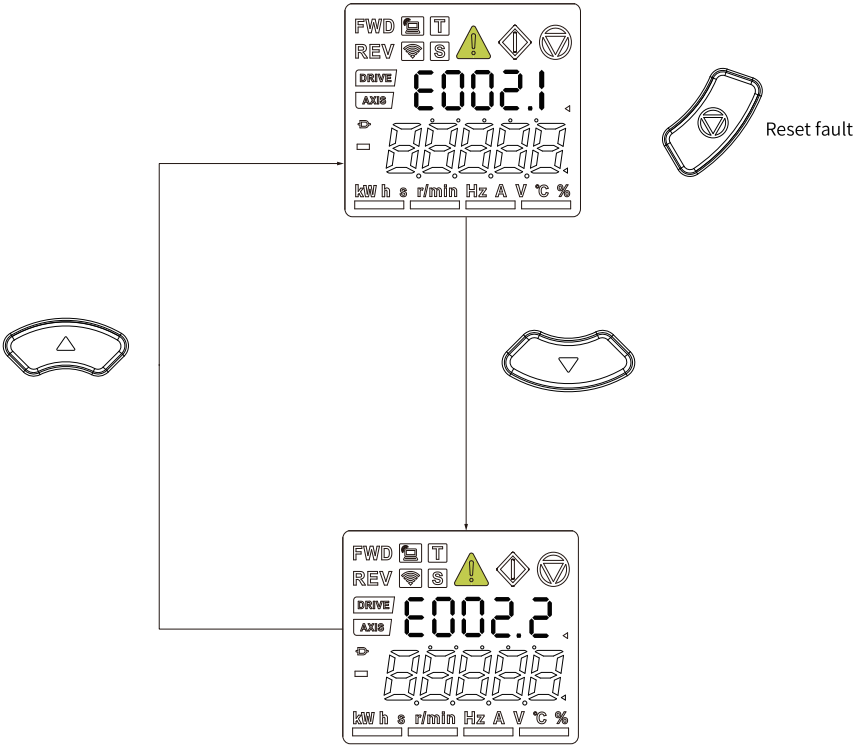


Figure 1-7 Viewing multiple faults and resetting the device

1.7 MF.K Multi-functional Key

The 

key on the operating panel is a multi-functional key. Its function can be set using F7-01. In the stop or running state, you can press the key for control mode switchover, and switchover between forward and reverse run, and forward/reverse jog.

Table 1–7 MF.K key parameter descriptions

Parameter Code	Parameter Name	Default	Value Range	Description
F7-01	MF.K key function selection	0	0: MF.K key disabled 1: Forcibly change to operating panel control 2: Switchover between forward run and reverse run 3: Forward jog 4: Reverse jog	The MF.K key is a multi-functional key. This parameter is used to set the function of the MF.K key. 0: MF.K key disabled The MF.K key is invalid. 1: Forcibly change to operating panel control If F0-02 is set to 0 (operating panel), pressing the MF.K key produces no effect. If F0-02 is set to 1 (terminal), pressing the MF.K key can implement switchover between terminal control and operating panel control. If F0-02 is set to 2 (communication), pressing the MF.K key can implement switchover between communication control and operating panel control. 2: Switchover between forward run and reverse run You can change the direction of the frequency reference by using the MF.K key. This function is valid only when the command source is set to the operating panel. 3: Forward jog Pressing the MF.K key implements forward jogging (FJOG). This function is valid only when the command source is set to the operating panel. 4: Reverse jog Pressing the MF.K key implements reverse jog (RJOG). This function is valid only when the command source is set to the operating panel.

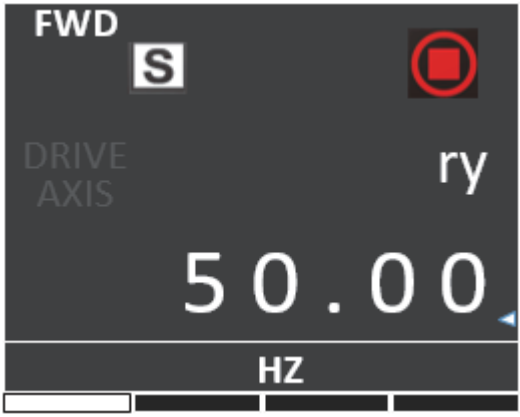
1.8 Driving the Motor with the Operating Panel

You can press 

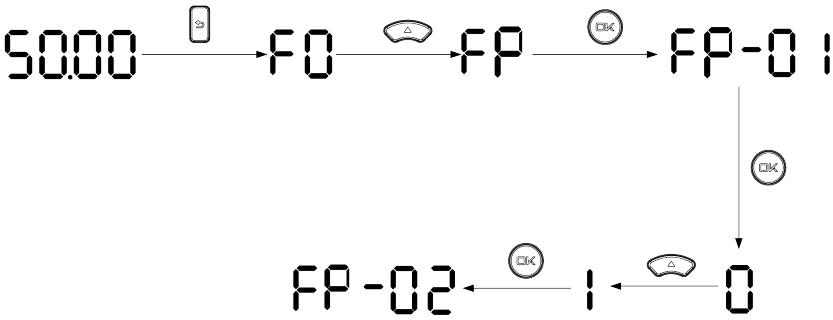
on the operating panel to enable the motor to jog forwardly or reversely, and press  or  to start or stop the motor.

Procedure

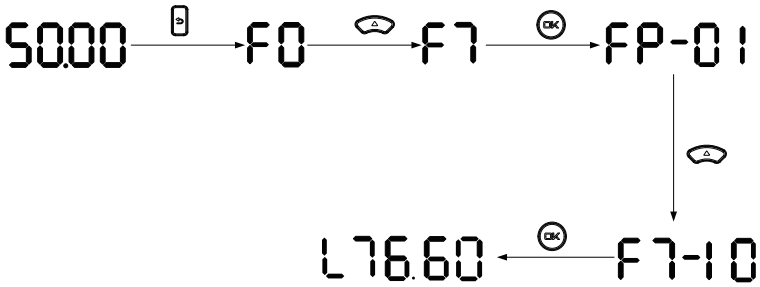
1. Perform check before power-on.
   Check the installation and wiring according to the installation guide. For detailed inspection, see the description of check operations before power-on in the *MD520 Series General-Purpose AC Drive Installation Guide*.
2. Press the power switch to power on the AC drive.
3. Check that "ry" is displayed in the secondary display area, and "50.00" is displayed on the operating panel, which indicates successful power-on.



4. Set FP-01 to 001 and restore all parameters to default values. The operation example is shown in the following figure.



5. Check the value of F7-10, which indicates the software version.



6. Set motor parameters in group F1 according to the motor nameplate.

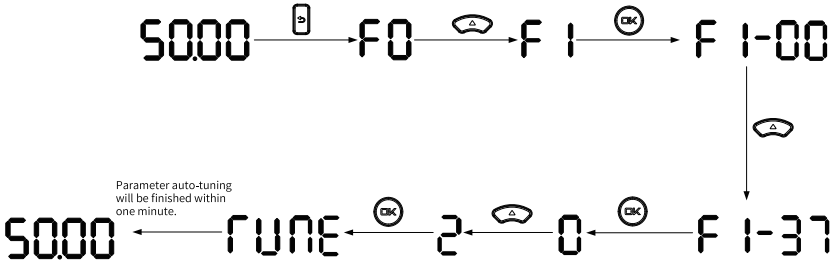
Table 1–8 Motor parameters

Parameter Code	Parameter Name	Default	Value Range	Description	Value
F1-00	Motor type	0	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Permanent magnet synchronous motor 3: Reluctance motor without permanent magnet 4: Electromagnetic coil	This parameter is used to set the motor type. 0: Common asynchronous motor A common asynchronous motor is suitable for applications with normal voltage but often full load. It is designed based on constant frequency and constant voltage. Therefore, it may not meet all the frequency and speed control requirements. 1: Variable frequency asynchronous motor A variable frequency motor can adjust its frequency and speed according to the load. When the voltage is low, the variable frequency motor can reduce the frequency for a reliable start. When the load is light, it can reduce the frequency, speed, and current to save electric energy. 2: Permanent magnet synchronous motor A permanent magnet synchronous motor provides excitation with a permanent magnet. It features simple structure, small size, high efficiency, and high power factor. 3: Reluctance motor without permanent magnet The reluctance motor is a synchronous motor without permanent magnet, whose torque output is totally from the magnetic reluctance torque generated from q-axis and d-axis inductance difference. 4: Electromagnetic coil The electromagnetic coil is generally an inductive coil used for applications such as electromagnetic suction force and heating.	0

Parameter Code	Parameter Name	Default	Value Range	Description	Value
F1-01	Rated motor power	Model dependent	0.1 kW to 1000.0 kW	This parameter indicates the power of the motor during normal operation. The rated power of the motor is the rated voltage x rated current of the motor. 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.	3.7 kW
F1-02	Rated motor voltage	Model dependent	1 V to 2000 V	The rated motor voltage indicates the voltage of the motor during normal operation, which usually refers to the line voltage.	380 V
F1-03	Rated motor current	Model dependent	0.01 A to 655.35 A	The rated motor current indicates the current of the motor during normal operation, which usually refers to the line current. For models with the power of 55 kW and below, two decimal places are displayed, such as 0.01 A to 655.35 A. For models with the power above 55 kW, one decimal place is displayed, such as 0.1 A to 6553.5 A.	9.00 A
F1-04	Rated motor frequency	Model dependent	0.01 Hz to F0-10	The rated motor frequency indicates the frequency of the power supply connected to the stator winding under the rated operation conditions of the motor.	50.00 Hz
F1-05	Rated motor speed	Model dependent	1 rpm to 65535 rpm	The rated motor speed indicates the speed (in the unit of rpm) of the rotor under the rated operation conditions.	1460 rpm

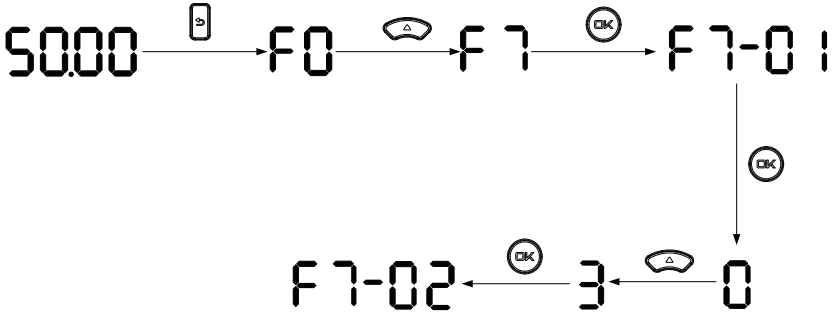
7. Select an auto-tuning mode by setting F1-37 and press ENTER. The operating panel

will display  . Press the Run key on the operating panel to start motor auto-tuning. During this process, the Run indicator is steady ON, the secondary display area displays "TUNE", and the AC drive energizes the motor. Later, the secondary display area displays "ry", and the primary display area displays "50.00", indicating that the auto-tuning is completed.



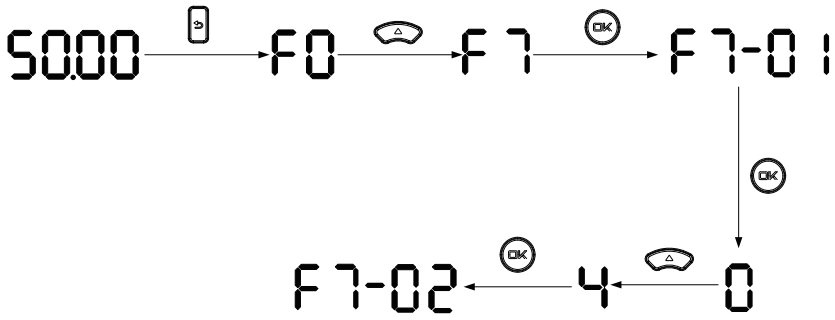
8. Set F7-01 to 3, and then press 

to enable the motor to jog forwardly.



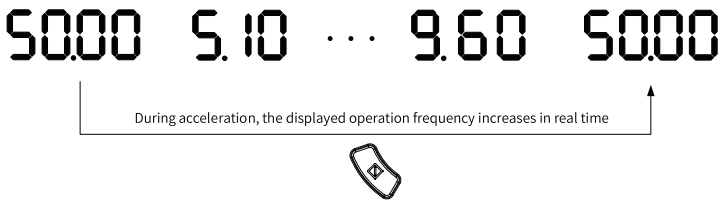
9. Set F7-01 to 4, and then press 

to enable the motor to jog reversely.



10. Press  to start the motor. The motor shaft starts to rotate and accelerate, and the operating panel displays the current running frequency, as shown in the following figure. After acceleration is completed, the displayed frequency is 50.00.

Press  to switch the displayed status parameter.



11. Press  . The motor will decelerate to stop.

2 Commissioning and Trial Run

2.1 Commissioning Flowchart

2.1.1 Basic Commissioning Flowchart

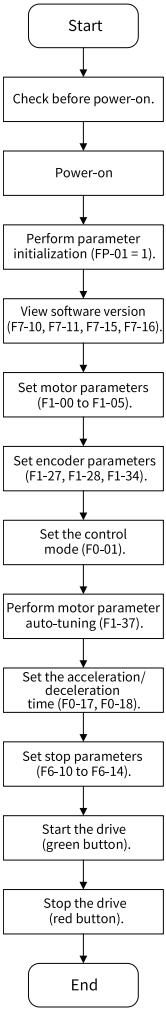


Figure 2-1 Basic commissioning flowchart

Table 2–1 Basic commissioning flowchart

No.	Step	Related Parameter
1	Check before power-on	/
2	Power-on	/
3	Parameter initialization	FP-01
4	View the software version.	F7-10, F7-11, F7-15, F7-16
5	Set motor parameters.	F1-00 to F1-05 Note that you must set the motor type.
6	Set encoder parameters.	F1-27, F1-28, F1-34
7	Set the control mode.	F0-01
8	Perform motor parameter auto-tuning.	F1-37
9	Set the command source.	F0-02
10	Select the frequency source.	F0-03
11	Set the acceleration and deceleration time.	F0-17, F0-18
12	Set the stop parameters.	F6-10 to F6-14
13	Start	/
14	Stop	/

2.1.2 Commissioning Flowchart in V/f Control Mode

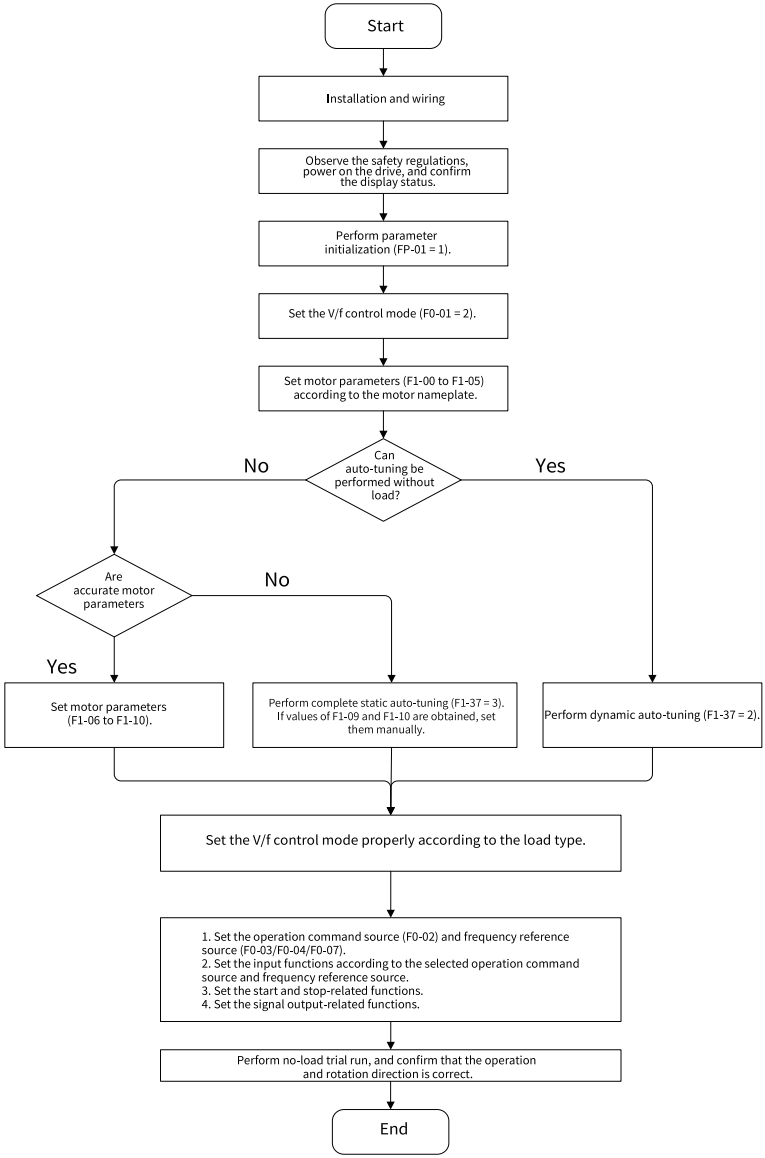


Figure 2-2 Commissioning flowchart in V/f control mode

Note

In the static auto-tuning mode, some parameters are not tuned. For details, see *Asynchronous Motor Parameter Auto-tuning* and *Synchronous Motor Parameter Auto-tuning* sections.

2.1.3 Commissioning Flowchart in SVC Mode

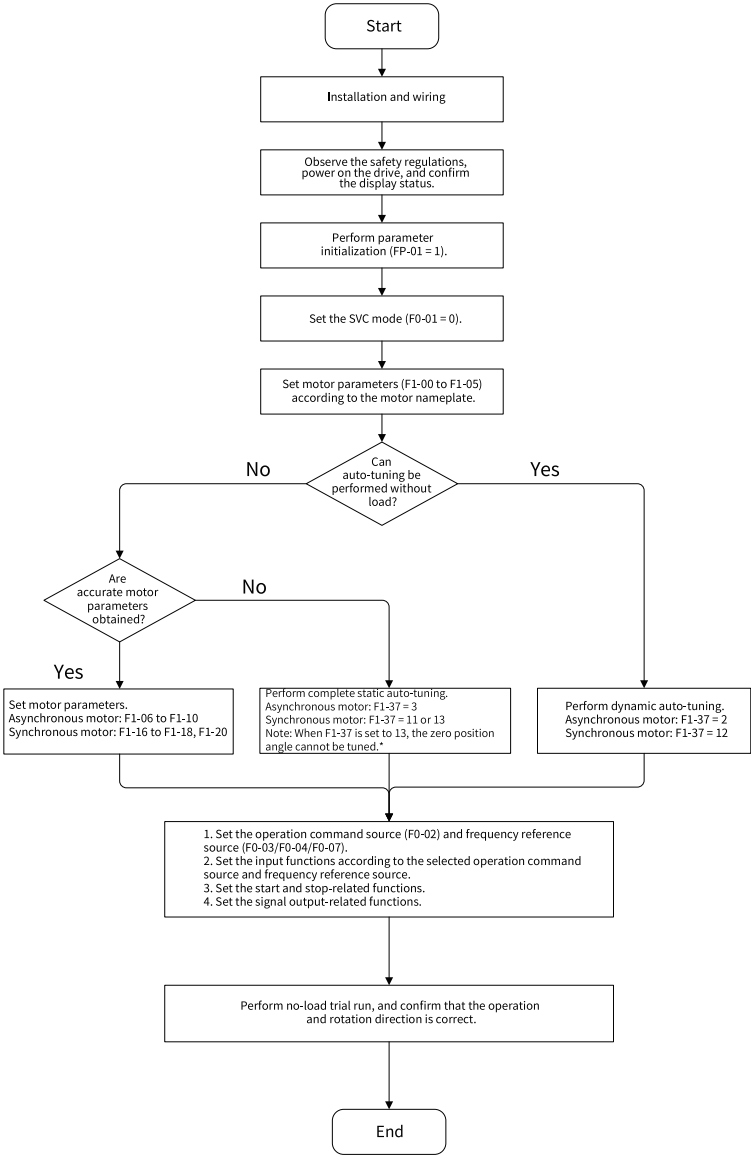


Figure 2-3 Commissioning flowchart in SVC mode

Note

* If bit 0 of A9-09 is enabled and F1-37 is set to 11, the encoder zero position angle will be tuned, but the encoder rotation direction will be not tuned. If F1-37 is set to 13, the encoder will not be tuned. If bit 0 of A9-09 is enabled and F1-37 is set to 11 or 13, the encoder will not be tuned.

During static auto-tuning, the motor will rotate slowly to a certain position when the encoder zero position angle is tuned.

In the static auto-tuning mode, some parameters are not tuned. For details, see *Asynchronous Motor Parameter Auto-tuning* and *Synchronous Motor Parameter Auto-tuning* sections.

2.1.4 Commissioning Flowchart in FVC Mode

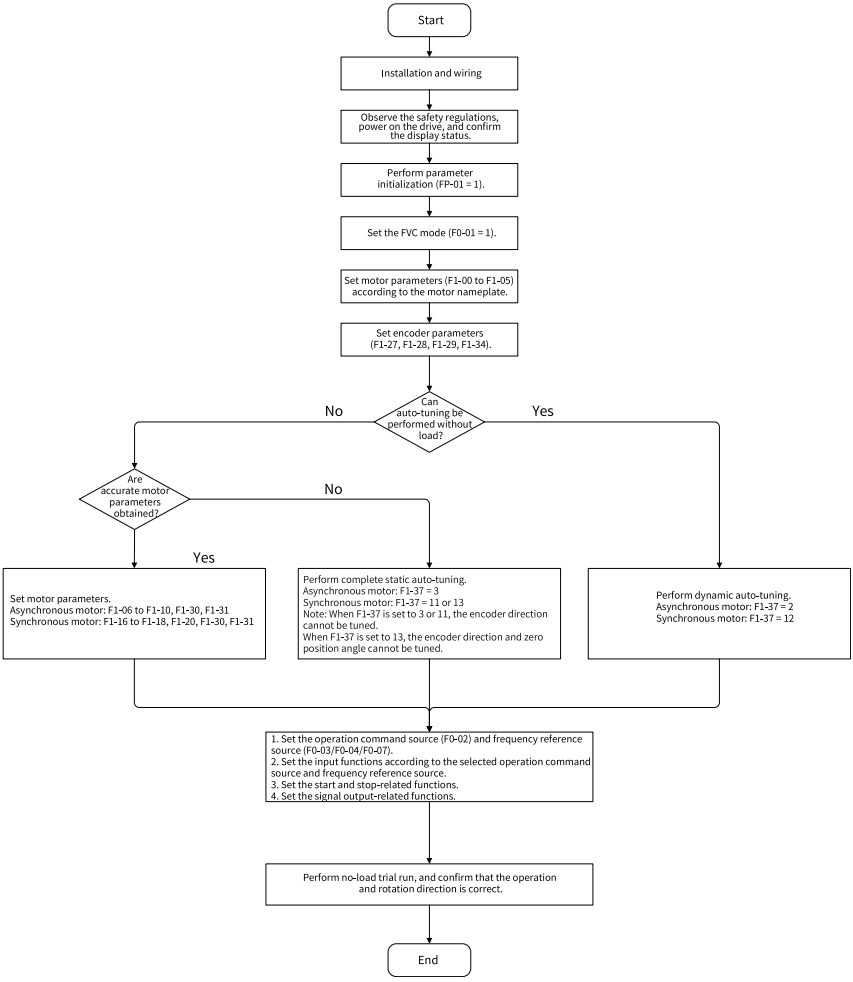


Figure 2-4 Commissioning flowchart in FVC mode

Note

Note:

1. During static auto-tuning, the motor will rotate slowly to a certain position when the encoder zero position angle is tuned.
2. Before static auto-tuning is performed (F1-37 = 11) to tune the zero position angle, check the encoder running direction (F1-30) and set it correctly. At the same time, the motor will rotate slightly static auto-tuning 11 rotates the motor slightly when the encoder zero position angle is tuned.

Encoder direction: The incorrect encoder direction can affect the precise control of the motor by the AC drive. For example, an incorrect direction may cause motor stall. The AC drive will report overload, overcurrent, overheat, and excessive speed deviation faults, which affects the safety and reliability of the system.

Zero position angle: The zero position angle of the motor indicates the position angle of the motor when the magnetic pole is aligned between the stator and the rotor. The following faults will occur when the zero position angle is incorrect:

1. **Positioning error:**An error will occur between the actual position of the motor and the set position. In this case, the position control system cannot locate the position accurately, affecting the operating accuracy of the equipment.
2. **Unstable motion:**Inaccurate zero point angle will cause unsuitability or vibration when the motor executes motion commands, affecting the stability and reliability of the system.
3. **Path deviation:**In applications requiring precise path control (such as manipulators and CNC machines), inaccurate zero position angle may cause path deviation, affecting the quality of processing or operation.
4. **Invalid system protection:**Some systems may rely on the zero position angle to set the safety boundary or limit position. If the zero position angle is not accurate, the system protection mechanism may fail, increasing the risk of mechanical collision or damage.

In the static auto-tuning mode, some parameters are not tuned. For details, see *Asynchronous Motor Parameter Auto-tuning* and *Synchronous Motor Parameter Auto-tuning* sections.

2.2 Commissioning Procedure

2.2.1 Check Before Power-on

Check the following items before power-on.

Table 2–2 Checklist before power-on

Item	Description
Main circuit wiring	Confirm that the power supply voltage is correct. • Three-phase 380 VAC: 3PH 380 VAC to 480 VAC, 50 Hz/60 Hz • Three-phase 220 V: 3PH 200 VAC to 240 VAC, 50 Hz/60 Hz • Single-phase 220 V: 1PH 200 VAC to 240 VAC, 50 Hz/60 Hz
	The power supply input terminals and the AC drive input terminals (R/S/T) are connected properly.
	The motor input terminals and the AC drive output terminals (U/V/W) are connected properly.
	The AC drive and motor are properly grounded.
	The cross sectional area of the main circuit cables meet the requirements.
	Heat-shrinkable tubes are applied to copper tubes of the main circuit cable and conductors, and heat-shrinkable tubes are completely cover the conductors.
	The motor output cable does not exceed 50 m. Otherwise, the carrier frequency needs to be reduced through F0-15.
Control circuit wiring	The control circuit terminals are reliably connected to other control devices.
	The control circuit cables are shielded twisted pairs cables.
	Optional cards are connected correctly.
	Control circuit cables and main circuit power cables are routed separately.
	The control circuit terminals of the AC drive are all in the OFF state (the AC drive is not running).
Load	The motor is in the no-load state and is not connected to any mechanical system.
Braking resistor	The braking resistor and braking unit (if have) with proper resistance are wired properly.

2.2.2 Power-On

Close the power supply switch and check the display on the operating panel of the AC drive. If the operating panel displays 50.00, the AC drive is powered on.

Figure 2-5 Display on the operating panel upon power-on

2.2.3 Parameter Initialization

Parameter Code	Parameter Name	Default	Value Range	Description
FP-01	Parameter initialization	0	0: No action 1: Restore parameters (excluding motor parameters) to factory settings 2: Clear records 4: Back up current user parameters 501: Restore user parameters from backup 503: Restore parameters (including motor parameters) to factory settings	This parameter is used to select the parameter initialization mode. 0: The AC drive does not perform any operation. 1: Most of the AC drive parameters are restored to factory settings. However, motor parameters, frequency reference decimal (F0-22), maximum frequency (F0-10), frequency upper limit (F0-12), fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), cumulative power consumption (F7-14), and drive unit heatsink temperature (F7-07) are not restored. 2: The fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), and cumulative power consumption (F7-14) are cleared. 4: The current parameter settings are backed up. 501: Parameters backed up by setting FP-01 to 4 are restored. 503: All AC drive parameters except FP-00, FP-01, and the parameters in group FF are restored to factory settings.

2.2.4 Software Version Check

Parameter Code	Parameter Name	Value Range	Description
F7-10	Performance software version	0.00 to 655.35	This parameter indicates the performance software version of the AC drive.
F7-11	Function software version	0.00 to 655.35	This parameter indicates the function software version of the AC drive.
F7-15	Temporary performance software version	0.00 to 655.35	This parameter indicates the temporary performance software version of the AC drive.
F7-16	Temporary function software version	0.00 to 655.35	This parameter indicates the temporary function software version of the AC drive.

2.2.5 Motor Parameter Settings

Parameter Code	Parameter Name	Value Range	Description
F1-00	Motor type	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Permanent magnet synchronous motor 3: Reluctance motor without permanent magnet 4: Electromagnetic coil	This parameter is used to set the motor type. 0: Common asynchronous motor A common asynchronous motor is suitable for applications with normal voltage but often full load. It is designed based on constant frequency and constant voltage. Therefore, it may not meet all the frequency and speed control requirements. 1: Variable frequency asynchronous motor A variable frequency motor can adjust its frequency and speed according to the load. When the voltage is low, the variable frequency motor can reduce the frequency for a reliable start. When the load is light, it can reduce the frequency, speed, and current to save electric energy. 2: Permanent magnet synchronous motor A permanent magnet synchronous motor provides excitation with a permanent magnet. It features simple structure, small size, high efficiency, and high power factor. 3: Reluctance motor without permanent magnet The reluctance motor is a synchronous motor without permanent magnet, whose torque output is totally from the magnetic reluctance torque generated from q-axis and d-axis inductance difference. 4: Electromagnetic coil The electromagnetic coil is generally an inductive coil used for applications such as electromagnetic suction force and heating.
F1-01	Rated motor power	0.1 kW to 1000.0 kW	This parameter indicates the power of the motor during normal operation. The rated power of the motor is the rated voltage x rated current of the motor. 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.
F1-02	Rated motor voltage	1 V to 2000 V	The rated motor voltage indicates the voltage of the motor during normal operation, which usually refers to the line voltage.
F1-03	Rated motor current	0.01 A to 655.35 A (AC drive power ≤ 55 kW) 0.1 A to 6553.5 A (AC drive power > 55 kW)	The rated motor current indicates the current of the motor during normal operation, which usually refers to the line current.
F1-04	Rated motor frequency	0.01 Hz to F0-10	The rated motor frequency indicates the frequency of the power supply connected to the stator winding under the rated operation conditions of the motor.
F1-05	Rated motor speed	1 rpm to 65535 rpm	The rated motor speed indicates the speed (in the unit of rpm) of the rotor under the rated operation conditions.

Parameter Code	Parameter Name	Value Range	Description
F1-06	Asynchronous motor stator resistance	0.001 Ω to 65.535 Ω	This parameter indicates the DC resistance of stator winding of the asynchronous motor. This parameter can be obtained through motor auto-tuning.
F1-07	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	The motor rotor resistance is the DC resistance of the motor rotor winding, which can be obtained through motor static or dynamic auto-tuning.
F1-08	Leakage inductance of asynchronous motor	0.01 mH to 655.35 mH	The leakage inductance of the asynchronous motor is caused by the leakage flux of motor winding. This parameter can be obtained through motor auto-tuning.
F1-09	Mutual inductance of asynchronous motor	0.1 mH to 6553.5 mH	When the current in one coil of the motor changes, induced EMF is generated in the coil adjacent to it. This mutually induced EMF can be expressed by mutual inductance. The mutual inductance of a motor can be roughly divided into two types. One is the inter-phase inductance of the stator or rotor, which is the reactance between two phases of the stator or rotor. The other is the inductance between the stator and the rotor. The inductance of the first type does not change with the rotation of the rotor, whereas the inductance of the second type changes accordingly with the rotation of the rotor. Both types are motor mutual inductance, which can be obtained by dynamic motor auto-tuning.
F1-10	No-load current of asynchronous motor	0.01 A to F1-03	This parameter indicates the current that passes through the three-phase winding of the stator during no-load operation of the asynchronous motor. The parameter can be obtained by dynamic motor auto-tuning.
F1-17	D axis inductance of synchronous motor	0.01 mH to 655.35 mH	This parameter defines the inductance of the main magnetic pole axis (longitudinal axis) of the synchronous motor. Note: When the power is lower than or equal to 55 kW, the value has two decimal places. When the power is larger than 55 kW, the value has three decimal places.
F1-18	Q axis inductance of synchronous motor	0.01 mH to 655.35 mH	This parameter defines the inductance of the center line (quadrature axis) between the adjacent magnetic pole axes of the synchronous motor rotor.
F1-20	Back EMF of synchronous motor	0.0 V to 6553.5 V	This parameter indicates the valid value of the motor back EMF at the rated motor frequency defined by F1-04.
F1-27	Encoder PPR	1 to 65535	This parameter sets the number of ABZ encoder PPR (total AB pulses per revolution/4), or number of waves per revolution of the sin-cos encoder. In the FVC mode, the encoder PPR must be set properly. Otherwise, the motor cannot run normally. Note: The encoder PPR does not need to be set for the 23-bit encoder.

Parameter Code	Parameter Name	Value Range	Description
F1-28	Encoder type	0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver 3: External input 4: Sin-cos encoder	After the PG card is installed, you need to set this parameter properly according to the onsite encoder type to ensure normal running of the AC drive. 0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver 3: External input 4: Sin-cos encoder
F1-29	Speed feedback PG card	0: Main PG card 1: Auxiliary PG card	This parameter is used to select the speed measuring angle source. 0: Main PG card The main PG card is used to measure the speed. 1: Auxiliary PG card The auxiliary PG card is used to measure the speed. The main PG card and the auxiliary PG card are installed in the J4 and J13 slots of the control board, respectively. It is recommended to set use the main PG card as the speed feedback source for motor control. The auxiliary PG card can be used to obtain the processing control position/speed.
F1-30	A/B phase sequence of encoder	0: Forward 1: Reverse	In some applications, the direction of the measured encoder speed is opposite to the actual setting. You can change the encoder speed measurement phase sequence through this parameter.
F1-31	Encoder installation angle	0.0° to 359.9°	This parameter indicates the angle between motor zero and encoder zero used by the synchronous motor, which can be obtained through motor auto-tuning.
F1-33	Rated speed of high-speed motor	0 rpm to 65535 rpm (10 rpm)	When the rated speed of the high-speed motor is higher than 60000 rpm, and the value of this parameter is larger than or equal to 6000 (corresponding to 60000 rpm), the parameter value applies; Otherwise, the value of F1-05 applies. The unit is 10 rpm.

2.2.6 Motor Parameter Auto-tuning

Enter motor parameters (F1-00 to F1-05) correctly according to its nameplate. Set F1-37 and press **ENTER**. The operating panel displays TUNE. Press **RUN**. The motor auto-tuning starts. When the operating panel displays the pre-set frequency set by F0-08, the auto-tuning is completed. After auto-tuning, parameters F1-06 to F1-10 are obtained and written.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-37	Motor parameter auto-tuning mode	0	0: Disable 1: Static partial auto-tuning for asynchronous motor 2: Dynamic auto-tuning for asynchronous motor 3: Static complete auto-tuning for asynchronous motor 4: Inertia auto-tuning (To be continued)	For high-performance motor operation, accurate motor parameters are required. Select different motor auto-tuning modes based on the motor type to obtain motor parameters. 0: Disable Parameters are not tuned. 1: Static partial auto-tuning for asynchronous motor This mode is applicable to scenarios where the motor cannot be disconnected from loads and dynamic auto-tuning is not feasible. In this mode, some motor parameters are auto-tuned, including F1-06 (Asynchronous motor stator resistance), F1-07 (Asynchronous motor rotor resistance), and F1-08 (Asynchronous motor leakage inductance). Other parameters use the default values. 2: Dynamic auto-tuning for asynchronous motor This mode is applicable to scenarios requiring high-speed operation. Dynamic auto-tuning can be performed without load or with pure inertia load. Auto-tuning is performed on all the motor parameters, including F1-06 (Asynchronous motor stator resistance), F1-07 (Asynchronous motor rotor resistance), F1-08 (Asynchronous motor leakage inductance), F1-09 (Asynchronous motor mutual inductance), F1-10 (Asynchronous motor no-load current), F1-30 (Encoder phase sequence), motor inertia ratio (A9-17), and friction torque (A9-18). 3: Static complete auto-tuning for asynchronous motor This mode is applicable to scenarios where the motor cannot be disconnected from loads and dynamic complete auto-tuning is not feasible. Auto-tuning is performed on some motor parameters, including F1-06 (Asynchronous motor stator resistance), F1-07 (Asynchronous motor rotor resistance), F1-08 (Asynchronous motor leakage inductance), F1-09 (Asynchronous motor mutual inductance), and F1-10 (Asynchronous motor no-load current). However, F1-09 and F1-10 have higher precision in the dynamic auto-tuning mode than in this mode. 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. After auto-tuning is done, A9-17 (Inertia ratio), A9-18 (Friction torque), and A9-16 (Motor time constant) are updated. 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. The auto-tuned value is saved in BF-22, and BF-23 to BF-38. (To be continued)

Parameter Code	Parameter Name	Default	Value Range	Description
F1-37	Motor parameter auto-tuning mode	0	Continued 5: Dead zone auto-tuning 11: With-load auto-tuning (excluding back EMF) for synchronous motor 12: No-load auto-tuning for synchronous motor (To be continued)	Continued 11: With-load auto-tuning (excluding back EMF) for synchronous motor This mode is applicable to scenarios where the motor cannot be disconnected from the load. The motor may rotate for several revolutions slowly during auto-tuning. Auto-tuned motor parameters include F1-06 (Motor stator resistance), F1-17 (D-axis inductance of synchronous motor), F1-18 (Q-axis inductance of synchronous motor), and F1-31 (Encoder mounting angle) in the FVC mode. F1-30 (Encoder direction) in the FVC mode is not tuned. Note: Before setting the drive to the FVC mode, change the drive to the SVC mode and check that the encoder direction is correct. Then switch the drive to the FVC mode. 12: No-load dynamic complete auto-tuning for synchronous motor This mode is applicable to scenarios where the motor can be disconnected from the load. Auto-tuned motor parameters in the FVC mode include F1-06 (Motor stator resistance), F1-17 (D-axis inductance of synchronous motor), F1-18 (Q-axis inductance of synchronous motor), F1-19 (Synchronous motor back EMF), F1-30 (Encoder phase sequence), and F1-31 (Encoder mounting angle). F1-30 and F1-31 are not tuned in other control modes. (To be continued)
F1-37	Motor parameter auto-tuning mode	0	Continued 13: With-load rotation auto-tuning (excluding zero point angle) for synchronous motor 14: UV gain inter-phase deviation auto-tuning 15: No-load auto-tuning	Continued 13: With-load rotation auto-tuning (excluding zero point angle) for synchronous motor This mode is applicable to scenarios where the motor cannot be disconnected from the load and dynamic complete auto-tuning is not feasible. The motor does not rotate during auto-tuning. Auto-tuned motor parameters include F1-06 (Motor stator resistance), F1-17 (Synchronous motor d-axis inductance), and F1-18 (Synchronous motor q-axis inductance). Encoder parameters are not tuned. Note: Before setting the drive to the FVC mode, change the drive to the SVC mode and check that the encoder direction is correct. Then switch the drive to the FVC mode. 14: UV gain inter-phase deviation auto-tuning The current sampling gain deviation between output phases is tuned. The tuned result is updated in FF-05 (Current sampling gain error between U-phase current and V-phase current) and FF-06 (Current sampling gain error between U-phase current and W-phase current). 15: No-load auto-tuning Based on the tuned results, prepare a table to control the maximum torque-to-current ratio of synchronous reluctance motors.

2.2.7 Command Source Settings

Set F0-02 to select a command source, The command source is the source or input mode of commands to control the startup, stop, forward running, reverse running, and jogging of the AC drive.

Parameter Code	Parameter Name	Default	Value Range	Description
F0-02	Operation command source selection	0	0: Operating panel 1: Terminal 2: Communication 3: User-defined mode	This parameter is used to select the input channel of the AC drive control commands, such as run, stop, forward run, reverse run, and jog operation. 0: Operating panel Operation commands are input using the keys on the operating panel. This mode is suitable for initial commissioning. 1: Terminal Operation commands are input using the DI of the AC drive. The DI can be assigned with different functions such as start/stop, forward/ reverse run, jog, two-wire/three-wire mode, and multi-reference. This mode is suitable for most applications. 2: Communication Operation commands are 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. 3: User-defined mode The command source is defined by the user as needed for expansion.

2.2.8 Frequency Source Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F0-03	Main frequency source X selection	0	0: Digital setting (non-retentive upon power failure) 1: Digital setting (retentive upon power failure) 2: AI1 3: AI2 4: AI3 5: Pulse reference (DI5) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication Others: F connector	This parameter is used to set the source of the main frequency source X as below. 0: Digital setting (non-retentive upon power failure) The initial value of the frequency reference is the value of F0-08 (Preset frequency). The frequency can be changed by using the ▲ and ▼ keys on the operating panel or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered on again after a power failure, the frequency reference is restored to the value of F0-08. 1: Digital setting (retentive upon power failure) The initial value of the frequency reference is the value of F0-08 (Preset frequency). The frequency can be changed by using the ▲ and ▼ keys on the operating panel or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered on again after a power failure, the frequency reference is the same as that at the moment of the last power failure. Modifications made by using keys ▲ and ▼ keys on the operating panel or the multi-functional input terminal functioning as the UP and DOWN key remain effective. 2: AI1 The frequency reference is input through AI1, which inputs voltage signals. The frequency is calculated according to the AI curve, which is set by parameters in group F4. 3: AI2 The frequency reference is input through AI2, which inputs current or voltage signals. The frequency is calculated according to the AI curve, which is set by parameters in group F4. 4: AI3 The frequency reference is input through AI3, which inputs voltage signals. The frequency is calculated according to the AI curve, which is set by parameters in group F4. 5: Pulse reference (DI5) The frequency reference is set by using the pulse frequency input through DI5. The frequency is calculated (F4-28 to F4-31) according to the relationship curve between the pulse frequency and the frequency reference. 6: Multi-reference When the parameter is set to 6, combinations of different DI states correspond to different frequency references. The four multi-reference terminals (assigned with functions 12 to 15) can provide 16 states, corresponding to 16 frequencies (set by FC-00 to FC-15). To be continued

Parameter Code	Parameter Name	Default	Value Range	Description
Continued	Continued	Continued	Continued	Continued 7: Simple PLC Simple PLC is a multi-reference used to control the running time and acceleration/deceleration time. Parameters FC-00 to FC-15 are used to set the values of each frequency. FC-18 to FC-49 are used to set the running time and acceleration and deceleration time of each frequency. Up to 16 frequencies can be set. 8: PID PID is selected as the frequency source. 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. PID control is generally used in closed-loop control scenarios, such as constant pressure closed-loop control and constant tension closed-loop control. Set PID-related parameters in group FA. 9: Communication The frequency is set through communication. This mode is applicable to applications requiring remote control or centralized control of multiple devices. In this mode, you can input the frequency through remote communication (address 0x7310). In this case, the AC drive must be installed with a communication card for communicating with the host controller. Others: F connector This parameter is set to the number of a floating connector. In this case, the value of the connector is read as an auxiliary frequency reference. This mode is used for expansion besides the common sources.

2.2.9 Control Mode Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F0-01	Motor 1 control mode	2	0: SVC 1: FVC 2: V/f	This parameter is used to set the motor control mode based on the application scenario and motor type. 0: Sensorless vector control (SVC) 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 SVC mode. The effect of the vector control mode is dependent on accurately tuned motor parameters. 1: Feedback vector control (FVC) It is a closed-loop vector control mode. The motor must be configured with an encoder and the AC drive must be installed with a PG card matching the encoder type. This mode is applicable to high-accuracy speed control or torque control applications, where one AC drive can drive only one motor. It is used for loads such as high-speed papermaking machinery, hoisting machinery, and elevators. 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 control (speed open loop control) This mode is applicable to scenarios without high requirements on load control performance, such as fans and pumps. The V/f control mode is the only choice if one AC drive needs to drive multiple motors. Motor parameters must be set accurately in this mode. If one AC drive needs to drive multiple motors, the total current and total power must be determined.

2.2.10(Optional) V/f Parameter Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F3-00	V/f curve setting	0	0: Linear V/f curve 1: Multi-point V/f curve 2-9: Reserved 10: V/f complete separation mode 11: V/f semi-separation mode	0: Linear V/f curve The output voltage changes linearly with the output frequency when the frequency is lower than the rated frequency. This curve applies to general mechanical transmission applications such as acceleration of high-inertia fans, punch presses, centrifuges, and water pumps. 1: Multi-point V/f curve The frequency ranges from 0.00 Hz to the rated motor frequency. The range of the voltage point is 0.0% to 100.0%, which corresponds to 0 V to the rated motor voltage. Set the multi-point V/f curve based on load characteristics of the motor. Observe this formula during settings: F3-03 ⩽ F3-05 ⩽ F3-07 10: V/f complete separation mode The output frequency and output voltage of the drive are independent of each other. The output frequency is determined by the frequency source, and the output voltage is determined by the V/f separation voltage source. This curve applies to torque motor control applications. 11: V/f semi-separation mode In this mode, the voltage and frequency are proportional, which can be set through the voltage source. The relationship between the voltage and frequency is also related to the rated voltage and rated frequency of the first group of the motor. The relationship between the output voltage of the drive (V) and frequency (f) is as follows: V/f = 2 x (Voltage source input) x (Rated motor voltage)/(Rated motor frequency). Note: The input value of the voltage source is 0 to 100%.

2.2.11(Optional) SVC Parameter Settings

Parameter Code	Parameter Name	Value Range	Default	Description
F2-00	Speed loop proportional gain 1	1 to 300	Asynchronous motor: 30 Synchronous motor: 20	This parameter sets the low-speed speed loop gain Kp. This is the PID control parameter Kp for the speed loop, which affects the response to the motor speed. A larger Kp value indicates higher adjustment sensitivity and adjustment intensity. A smaller Kp value indicates lower adjustment sensitivity and adjustment intensity. The low-speed speed loop Kp is used at the low speed.
F2-01	Speed loop integral time 1	0.01s-10.00s	0.50s	This parameter sets the low-speed speed loop integral time Ti. The reciprocal of the speed loop integral time constant is the integral gain. The speed loop integral time constant affects the steady-state speed error of the motor and the stability of the speed loop system. If the speed loop integral time constant increases, the speed loop response slows down. At this time, the proportional gain of the speed loop needs to be increased to shorten the speed loop response time. The low-speed speed loop Ti is used at the low speed.
F2-02	Switchover frequency 1	0.00 Hz to F2-05	5.00 Hz	The speed loop PI parameters are divided into low-speed and high-speed groups. If the running frequency is lower than F2-02 (Switchover frequency 1), the speed loop PI adjustment parameters are F2-00 and F2-01. If the running frequency is higher than F2-05 (Switchover frequency 2), the speed loop PI adjustment parameters are F2-03 and F3-04. If the running frequency falls between switchover frequency 1 and switchover frequency 2, speed loop PI adjustment parameters are switched between F2-00/F2-01 and F2-03/F2-04 linearly. The parameter value must be lower than F2-05 (Switchover frequency 2).
F2-03	Speed loop proportional gain 2	1 to 300	20	This parameter sets the high-speed speed loop gain Kp. This is the PID control parameter Kp for the speed loop, which affects the response to the motor speed. A larger Kp value indicates higher adjustment sensitivity and adjustment intensity. A smaller Kp value indicates lower adjustment sensitivity and adjustment intensity. The high-speed speed loop Kp is used at the high speed.
F2-04	Speed loop integral time 2	0.01s-10.00s	1.00s	This parameter sets the high-speed speed loop integral time Ti. The reciprocal of the speed loop integral time constant is the integral gain. The speed loop integral time constant affects the steady-state speed error of the motor and the stability of the speed loop system. If the speed loop integral time constant increases, the speed loop response slows down. At this time, the proportional gain of the speed loop needs to be increased to shorten the speed loop response time. The high-speed speed loop Ti is used at the high speed.

Parameter Code	Parameter Name	Value Range	Default	Description
F2-05	Switchover frequency 2	F2-02 to F0-10	10.00 Hz	The speed loop PI parameters are divided into low-speed and high-speed groups. If the running frequency is lower than F2-02 (Switchover frequency 1), the speed loop PI adjustment parameters are F2-00 and F2-01. If the running frequency is higher than F2-05 (Switchover frequency 2), the speed loop PI adjustment parameters are F2-03 and F3-04. If the running frequency falls between switchover frequency 1 and switchover frequency 2, speed loop PI adjustment parameters are switched between F2-00/F2-01 and F2-03/F2-04 linearly. This parameter must be set to a value higher than F2-02 (Switchover frequency 1).
F2-06	Vector control slip gain	50% to 200%	100%	In the SVC mode, this parameter is used to adjust the speed stability accuracy of the motor. For example, when the running frequency of the motor is lower than the output frequency of the AC drive, you can increase the value of this parameter. In the FVC mode, this parameter is used to adjust the output current of the AC drive with the same load. For example, if the load capacity of a high-power AC drive is weak, decrease the value of this parameter gradually. No adjustment is required under normal circumstances.

2.2.12(Optional) FVC Parameter Settings

Parameter Code	Parameter Name	Value Range	Default	Description
F1-27	Encoder PPR	1 to 65535	1024	This parameter sets the number of ABZ encoder PPR (total AB pulses per revolution/4), or number of waves per revolution of the sin-cos encoder. In the FVC mode, the encoder PPR mus be set properly. Otherwise, the motor cannot run normally. Note: The encoder PPR does not need to be set for the 23-bit encoder.
F1-28	Encoder type	0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver 3: External input 4: Sin-cos encoder	0	After the PG card is installed, you need to set this parameter properly according to the onsite encoder type to ensure normal running of the AC drive. 0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver 3: External input 4: Sin-cos encoder

Parameter Code	Parameter Name	Value Range	Default	Description
F1-34	Number of resolver pole pairs	1 to 65535	1	This parameter indicates the number of pole pairs of the resolver. The higher the number of pole pairs, the higher the precision. A resolver is an electromagnetic transducer, also known as a synchronous resolver. It is a small AC motor used to measure angles, and measure shaft angular displacement and angular velocity of a rotating object. It consists of stators and rotors. If a resolver is applied, set the number of pole pairs of the resolver properly. The number of resolver pole pairs must be less than or equal to the number of motor pole pairs, and the number of motor pole pairs divided by the number of resolver pole pairs must be an integer.
F2-00	Speed loop proportional gain 1	1 to 300	30: Asynchronous motor 20: Synchronous motor	This parameter sets the low-speed speed loop gain Kp. The value of speed loop Kp affects the response speed of the motor speed. A larger Kp value indicates higher adjustment sensitivity and adjustment intensity. A smaller Kp value indicates lower adjustment sensitivity and adjustment intensity. The low-speed speed loop Kp is used at the low speed.
F2-01	Speed loop integral time 1	0.01s to 10.00s	0.50s	This parameter sets the low-speed speed loop integral time Ti. The reciprocal of the speed loop integral time constant is the integral gain. The speed loop integral time constant affects the steady-state speed error of the motor and the stability of the speed loop system. Increasing the speed loop integral time constant slows down the response of the speed loop. In this case, increase the speed loop proportional gain to shorten the response time of the speed loop. The low-speed speed loop Ti is used at the low speed.
F2-02	Switchover frequency 1	0.00 Hz to F2-05	5.00 Hz	The speed loop PI parameters are divided into low-speed and high-speed groups. If the running frequency is lower than F2-02 (Switchover frequency 1), the speed loop PI adjustment parameters are F2-00 and F2-01. If the running frequency is higher than F2-05 (Switchover frequency 2), the speed loop PI adjustment parameters are F2-03 and F3-04. If the running frequency falls between switchover frequency 1 and switchover frequency 2, speed loop PI adjustment parameters are switched between F2-00/F2-01 and F2-03/F2-04 linearly. The parameter value must be lower than F2-05 (Switchover frequency 2).
F2-03	Speed loop proportional gain 2	1 to 300	20	This parameter sets the high-speed speed loop gain Kp. A larger Kp value indicates higher adjustment sensitivity and adjustment intensity. A smaller Kp value indicates lower adjustment sensitivity and adjustment intensity.

Parameter Code	Parameter Name	Value Range	Default	Description
F2-04	Speed loop integral time 2	0.01s to 10.00s	1.00s	This parameter sets the high-speed speed loop integral time Ti. The speed loop integral time constant affects the steady-state speed error of the motor and the stability of the speed loop system. Increasing the speed loop integral time constant slows down the response of the speed loop. In this case, increase the speed loop proportional gain to shorten the response time of the speed loop.
F2-05	Switchover frequency 2	F2-02 to F0-10	10.00 Hz	The speed loop PI parameters are divided into low-speed and high-speed groups. If the running frequency is lower than F2-02 (Switchover frequency 1), the speed loop PI adjustment parameters are F2-00 and F2-01. If the running frequency is higher than F2-05 (Switchover frequency 2), the speed loop PI adjustment parameters are F2-03 and F3-04. If the running frequency falls between switchover frequency 1 and switchover frequency 2, speed loop PI adjustment parameters are switched between F2-00/F2-01 and F2-03/F2-04 linearly. This parameter must be set to a value higher than F2-02 (Switchover frequency 1).
F2-06	Vector control slip gain	50% to 200%	100%	In the SVC mode, this parameter is used to adjust the speed stability accuracy of the motor. For example, when the running frequency of the motor is lower than the output frequency of the AC drive, you can increase the value of this parameter. In the FVC mode, this parameter is used to adjust the output current of the AC drive under the same load. For example, if the load capacity of a high-power AC drive is weak, decrease the value of this parameter gradually. No adjustment is required under normal circumstances.
F2-07	Speed loop feedback filter time in SVC mode	0.000s to 0.100s	0.015s	In the SVC mode (F0-01 = 0), the speed loop feedback filter time is effective. Adjusting the parameter can improve the motor stability. Increasing the value of this parameter enhances motor stability but slows down the dynamic response speed. Decreasing the value of this parameter speeds up dynamic response. Note that an excessively low value will lead to motor oscillation. The default value of this parameter applies to most of applications.

2.2.13Acceleration/Deceleration Time Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F0-17	Acceleration time 1	20.0s	0.0s to 6500.0s	This parameter indicates the time required for the output frequency to increase from 0 to the value of F0-25. The acceleration time is usually determined by the rising of frequency setting signal. When the motor accelerates, the rising rate of the frequency reference must be limited to prevent overcurrent. 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.
F0-18	Deceleration time 1	20.0s	0.0s to 6500.0s	This parameter indicates the time required for the output frequency to decrease from the value of F0-25 to 0. The deceleration time is usually determined by the falling of frequency setting signal. When the motor decelerates, the dropping rate of the frequency must be limited to prevent overvoltage. Deceleration time setting requirements: Avoid too large smoothing circuit voltage, so as not to cause the AC drive to trip due to overvoltage stall.
F0-25	Acceleration/ deceleration time base frequency	0	0: F0-10 (Maximum frequency) 1: Frequency reference 2: 100 Hz 3: Rated frequency	This parameter sets the acceleration/deceleration time base frequency. This parameter defines the target frequency during acceleration and the starting frequency during deceleration.

2.2.14(Optional) Startup Mode Settings

- Direct start: This mode is applicable to most load conditions. Startup with the startup frequency is applicable to load hoisting applications such as elevators and cranes.
- Flying start: This mode is applicable to scenarios where the motor is not static before AC drive startup, for example, restart of a large-inertia fan upon an instantaneous power failure. In some scenarios, the motor is rotating before the AC drive is started. This mode allows the AC drive to automatically follow the motor speed and direction to start smoothly without impacting the running motor. For example, when an instantaneous power failure of the grid occurs, the AC drive in the running state is powered off, but the motor is still running due to inertia. In this case, the AC drive must detect the actual speed of the motor to control the asynchronous motor again. Otherwise, overcurrent or overvoltage will occur on the AC drive during start, which may damage the power transistor of the AC drive.

- Vector pre-excitation start (AC asynchronous motor): This mode is applicable to scenarios with large static load resistance that requires large start torque. Pre-excitation start can increase the start torque. This mode is applicable to asynchronous motors only in the SVC and FVC modes. Before startup, the AC drive pre-excites the motor to speed up the motor response and reduce the startup current. This mode follows the same time sequence as startup after DC braking.
- SVC quick start: This mode is applicable to most load conditions. Startup with the startup frequency is applicable to load hoisting applications such as elevators and cranes.

Note

Note: Use flying start to start a motor that is rotating at a high speed. Pre-excitation start and SVC quick start are applicable only to AC asynchronous motors.

Parameter Code	Parameter Name	Default	Value Range	Description
F6-00	Start mode	0	0: Direct start 1: Flying start 2: Pre-excitation start (AC asynchronous motor) 3: SVC quick start	This parameter is used to set the start mode of the motor. Flying start is recommended if you need to start a motor that is rotating at a high speed. Pre-excitation start and SVC quick start apply only to AC asynchronous motors. 0: Direct start The direct start mode applies to most load conditions. 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. 2: Pre-excitation start (AC asynchronous motor) This mode is applicable to inductive AC asynchronous motors only in the SVC and FVC modes. Before startup, the AC drive pre-excites the motor to speed up the motor response and reduce the startup current. 3: SVC quick start This mode is applicable to asynchronous motors only in SVC mode, which can shorten acceleration time. It is used when system inertia is large and quick start is required. However, torque impact exists in this mode.

2.2.15(Optional) Startup Frequency Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F6-03	Startup frequency	0.00 Hz	0.00 Hz to 10.00 Hz	This parameter defines the startup frequency for direct start of the AC drive. When the startup frequency is higher than the frequency reference, the AC drive will not start but stay standby.
F6-04	Startup frequency holding time	0.0s	0.0s to 100.0s	This parameter defines the time during which the output frequency remains at the startup frequency. After the time elapses, the AC drive will accelerate/decelerate from the output frequency to the reference frequency.

2.2.16(Optional) S-curve Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F6-07	Acceleration/ Deceleration mode	0	0: Linear acceleration/ deceleration 1: S-curve acceleration/ deceleration	This parameter is used to select the acceleration/deceleration mode 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 applications requiring smooth operation and quick response in real time.
F6-08	Time proportion of S-curve start segment	30.0%	0.0% to (100.0% to F6-09)	The value ranges from 0.0 to 100.0% minus the value of F6-09.
F6-09	Time proportion of S-curve end segment	30.0%	0.0% to (100.0% to F6-08)	The value ranges from 0.0 to 100.0% minus the value of F6-08.

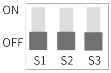
2.2.17Stop Parameter Settings

Parameter Code	Parameter Name	Value Range	Default	Description
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop 2: Stop at maximum capability	0	This parameter is used to select the stop mode of the AC drive. 0: Decelerate to stop After the stop command becomes active, the AC drive decreases the output frequency based on the deceleration time, and stops when the frequency is reduced to 0. 1: Coast to stop After the stop command becomes active, the drive stops output immediately and the motor coasts to stop based on the mechanical inertia. 2: Stop at maximum capability. The motor speed reference is set to 0 forcibly. The motor decelerates to 0 based on the maximum output capacity. The motor torque or current may reach the limit value during deceleration.
F6-11	Start frequency of DC braking for stop	0.00 Hz to F0-10	0.00 Hz	During decelerating to stop, the drive starts DC braking when the operating frequency drops below the value of F6-11.
F6-12	Waiting time of DC braking for stop	0.0s to 100.0s	0.0s	When the operating frequency decreases to the start frequency of DC braking for stop, the drive stops output for a period set by F6-12 and then starts DC braking. This prevents faults such as overcurrent caused by DC braking at a high speed.
F6-13	DC braking current for stop	0% to 100%	50%	The higher the DC braking current, the stronger the braking force. The value 100.0% corresponds to the rated current of the motor. The default upper limit of the DC braking current for stop is 80% of the rated drive current, which can be set by F6-34. The maximum upper limit of the DC braking current for stop is 135% of the rated drive current.
F6-14	DC braking time for stop	0.0s to 100.0s	0.0s	This parameter specifies the holding time of DC braking. If it is set to 0, DC braking is disabled.

2.2.18(Optional) AI Settings

Functions of the AI can be set by using the DIP switches on the main control board, as summarized in the following table.

Table 2–3 Descriptions of DIP switches S1 to S3

DIP Switch Diagram	DIP Switch Status			Function Description
	S1	S2	S3	
	OFF	OFF	OFF	Voltage mode with the range of 0 VDC to 10 VDC for AI2
	ON	OFF	OFF	Temperature mode for AI2 Set the temperature sensor type through F9-75. 0: Temperature sensor not supported (AI used for analog input) 1: PT100, supporting the temperature range of -25°C to 200°C 2: PT1000, supporting the temperature range of -25°C to 200°C 3: KTY84-130, supporting the temperature range of -40°C to 260°C 4: PTC130, supporting the temperature range of -20°C to 180°C
	OFF	ON	OFF	Current mode for AI2; current range: 0 mA to 20 mA; input impedance: 500 Ω
	OFF	ON	ON	Current mode for AI2; current range: 0 mA to 40 mA; input impedance: 250 Ω

Note

S1, S2, and S3 are DIP switches used in combination. For details, see *"Table 2–3 " on page 66*.

Table 2–4 Related parameters

Parameter Code	Parameter Name	Value Range	Default	Description
F4-13	Minimum input of AI curve 1	-10.00 V to F4-15	0.00 V	When the main frequency is set by the AI, each AI supports five types of AI curves. The AI curve is used to set the relationship between the analog input voltage (or current) and the percentage corresponding to the maximum frequency (F0-10). The x axis of the AI curve represents the analog input voltage or current, and the y axis represents the set value corresponding to the analog input, which is the percentage of the maximum frequency (F0-10). Five AI curves are provided. Curves 1 to 3 are two-point curves, and their relevant parameters are F4-13 to F4-27. Curves 4 and 5 are four-point curves, and their relevant parameters are A6-00 to A6-15. The two points on curves 1 to 3 are the minimum input point and maximum input point, respectively. F4-13 corresponds to the x axis of the AI curve 1 minimum input, that is, the minimum analog input voltage or current.
F4-14	Percentage corresponding to minimum input of AI curve 1	-100.0% to 100.0%	0.0%	F4-14 corresponds to the y axis of AI curve 1 minimum input, that is, the set value corresponding to the minimum analog input.
F4-15	Maximum input of AI curve 1	F4-13 to 10.00 V	10.00 V	F4-15 corresponds to the x axis of AI curve 1 maximum input, that is, the maximum analog input voltage or current.
F4-16	Percentage corresponding to maximum input of AI curve 1	-100.0% to 100.0%	100.0%	F4-16 corresponds to the y axis of AI curve 1 maximum input, that is, the set value corresponding to the maximum analog input.
F4-17	AI1 filter time	0.00s to 10.00s	0.10s	This parameter indicates the software filter time of AI1. 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. When analog signals on the site are susceptible to interference, increase the AI filter time to enhance the stability of analog signals.

Parameter Code	Parameter Name	Value Range	Default	Description
F4-18	Minimum input of AI curve 2	-10.00 V to F4-20	0.00 V	F4-18 corresponds to the x axis of the AI curve 2 minimum input, that is, the minimum analog input voltage or current.
F4-19	Percentage corresponding to minimum input of AI curve 2	-100.0% to 100.0%	0.0%	F4-19 corresponds to the y axis of AI curve 2 minimum input, that is, the set value corresponding to the minimum analog input.
F4-20	Maximum input of AI curve 2	F4-18 to 10.00 V	10.00 V	F4-20 corresponds to the x axis of AI curve 2 maximum input, that is, the maximum analog input voltage or current.
F4-21	Percentage corresponding to maximum input of AI curve 2	-100.0% to 100.0%	100.0%	F4-21 corresponds to the y axis of AI curve 2 maximum input, that is, the set value corresponding to the maximum analog input.
F4-22	AI2 filter time	0.00s to 10.00s	0.10s	This parameter indicates the software filter time of AI2. 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. When analog signals on the site are susceptible to interference, increase the AI filter time to enhance the stability of analog signals.
F4-23	Minimum input of AI curve 3	-10.00 V to F4-25	-10.00 V	F4-23 corresponds to the x axis of the AI curve 3 minimum input, that is, the minimum analog input voltage or current.
F4-24	Percentage corresponding to minimum input of AI curve 3	-100.0% to 100.0%	-100.0%	F4-24 corresponds to the y axis of AI curve 3 minimum input, that is, the set value corresponding to the minimum analog input.
F4-25	Maximum input of AI curve 3	F4-23 to 10.00 V	10.00 V	F4-25 corresponds to the x axis of AI curve 3 maximum input, that is, the maximum analog input voltage or current.
F4-26	Percentage corresponding to maximum input of AI curve 3	-100.0% to 100.0%	100.0%	F4-26 corresponds to the y axis of AI curve 3 maximum input, that is, the set value corresponding to the maximum analog input.

Parameter Code	Parameter Name	Value Range	Default	Description
F4-27	AI3 filter time	0.00s to 10.00s	0.10s	This parameter indicates the software filter time of AI3. 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. When analog signals on the site are susceptible to interference, increase the AI filter time to enhance the stability of analog signals.
F4-33	AI curve selection	Ones place: AI1 curve selection 1: Curve 1 (2 points, see F4-13 to F4-16) 2: Curve 2 (2 points, see F4-18 to F4-21) 3: Curve 3 (2 points, see F4-23 to F4-26) 4: Curve 4 (4 points, see A6-00 to A6-07) 5: Curve 5 (4 points, see A6-08 to A6-15) Tens place: AI2 curve selection 1: Curve 1 (2 points, see F4-13 to F4-16) 2: Curve 2 (2 points, see F4-18 to F4-21) 3: Curve 3 (2 points, see F4-23 to F4-26) 4: Curve 4 (4 points, see A6-00 to A6-07) 5: Curve 5 (4 points, see A6-08 to A6-15) Hundreds place: AI3 curve selection 1: Curve 1 (2 points, see F4-13 to F4-16) 2: Curve 2 (2 points, see F4-18 to F4-21) 3: Curve 3 (2 points, see F4-23 to F4-26) 4: Curve 4 (4 points, see A6-00 to A6-07) 5: Curve 5 (4 points, see A6-08 to A6-15)	801	The ones to hundreds places of this parameter are used to select curves for AI1 to AI3. Each digit can be used to set a curve for an AI. Different AIs can be set with the same curve.

Parameter Code	Parameter Name	Value Range	Default	Description
A6-00	Minimum input of AI curve 4	-10.00 V to A6-02	0.00 V	A6-00 corresponds to the x axis of the AI curve 4 minimum input, that is, the minimum analog input voltage or current.
A6-01	Percentage corresponding to minimum input of AI curve 4	-100.0% to 100.0%	0.0%	A6-01 corresponds to the y axis of AI curve 4 minimum input, that is, the set value corresponding to the minimum analog input.
A6-02	Inflection point 1 input of AI curve 4	A6-00 to A6-04	3.00 V	A6-02 corresponds to the x axis of the AI curve 4 inflection point 1, that is, the minimum analog input voltage.
A6-03	Percentage corresponding to inflection point 1 input of AI curve 4	-100.0% to 100.0%	30.0%	A6-03 corresponds to the y axis of the AI curve 4 inflection point 1, that is, the set value corresponding to the minimum analog input.
A6-04	Inflection point 2 input of AI curve 4	A6-02 to A6-06	6.00 V	A6-04 corresponds to the x axis of the AI curve 4 inflection point 2, that is, the minimum analog input voltage.
A6-05	Percentage corresponding to inflection point 2 input of AI curve 4	-100.0% to 100.0%	60.0%	A6-05 corresponds to the y axis of the AI curve 4 inflection point 2, that is, the set value corresponding to the minimum analog input.
A6-06	Maximum input of AI curve 4	A6-04 to 10.00 V	10.00 V	A6-06 corresponds to the x axis of AI curve 4 maximum input, that is, the maximum analog input voltage or current.
A6-07	Percentage corresponding to maximum input of AI curve 4	-100.0% to 100.0%	100.0%	A6-07 corresponds to the y axis of AI curve 4 maximum input, that is, the set value corresponding to the maximum analog input.
A6-08	Minimum input of AI curve 5	-10.00 V to A6-10	-10.00 V	A6-08 corresponds to the x axis of the AI curve 5 minimum input, that is, the minimum analog input voltage or current.
A6-09	Percentage corresponding to minimum input of AI curve 5	-100.0% to 100.0%	-100.0%	A6-09 corresponds to the y axis of AI curve 5 minimum input, that is, the set value corresponding to the minimum analog input.
A6-10	Inflection point 1 input of AI curve 5	A6-08 to A6-12	-3.00 V	A6-10 corresponds to the x axis of the AI curve 5 inflection point 1, that is, the minimum analog input voltage.

Parameter Code	Parameter Name	Value Range	Default	Description
A6-11	Percentage corresponding to inflection point 1 input of AI curve 5	-100.0% to 100.0%	-30.0%	A6-11 corresponds to the y axis of the AI curve 5 inflection point 1, that is, the set value corresponding to the minimum analog input.
A6-12	Inflection point 2 input of AI curve 5	A6-10 to A6-14	3.00 V	A6-12 corresponds to the x axis of the AI curve 5 inflection point 2, that is, the minimum analog input voltage.
A6-13	Percentage corresponding to inflection point 2 input of AI curve 5	-100.0% to 100.0%	30.0%	A6-13 corresponds to the y axis of the AI curve 5 inflection point 2, that is, the set value corresponding to the minimum analog input.
A6-14	Maximum input of AI curve 5	A6-12 to 10.00 V	10.00 V	A6-14 corresponds to the x axis of AI curve 5 maximum input, that is, the maximum analog input voltage or current.
A6-15	Percentage corresponding to maximum input of AI curve 5	-100.0% to 100.0%	100.0%	A6-15 corresponds to the y axis of AI curve 5 maximum input, that is, the set value corresponding to the maximum analog input.
A6-24	AI1 jump point	-100.0% to 100.0%	0.0%	This parameter is used to set the AI1 jump point. If the input value is within the range from A6-24 - A6-25 to A6-24 + A6-25, the value of the AI1 jump point (A6-24) will be output.
A6-25	AI1 jump amplitude	0.0% to 100.0%	0.1%	This parameter is used to set the AI1 jump amplitude. If the input value is within the range from A6-24 - A6-25 to A6-24 + A6-25, the value of the AI1 jump point (A6-24) will be output.
A6-26	AI2 jump point	-100.0% to 100.0%	0.0%	This parameter is used to set the AI2 jump point. If the input value is within the range from A6-26 - A6-27 to A6-26 + A6-27, the value of the AI2 jump point (A6-26) will be output.
A6-27	AI2 jump amplitude	0.0% to 100.0%	0.1%	This parameter is used to set the AI2 jump amplitude. If the input value is within the range from A6-26 - A6-27 to A6-26 + A6-27, the value of the AI2 jump point (A6-26) will be output.
A6-28	AI3 jump point	-100.0% to 100.0%	0.0%	This parameter is used to set the AI3 jump point. If the input value is within the range from A6-28 - A6-29 to A6-28 + A6-29, the value of the AI3 jump point (A6-28) will be output.
A6-29	AI3 jump amplitude	0.0% to 100.0%	0.1%	This parameter is used to set the AI3 jump amplitude. If the input value is within the range from A6-28 - A6-29 to A6-28 + A6-29, the value of the AI3 jump point (A6-28) will be output.

Parameter Code	Parameter Name	Value Range	Default	Description
A6-30	AI automatic adjustment curve	Ones place: Point selection (for settings) 0: Disable 1: Point 1 2: Point 2 3: Point 3 4: Point 4 Tens place: AI channel selection (for settings) 0: Disable 1: AI1 2: AI2 3: AI3 Hundreds place: Control function (for settings) 0: Disable 1: Enable Thousands place: 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 place: Reserved	0	You can set different AI curves, curve types (2-point curve or 4-point curve), and control functions through the ones, tens, hundreds, thousands, and ten thousands places of this parameter.
A6-31	AI1 input	0: Disable 1: Enable Others: B connector	1	-
A6-32	AI2 input	0: Disable 1: Enable Others: B connector	1	-
A6-33	AI3 input	0: Disable 1: Enable Others: B connector	1	-

Parameter Code	Parameter Name	Value Range	Default	Description
A6-34	AI polarity selection	Ones position: AI1 0: Normal value 1: Absolute value 2: Opposite to the normal value 3: Opposite to the absolute value Tens position: AI2 0: Normal value 1: Absolute value 2: Opposite to the normal value 3: Opposite to the absolute value Hundreds position: AI3 0: Normal value 1: Absolute value 2: Opposite to the normal value 3: Opposite to the absolute value	0	You can set AI1, AI2, and AI3 input polarities through the ones, tens, and hundreds places of this parameter. 0: Normal value 1: Absolute value 2: Opposite to the normal value 3: Opposite to absolute value
A6-35	AI hardware source selection	Ones place: AI1 source 0: Hardware sampling 1: Forced value Tens place: AI2 source 0: Hardware sampling 1: Forced value Hundreds place: AI3 source 0: Hardware sampling 1: Forced value	0	You can set AI1, AI2, and AI3 hardware sources through the ones, tens, and hundreds places of this parameter. If the source is set to 0 (hardware sampling), the AI value is sourced from hardware sampling. If the source is set to 1 (forced value), the AI value can be forcibly set through parameters A6-36 to A6-38.
A6-36	AI1 forced value	-10.00 V to 10.00 V	0.00 V	If the ones place of A6-35 is set to 1 (forced value), you can set the AI1 value forcibly through A6-36.
A6-37	AI2 forced value	-10.00 V to 10.00 V	0.00 V	If the tens place of A6-35 is set to 1 (forced value), you can set the AI2 value forcibly through A6-37.
A6-38	AI3 forced value	-10.00 V to 10.00 V	0.00 V	If the hundreds place of A6-35 is set to 1 (forced value), you can set the AI3 value forcibly through A6-38.
A6-39	High level judgment threshold when AI uses as DI	5.5 V to 9.0 V	7.0 V	This parameter defines the threshold for judging high level when the AI is used as the DI.
A6-40	Low level judgment threshold when AI uses as DI	1.0 V to 4.5 V	3.0 V	This parameter defines the threshold for judging low level when the AI is used as the DI.

Parameter Code	Parameter Name	Value Range	Default	Description
A6-41	AI1 gain	-10.00 to +10.00	1.00	This parameter defines the gain multiple of AI1 analog sampling value.
A6-42	AI1 offset	-10.00 V to 10.00 V	0.00 V	This parameter defines the zero offset coefficient for AI1 correction voltage.
A6-43	AI1 denoising threshold	0.0% to 100.0%	0.0%	This parameter defines the AI1 denoising threshold. If the absolute value of the difference between the current input and the last input is below the threshold, denoising will be applied.
A6-44	AI1 dead zone width	0.0% to 100.0%	0.0%	This parameter defines the AI1 dead zone width. The output 0.0% within the dead zone range is used to eliminate the fluctuation near zero.
A6-47	AI2 gain	-10.00 to +10.00	1.00	This parameter defines the gain multiple of AI2 analog sampling value.
A6-48	AI2 offset	-10.00 V to 10.00 V	0.00 V	This parameter defines the AI2 analog sampling offset.
A6-49	AI2 denoising threshold	0.0% to 100.0%	0.0%	This parameter defines AI2 denoising threshold. If the absolute value of the difference between the current input and the last input is below the threshold, denoising will be applied.
A6-50	AI2 dead zone width	0.0% to 100.0%	0.0%	This parameter defines the AI2 dead zone width. The output 0.0% within the dead zone range is used to eliminate the fluctuation near zero.
A6-53	AI3 gain	-10.00 to +10.00	1.00	This parameter defines the gain factor of AI3 analog sampling measurement.
A6-54	AI3 offset	-10.00 V to 10.00 V	0.00 V	This parameter defines the AI3 analog sampling offset.
A6-55	AI3 denoising threshold	0.0% to 100.0%	0.0%	This parameter defines AI3 denoising threshold. If the absolute value of the difference between the current input and the last input is below the threshold, denoising will be applied.
A6-56	AI3 dead zone width	0.0% to 100.0%	0.0%	This parameter defines the AI3 dead zone width. The output 0.0% within the dead zone range is used to eliminate the fluctuation near zero.

2.2.19(Optional) AO Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F5-07	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: Pulse input 7: AI1 8: AI2 9: AI3 10: Length 11: Count value 12: Communication 13: Motor speed 14: Output current (100.0% corresponds to 1000.0 A.) 15: Bus voltage (100.0% corresponding to 1000.0 V.) 16: Output torque (actual value) Others: F connector	0: Running frequency. 100.0% corresponds to the maximum frequency (F0-10). 1: Frequency reference. 100.0% corresponds to the maximum frequency (F0-10). 2: Output current. 100.0% corresponds to two times the rated motor current. 3: Output torque. 100.0% corresponds to two times the rated motor torque (absolute value). 4: Output power. 100.0% corresponds to two times the rated motor power. 5: Output voltage. 100.0% corresponds to 1.2 times the rated motor voltage. 6: Pulse input. 100.0% corresponds to 100.0 kHz. 7: AI1. 100.0% corresponds to 10 V. 8: AI2. 100.0% corresponds to 10 V. 9: AI3. 100.0% corresponds to 10 V. 10: Length. 100.0% corresponds to FB-05. 11: Count value. 100.0% corresponds to FB-08. 12: Communication. 100.0% corresponds to the AO communication setting value. 13: Motor speed. 100.0% corresponds to the maximum frequency (F0-10). 14: Output current. 100.0% corresponds to 1000.0 A. 15: Bus voltage. 100.0% corresponds to 1000.0 V. 16: Output 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 (actual value). Others: F connector When this option is selected, the output function is the signal or function state of the parameter to which the connector is connected.
F5-08	Output function selection of AO2 on expansion card	1		

2.2.20(Optional) DI Settings

Parameter Code	Parameter Name	Default	Value Range	Description
F4-00	DI1 function selection	1	0: No function 1: Forward run (IN1) 2: Reverse run (IN2) 3: Three-wire control (IN3) 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 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 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 18: Frequency command switchover 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Command source switchover terminal 1 21: Acceleration/Deceleration inhibition 22: PID pause 23: Simple PLC state reset 24: Wobble frequency pause 25: Counter input 26: Counter reset 27: Length input 28: Length reset 29: Torque control inhibition 30: Pulse frequency input (valid only for DI5) 31: Reserved 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 37: Command source switchover terminal 2 38: PID integral pause 39: Switchover between main frequency X and preset frequency 40: Switchover between auxiliary frequency Y and preset frequency 41: Motor selection terminal 1 42: Reserved 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control selection 47: Emergency stop 48: External stop terminal 2 49: Deceleration DC braking 50: Clear the current running time 51: Two-wire/Three-wire mode switchover 52: Reverse rotation inhibition 64: Forward limit switch 65: Reverse limit switch 66: Water-cooling fault input 67: Low liquid level fault input 70: Control channel selection 71: Setting channel selection (reserved) 72: Terminal module A/B selection 73: Startup mode selection bit 0 74: Startup mode selection bit 1 75: Command source switchover terminal 3 76: Motor selection terminal 2 77: Running enable 78: Forward run permission 79: Reverse run permission 80: Set RFG input to zero 86: Wire breakage detection (wire drawing machine)	See descriptions below.
F4-01	DI2 function selection	4		
F4-02	DI3 function selection	9		
F4-03	DI4 function selection	12		
F4-04	DI5 function selection	13		
F4-05	DI6 function selection	0		
F4-06	DI7 function selection	0		
F4-07	DI8 function selection	0		
F4-08	DI9 function selection	0		
F4-09	DI10 function selection	0		

Note

Function 30 (pulse frequency input) is available for F4-04 but not available for F4-00 to F4-03 and F4-05 to F4-09.

0: No function

No function is assigned to the DI.

1: Forward run (IN1)

The AC drive runs in the forward direction. FWD indicates forward running. In two-wire mode 1 (F4-11 = 0), activating DI function 1 triggers forward running. In two-wire operation mode 2 (F4-11 = 1), activating DI function 1 triggers a running command.

2: Reverse run (IN2)

The AC drive runs in the reverse direction. REV indicates reverse running. In two-wire mode 1 (F4-11 = 2), activating DI function 2 triggers reverse running. In two-wire mode 2 (F4-11 = 1),activating DI function 2 triggers forward/reverse running.

3: Three-wire control (IN3)

The DI is used to set the three-wire mode for the AC drive. To set the running command source to the terminal, set F4-11 (terminal command mode) to 2 (three-wire mode 1) or 3 (three-wire mode 2), and set the DI to function 3. The three-wire control modes include three-wire mode 1 and three-wire mode 2.

4: Forward jog (FJOG)

The terminal is used to set the AC drive to jog forwardly. In the jogging mode, the drive runs at the frequency set by F8-00 (Jogging frequency), which is generally used for maintenance and commissioning of the equipment on site.

5: Reverse jog (RJOG)

The terminal is used to set the AC drive to jog reversely. In the jogging mode, the drive runs at the frequency set by F8-00 (Jogging frequency), which is generally used for maintenance and commissioning of the equipment on site.

6: Function as UP key for frequency adjustment

The terminal is used to increase the frequency. Activating the terminal is equivalent to pressing and holding the increment key. Deactivating the terminal is equivalent to releasing the increment key.

7: Function as DOWN key for frequency adjustment

The terminal is used to decrease the frequency. Activating the terminal is equivalent to pressing and holding the decrement key. Deactivating the terminal is equivalent to releasing the decrement key.

8: Coast to stop

Once the drive receives a stop command, it immediately stops output. The load then coasts to stop based on the mechanical inertia. 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. This is also known as inertia stop because the stop time is determined by the inertia of the driving system.

9: Fault reset (RESET)

The terminal is used to reset the fault of the drive, which functions the same as the STOP/RES key on the operating panel. This function allows you to perform a reset upon the fault remotely.

10: Running pause

This function is valid only when F0-02 is set to 1 (terminal). After this function is assigned to the terminal, the drive decelerates to stop with all the operating parameters memorized (such as PLC parameters, wobble frequency, and PID parameters). When the terminal is inactive, the drive resumes to the status before decelerating to stop.

11: NO input of external fault

When an external signal is sent to the drive, the drive reports E015.1.

12 to 15: Multi-reference terminals 1 to 4

Multi-reference is selected as the main frequency source. Sixteen speeds or sixteen references can be set through combinations of sixteen 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.

16 and 17: Acceleration/Deceleration selection terminals 1 and 2

The acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to the acceleration/deceleration base frequency (F0-25). The deceleration time indicates the time required by the AC drive to decelerate from the acceleration/deceleration base frequency (F0-25) to 0 Hz. Four groups of acceleration/deceleration time can be selected through combinations of four states of these two terminals.

For example, if DI1 is assigned with function 16 and DI2 is assigned with function 17, the active states of DI2 and DI1 can be used to indicate the following groups acceleration/deceleration time:

[0, 0]: Acceleration/deceleration time of group one

[0, 1]: Acceleration/deceleration time of group two

[1, 0]: Acceleration/deceleration time of group three

[1, 1]: Acceleration/deceleration time of group four

18: Frequency command switchover

The terminal is used to select the frequency reference input modes. The frequency reference is set through F0-07 (Frequency reference superposition).

19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key

Activating the terminal clears the frequency that is set by the increment or decrement key on the operating panel or the terminal functioning as UP/DOWN keys and resumes the frequency reference to the value specified by F0-08.

20: Command source switchover terminal 1

When the running command is set through the terminal (F0-02 = 1) and the terminal is valid, you can switch between the terminal control mode and the operating panel control mode. When the running command is set through communication (F0-02=2) and the terminal is valid, you can switch between the communication control mode and the operating panel control mode.

21: Acceleration/Deceleration inhibition

The drive runs at the current operating frequency without being affected by external input frequency except that a stop command is received.

22: PID pause

The PID is deactivated temporarily. The drive maintains the current output frequency without PID adjustment of the frequency source.

23: Simple PLC state reset

The terminal is used to restore the AC drive to the initial state of the simple PLC.

24: Wobble frequency pause

In the wobble process, when the terminal is active, the wobble frequency function is paused and the drive outputs at the center frequency.

25: Counter input

In the counting process, the counted pulse is input when the terminal is active.

26: Counter reset

In the counting process, the counter status is cleared when the terminal is active.

27: Length input

In the fixed length process, the counted length is input when the terminal is active.

28: Length reset

In the fixed length process, the length is set to zero when the terminal is active.

29: Torque control inhibition

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 input

When DI5 is used as the pulse input terminal, DI5 must be assigned with this function.

31: Reserved

32: Immediate DC braking

The terminal is used to switch the drive 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 an external signal is sent to the drive, the drive reports E015.2.

34: Frequency modification enable

When the terminal is active, the frequency can be modified. When the terminal is inactive, the frequency cannot be modified.

35: Opposite to the PID action direction

The terminal is used to reverse the PID action direction defined by FA-03 (PID action direction).

36: External stop terminal 1

The terminal is used to stop the drive regardless of the value of F0-02, which functions the same as the STOP/RES key on the operating panel.

37: Command source switchover terminal 2

The terminal is used to switch the drive between the terminal control mode and communication control mode. If the running command source is set to terminal control, the drive switches to communication control when the terminal is active. If the running command source is set to communication control, the system switches to terminal control when the terminal is active.

38: PID integral pause

The terminal is used to disable integral tuning of PID temporarily without affecting its proportional and derivative tuning.

39: Switchover between main frequency X and preset frequency

The terminal is used to switch from main frequency X to the preset frequency (F0-08).

40: Switchover between auxiliary frequency Y and preset frequency

The terminal is used to switch from auxiliary frequency Y to the preset frequency (F0-08).

41 and 76: Motor selection terminals 1 to 4

The terminal is used to select a motor. For example, when DI1 is assigned with function 41 and DI2 is assigned with function 76, motor 1 applies when DI1 and DI2 are inactive; motor 2 applies when DI1 is active and DI2 is inactive; motor 3 applies when DI1 is inactive and DI2 is active; motor 4 applies when DI1 and DI2 are both active.

42: Reserved

43: PID parameter switchover

If PID parameters are switched through the DI (FA-18 = 1), the PID parameters FA-05 (proportional gain Kp1), FA-06 (integral time Ti1), and FA-07 (derivative time Td1) are used when the terminal is inactive; the PID parameters FA-15 (proportional gain Kp2), FA-16 (integral time Ti2), and FA-17 (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 F9-49 (Fault protection action selection).

45: User-defined fault 2

The AC drive reports E027.2, and acts according to the value of F9-49 (Fault protection action selection).

46: Speed control/Torque control selection

The terminal is used to enable the drive to switch between the speed control mode and the torque control mode. If A0-00 (speed/torque control mode) is set to 0, the torque control mode is used when the terminal is active, and the speed control mode is used when the terminal is inactive. If A0-00 (speed/torque control mode) is set to 1, the speed control mode is used when the terminal is active, and the torque control mode is used when the terminal is inactive.

47: Emergency stop

When the system is in the emergency state, the drive decelerates according to F8-55 (Deceleration time for emergency stop) or according to the minimum unit time when the deceleration time for emergency stop is 0s in the V/f control mode. The input terminal does not need to be in the closed state continuously. Even if it is closed only for a moment, an emergency stop will occur immediately. Different from general deceleration time, 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.

48: External stop terminal 2

The drive decelerates to stop in any control mode (operating panel, terminal, or communication). In this case, the deceleration time is fixed to the value of F8-08 (deceleration time 4).

49: Deceleration DC braking

The drive decelerates to the start frequency of DC braking for stop (F6-11) and then enters the DC braking state.

50: Clear the current running time

The current running time of the drive (U0-26) is cleared. When the terminal is active, the current running time of the drive is not cleared.

51: Two-wire/Three-wire mode switchover

The terminal is used to switch the drive between the two-wire mode and the three-wire mode. When F4-11 is set to 0 (two-wire mode 1) and the terminal is active, the drive switches to three-wire mode 1. When the terminal is inactive, two-wire mode 1 is used. When F4-11 is set to 1 (two-wire mode 2) and the terminal is active, the drive switches to three-wire mode 2. When F4-11 is set to 2 (three-wire mode 1) and the terminal is active, the drive switches to two-wire mode 1. When F4-11 is set to 3 (three-wire mode 2) and the terminal is active, the drive switches to two-wire mode 2.

52: Reverse rotation inhibition

When the terminal is active, even if the reverse frequency is set, the actual frequency of the AC drive is fixed to 0. This function is the same as F8-13 (Reverse frequency inhibited).

64: Forward limit switch

65: Reverse limit switch

66: Water-cooling fault input

When an external signal is sent to the drive and the terminal is active, E064.1 is reported.

67: Low liquid level fault input

When an external signal is sent to the drive and the terminal is active, A066.1 (thousands place of F9-50 = 2) or E066.1 (thousands place of F9-50 = 0) is reported.

68-69: Reserved

70: Control channel selection

The terminal is used to select a user-defined command channel. Value 0 represents channel 1, and value 1 represents channel 2.

71: Setting channel selection (reserved)

72: Terminal module A/B selection

The terminal is used to select a terminal module. Value 0 represents module A, and value 1 represents module B.

73 and 74: Startup mode selection bit 0/bit 1

The terminal is used to select a start mode. For example, if DI1 and DI2 are assigned with functions 73 and 74, respectively, direct start is selected when both DI1 and DI2 are inactive; flying start is selected when DI1 is active but DI2 is inactive; DC braking start is selected when DI1 is inactive but DI2 is active; and the last start mode is selected when both DI1 and DI2 are active.

75: Command source switchover terminal 3

The terminal is used to switch the command source between the terminal/communication control mode and the user-defined operation command.

77: Running enable

When the terminal is active at high level, running is allowed. Otherwise, running is not allowed or the AC drive must stop according to the setting of AA-09 (stop mode during running).

78: Forward run permission

When the terminal is active at high level, the frequency reference is allowed to be a positive value. Otherwise, the positive frequency reference is reset to zero.

79: Reverse run permission

When the terminal is active at high level, the frequency reference is allowed to be a negative value. Otherwise, the negative frequency reference is reset to zero.

80: Set RFG input to zero

When the terminal is active at low level, the target reference is reset to zero. When the terminal is inactive at high level, the target reference is restored to its original setting.

86: Wire breakage detection (wire drawing machine)

After the AC drive is started and the time set by A7-32 (Breakage detection time for startup delay) expires, the DI starts detecting an active signal. If the DI detects an active signal, the AC drive reports E031.2 (breakage detection fault).

2.2.21(Optional) DO Settings

Parameter Code	Parameter Name	Default	Value Range		Description
F5-04	DO1 output function selection	0	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 warning 7: AC drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: Simple PLC cycle completed 12: Cumulative running time reach 13: Wobble frequency limit 14: Torque limit 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage 20: Communication setting 21: Brake output 22: Reserved	23: Running at zero speed 2 (output at stop) 24: Cumulative 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 reach 31: AI1 input limit exceeded 32: Load 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: Alarm (all faults) 39: Motor overtemperature 40: Current running time reach 41: Fault (excluding undervoltage) 42: STO 43: Operation restricted 44: Brake output at stop (wire drawing machine) Others: B connector	See descriptions below.
F5-05	Output function selection of DO2 on expansion card	4			

0: No output

The 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

When the drive encounters a fault, the terminal outputs an 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 (F8-19 x F8-20), the terminal stops outputting the active signal.

4: Frequency reach

When the running frequency of the AC drive is within a specific range (target frequency ± F8-21 x maximum frequency), 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 warning

Before motor overload protection, the AC drive determines whether the motor load exceeds the overload warning threshold according to the overload warning coefficient (F9-02). 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: AC drive overload warning

The terminal outputs an active signal 10s before AC drive overload protection applies.

8: Set count value reach

The terminal outputs an active signal when the counting value reaches the value of FB-08.

9: Designated count value reach

The terminal outputs an active signal when the counting value reaches the value of FB-09.

10: Length reach

The terminal outputs an active signal when the actual length detected exceeds the length defined by FB-05.

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 reach

The AC drive compares the cumulative running time and the time set by F8-17 and F8-75. If the former is greater than or equal to the latter, the terminal outputs an active signal.

13: Wobble frequency limit

In a wobble process, the terminal outputs an active signal when the set frequency exceeds the upper or lower limit of frequency and the output frequency of AC drive reaches the upper or lower limit of frequency.

14: Torque limit

The terminal outputs an active signal when the output torque of the AC drive reaches the toque limit in the speed control mode.

15: Ready to run

The terminal outputs an active signal if no exception occurs after the AC drive is powered on.

16: AI1 > AI2

The terminal outputs an active signal when the value of AI1 is greater than that of AI2.

17: Frequency upper limit reach

The terminal outputs an active signal when the running frequency reaches the upper limit (F0-12).

18: Frequency lower limit reach (no output at stop)

When F8-14 (Running mode when frequency reference < frequency lower limit) is set to 1 (stop), the terminal outputs an inactive signal no matter whether the operating frequency reaches the lower limit.

When F8-14 (Running mode when frequency reference < frequency lower limit) is set to 0 (run at the frequency lower limit) or 2 (run at zero speed) and the running frequency reaches the lower limit, the terminal outputs an active signal.

19: Undervoltage

The terminal outputs an active signal when undervoltage occurs on the AC drive.

20: Communication setting

The active or inactive state of the terminal is controlled by the setpoint of communication address 0x2001.

21: Brake output

The terminal outputs an active signal upon brake release, and outputs an inactive signal upon brake applying.

22: Reserved

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 reach

The AC drive compares the cumulative running time and the time set by F8-16 and F8-74. If the former is greater than or equal to the latter, the terminal outputs an active signal.

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 (F8-28 x F8-29).

26: Frequency 1 reach

The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by F8-30 (Detection frequency 1). Frequency detection range: F8-30 - F8-31 x F0-10 (Maximum frequency) to F8-30 + F8-31 x F0-10

27: Frequency 2 reach

The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by F8-32 (Detection frequency 2). Frequency detection range: F8-32 – F8-33 x F0-10 (Maximum frequency) to F8-32 + F8-33 x F0-10

28: Current 1 reach

The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by F8-38 (Detection current 1). Current detection range: F8-38 - F8-39 x F1-03 (Rated motor current) to F8-38 + F8-39 x F1-03

29: Current 2 reach

The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by F8-40 (Detection current 2). Current detection range = F8-40 - F8-41 x F1-03 (Rated motor current) to F8-40 + F8-41 x F1-03

30: Timing duration reach

The terminal outputs an active signal when F8-42 is active and the current operating time reaches the set timing duration. The timing duration is defined by F8-43 and F8-44.

31: AI1 input limit exceeded

If the value of AI1 input is larger than the value of F8-46 (AI1 input protection upper limit) or lower than the value of F8-45 (AI1 input protection lower limit), the terminal outputs an active signal.

32: Load loss

The terminal outputs an active signal when load loss occurs.

33: Reverse running

The terminal outputs an active signal when the AC drive is running reversely.

34: Zero current state

When the output current of the drive is within the zero current detection range for a duration longer than that defined by F8-35 (zero current detection delay), the terminal outputs an active signal. Zero current detection range: 0 to F8-34 x F1-03

35: Module temperature reach

The terminal outputs an active signal when the inverter heatsink temperature (F7-07) reaches the module temperature threshold (F8-47).

36: Output current limit exceeded

When the output current of the AC drive is higher than F8-36 (Output current threshold) for a period longer than F8-37 (Delay time for output current overlimit detection), the terminal outputs an active signal.

37: Frequency lower limit reach (output at stop)

The terminal outputs an active signal when the running frequency reaches the lower limit (F0-14). The terminal still outputs the active signal when the drive is in the stop state.

38: Alarm (all faults)

The terminal outputs an active signal when a fault occurs on the AC drive and the fault protection action is set to "continue to run". For details about the fault protection action, see F9-47 to F9-50.

39: Motor overtemperature

The terminal outputs an active signal when the motor temperature reaches the value of F9-58 (motor overtemperature warning threshold). You can check the motor temperature using U0-34.

40: Current running time reach

When the current operating time of the drive exceeds the time defined by F8-53 (Current running time reach), the terminal outputs an active signal.

41: Fault (excluding undervoltage)

The terminal outputs an active signal when a fault (other than the undervoltage fault) occurs on the AC drive.

42: STO

The terminal outputs an active signal when the STO function is triggered.

43: Operation restricted

When a minor fault that restricts the running of the AC drive occurs, the operating panel of the AC drive displays "Lxxx.y".

44: Brake output at stop (wire drawing machine)

When the AC drive stops and the running frequency is lower than the brake frequency set by A7-30, the terminal outputs an active signal. After the brake delay time set by A7-31 expires, the terminal outputs an active signal.

Others: B connector

When this option is selected, the output function is the signal or function state of the parameter to which the connector is connected.

2.2.22(Optional) Multi-reference Settings

Application scenario of parameters in group FC: When simple PLC is used as the main frequency source, set parameters in group FC. 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 is generally used in industrial equipment such as mixture mixing and industrial washing machines.

When the simple PLC is used as the main frequency source (F0-03=7), set parameters in group FC.

Parameter Code	Parameter Name	Default	Value Range	Description
FC-00	Multi-reference 1	0.0%	-100.0% to 100.0%	This parameter indicates the frequency reference of each speed in the unit of %. The actual frequency is the percentage of the maximum frequency. The value 100% corresponds to F0-10 (Maximum frequency). FC-55 to FC-58 can provide 16 state combinations, corresponding to 16 frequency references. The DIs assigned with functions 12 to 15 can also be used to provide 16 frequency references. The source of multi-reference 1 is selected by FC-51, and the other multi-references are set by other parameters. 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.
FC-01	Multi-reference 2			
FC-02	Multi-reference 3			
FC-03	Multi-reference 4			
FC-04	Multi-reference 5			
FC-05	Multi-reference 6			
FC-06	Multi-reference 7			
FC-07	Multi-reference 8			
FC-08	Multi-reference 9			
FC-09	Multi-reference 10			
FC-10	Multi-reference 11			
FC-11	Multi-reference 12			
FC-12	Multi-reference 13			
FC-13	Multi-reference 14			
FC-14	Multi-reference 15			
FC-15	Multi-reference 16			

2.2.23(Optional) Relay Output Settings

Parameter Code	Parameter Name	Default	Value Range		Description
F5-02	Output function selection of control panel relay (T/A-T/B-T/C)	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 warning 7: AC drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: Simple PLC cycle completed 12: Cumulative running time reach 13: Wobble frequency limit 14: Torque limit 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (no output at stop) 19: Undervoltage 20: Communication setting 21: Brake output 22: Reserved	23: Running at zero speed 2 (output at stop) 24: Cumulative 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 reach 31: AI1 input limit exceeded 32: Load 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: Alarm (all faults) 39: Motor overtemperature 40: Current running time reach 41: Fault (excluding undervoltage) 42: STO 43: Operation restricted 44: Brake output at stop (wire drawing machine) Others: B connector	See descriptions below.
F5-03	Output function selection of DO4 on expansion card relay (P/A-P/B-P/C)	0			

0: No output

The 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

When the drive encounters a fault, the terminal outputs an 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 (F8-19 x F8-20), the terminal stops outputting the active signal.

4: Frequency reach

When the running frequency of the AC drive is within a specific range (target frequency ± F8-21 x maximum frequency), 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 warning

Before motor overload protection, the AC drive determines whether the motor load exceeds the overload warning threshold according to the overload warning coefficient (F9-02). 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: AC drive overload warning

The terminal outputs an active signal 10s before AC drive overload protection applies.

8: Set count value reach

The terminal outputs an active signal when the counting value reaches the value of FB-08.

9: Designated count value reach

The terminal outputs an active signal when the counting value reaches the value of FB-09.

10: Length reach

The terminal outputs an active signal when the actual length detected exceeds the length defined by FB-05.

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 reach

The AC drive compares the cumulative running time and the time set by F8-17 and F8-75. If the former is greater than or equal to the latter, the terminal outputs an active signal.

13: Wobble frequency limit

In a wobble process, the terminal outputs an active signal when the set frequency exceeds the upper or lower limit of frequency and the output frequency of AC drive reaches the upper or lower limit of frequency.

14: Torque limit

The terminal outputs an active signal when the output torque of the AC drive reaches the toque limit in the speed control mode.

15: Ready to run

The terminal outputs an active signal if no exception occurs after the AC drive is powered on.

16: AI1 > AI2

The terminal outputs an active signal when the value of AI1 is greater than that of AI2.

17: Frequency upper limit reach

The terminal outputs an active signal when the running frequency reaches the upper limit (F0-12).

18: Frequency lower limit reach (no output at stop)

When F8-14 (Running mode when frequency reference < frequency lower limit) is set to 1 (stop), the terminal outputs an inactive signal no matter whether the operating frequency reaches the lower limit.

When F8-14 (Running mode when frequency reference < frequency lower limit) is set to 0 (run at the frequency lower limit) or 2 (run at zero speed) and the running frequency reaches the lower limit, the terminal outputs an active signal.

19: Undervoltage

The terminal outputs an active signal when undervoltage occurs on the AC drive.

20: Communication setting

The active or inactive state of the terminal is controlled by the setpoint of communication address 0x2001.

21: Brake output

The terminal outputs an active signal upon brake release, and outputs an inactive signal upon brake applying.

22: Reserved

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 reach

The AC drive compares the cumulative running time and the time set by F8-16 and F8-74. If the former is greater than or equal to the latter, the terminal outputs an active signal.

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 (F8-28 x F8-29).

26: Frequency 1 reach

The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by F8-30 (Detection frequency 1). Frequency detection range: F8-30 - F8-31 x F0-10 (Maximum frequency) to F8-30 + F8-31 x F0-10

27: Frequency 2 reach

The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by F8-32 (Detection frequency 2). Frequency detection range: F8-32 – F8-33 x F0-10 (Maximum frequency) to F8-32 + F8-33 x F0-10

28: Current 1 reach

The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by F8-38 (Detection current 1). Current detection range: F8-38 - F8-39 x F1-03 (Rated motor current) to F8-38 + F8-39 x F1-03

29: Current 2 reach

The terminal outputs an active signal when the output current of the AC drive is within the current detection range specified by F8-40 (Detection current 2). Current detection range = F8-40 - F8-41 x F1-03 (Rated motor current) to F8-40 + F8-41 x F1-03

30: Timing duration reach

The terminal outputs an active signal when F8-42 is active and the current operating time reaches the set timing duration. The timing duration is defined by F8-43 and F8-44.

31: AI1 input limit exceeded

If the value of AI1 input is larger than the value of F8-46 (AI1 input protection upper limit) or lower than the value of F8-45 (AI1 input protection lower limit), the terminal outputs an active signal.

32: Load loss

The terminal outputs an active signal when load loss occurs.

33: Reverse running

The terminal outputs an active signal when the AC drive is running reversely.

34: Zero current state

When the output current of the drive is within the zero current detection range for a duration longer than that defined by F8-35 (zero current detection delay), the terminal outputs an active signal. Zero current detection range: 0 to F8-34 x F1-03

35: Module temperature reach

The terminal outputs an active signal when the inverter heatsink temperature (F7-07) reaches the module temperature threshold (F8-47).

36: Output current limit exceeded

When the output current of the AC drive is higher than F8-36 (Output current threshold) for a period longer than F8-37 (Delay time for output current overlimit detection), the terminal outputs an active signal.

37: Frequency lower limit reach (output at stop)

The terminal outputs an active signal when the running frequency reaches the lower limit (F0-14). The terminal still outputs the active signal when the drive is in the stop state.

38: Alarm (all faults)

The terminal outputs an active signal when a fault occurs on the AC drive and the fault protection action is set to "continue to run". For details about the fault protection action, see F9-47 to F9-50.

39: Motor overtemperature

The terminal outputs an active signal when the motor temperature reaches the value of F9-58 (motor overtemperature warning threshold). You can check the motor temperature using U0-34.

40: Current running time reach

When the current operating time of the drive exceeds the time defined by F8-53 (Current running time reach), the terminal outputs an active signal.

41: Fault (excluding undervoltage)

The terminal outputs an active signal when a fault (other than the undervoltage fault) occurs on the AC drive.

42: STO

The terminal outputs an active signal when the STO function is triggered.

43: Operation restricted

When a minor fault that restricts the running of the AC drive occurs, the operating panel of the AC drive displays "Lxxx.y".

44: Brake output at stop (wire drawing machine)

When the AC drive stops and the running frequency is lower than the brake frequency set by A7-30, the terminal outputs an active signal. After the brake delay time set by A7-31 expires, the terminal outputs an active signal.

Others: B connector

When this option is selected, the output function is the signal or function state of the parameter to which the connector is connected.

3 Troubleshooting

3.1 Common Faults and Diagnosis

3.1.1 Alarm and Fault Display

Upon exceptions, the AC drive stops output immediately, the fault indicator blinks, and the contact of the fault relay acts. The operating panel of the AC drive displays a fault code (example: E0021), as shown in the following figure.

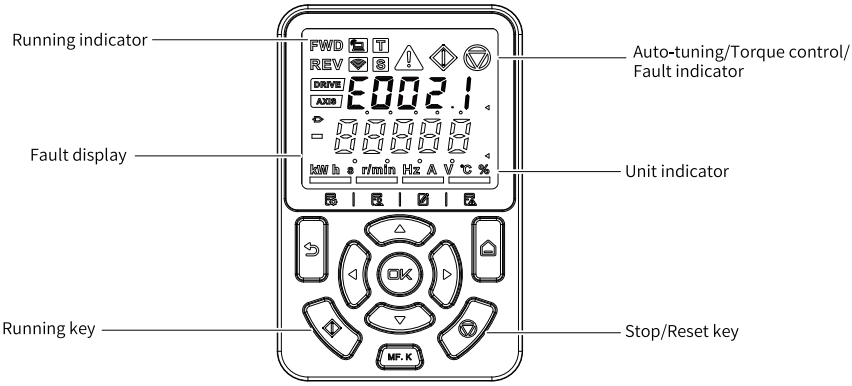


Figure 3-1 Display of faults

Caution

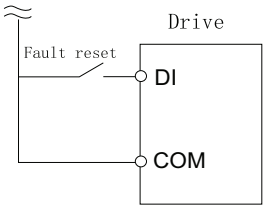
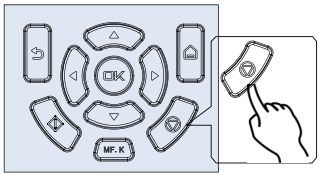
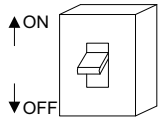
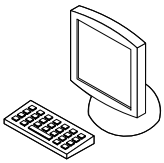
Do not repair or modify the AC drive by yourself. In case of any fault that cannot be rectified, contact the agent or Inovance for technical support.

3.1.2 Restart After Fault Occurrence

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.

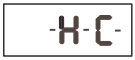
Table 3–1 Fault view and start method after fault occurrence

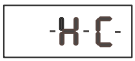
Stage	Solution	Description
Upon fault	Fault record 1: View the current fault code, fault subcode, fault information, minor fault code, minor fault subcode, minor fault information, warning code, warning subcode, warning information through the operating panel.	View the record through H0-00 to H0-53.
	Fault record 2: View the 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 three faults through the operating panel.	View the record through F9-14 and F9-44.
	Fault record 3: 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 parameters in groups H3 to H8.
Before fault reset	Before fault reset, find the fault cause and remove the fault according to the fault type displayed on the operating panel.	-

Stage	Solution	Description
Reset mode to clear faults	1. Allocate function 9 (fault reset) to the DI by setting any of F4-00 to F4-09 to 9.	
	2. Check that F7-02 is set to 1 (default value), indicating that the STOP/RES key is available in any operating mode.	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 F0-02 (Command source) is set to 2 (Communication control), write "7" (Fault reset) to communication address 2000H using the host controller to reset the AC drive after the fault is cleared.	

3.1.3 Common Troubleshooting

Table 3–2 Common faults and solutions

No.	Symptom	Possible Cause	Solution
1	There is no display upon power-on. 	The drive is not connected to the grid or the grid voltage is too low.	Check the power supply.
		The switched-mode power supply (SMPS) on the driver board of the AC drive is faulty.	Check whether the 24 V output voltage and 10 V output voltage on the control board are normal.
		The control board is disconnected from the driver board and operating panel.	Disconnect the main circuit from the power supply, and then re-connect the 8-pin and 40-pin flat cables.
		The pre-charge resistor of the AC drive is damaged.	Contact the agent or Inovance for technical support.
		The control board or the operating panel is faulty.	
		The rectifier bridge is damaged.	
2	"-H-C" is displayed after power-on. 	The cable connecting the driver board and the control board is in poor contact.	Re-connect the 8-pin and 28-pin flat cables.
		Related components on the control board are damaged.	Contact the agent or Inovance for technical support.
		The motor or the motor cable is short circuited to the ground.	
		The Hall sensor is faulty.	
		The mains voltage is too low.	
3	"E023.1" is displayed upon power-on. 	The motor or the motor cable is short circuited to ground.	Check the insulation status of the motor and the output cable with a megger.
		The AC drive is damaged.	Contact the agent or Inovance for technical support.

No.	Symptom	Possible Cause	Solution
4	The display is normal upon power-on. However, after the drive starts to run, "-H-C-" is displayed and the drive stops immediately. 	The fan is damaged or does not rotate.	Replace the fan.
		The cable of the external control terminal is short circuited.	Eliminate external short circuit.
5	E014.1 (module overtemperature) is reported frequently.	The carrier frequency is set too high.	Reduce the carrier frequency (F0-15).
		The cooling fan is damaged, or the air duct is blocked.	Replace the cooling fan or clean the air duct.
		Devices (thermistor or other devices) inside the AC drive are damaged.	Contact the agent or Inovance for technical support.
6	The motor does not rotate when the AC drive is running.	The wiring between the AC drive and the motor is abnormal.	Check that the wiring between the AC drive and the motor is correct.
		Motor parameters of the AC drive are set incorrectly.	Restore parameters to default settings and reset related parameters.
			Ensure encoder parameters and motor rated parameters are set properly, such as rated frequency and rated speed of the motor.
			Check that F0-01 (control mode) and F0-02 (operation mode) are set properly.
			Modify F3-01 (Torque boost) in the V/f control mode during start with heavy load.
		The cable connecting the driver board and the control board is in poor contact.	Re-connect the cable to ensure it is connected securely.
		The driver board is faulty.	Contact the agent or Inovance for technical support.

No.	Symptom	Possible Cause	Solution
7	DI inactive	The related parameters are set incorrectly.	Check and set the parameters in group F4 again.
		The external signal is incorrect.	Re-connect the external signal cable.
		The jumper between OP and +24V becomes loose.	Secure the jumper between OP and +24V.
		The control board is faulty.	Contact the agent or Inovance for technical support.
8	The motor speed cannot be increased in the FVC mode.	The encoder is faulty.	Replace the encoder disk and double check the cable connection.
		The encoder cable is connected improperly or in poor contact.	Reconnect the encoder to ensure good contact.
		The PG card is faulty.	Replace the PG card.
		The driver board is faulty.	Contact the agent or Inovance for technical support.
9	Frequent overcurrent and overvoltage faults	Motor parameters are set incorrectly.	Set the motor parameters again or perform motor parameter auto-tuning.
		The acceleration/ deceleration time is improper.	Set proper acceleration/ deceleration time.
		The load fluctuates.	Contact the agent or Inovance for technical support.
10	"E017.1" is detected upon power-on or running.	The soft startup contactor is not closed.	Check whether the contactor cable is loose.
			Check whether the contactor is faulty.
			Check whether 24 V power supply of the contactor is faulty.
			Contact the agent or Inovance for technical support.
11	The motor coasts to stop or the brake fails during deceleration or decelerating-to-stop.	The encoder is disconnected, or overvoltage stall suppression protection is enabled.	If the AC drive is in the FVC mode (F0-01 = 1), check the encoder cable connection.
			If a braking resistor is configured, disable the overvoltage stall suppression protection function by setting F3-23 to 0.

3.1.4 Troubleshooting During Trial Run in Different Control Modes

- SVC mode (F0-01= 0; default: 0)
  In this mode, the drive controls the motor speed and torque in a scenario without an encoder for speed feedback. Auto-tuning on motor parameters is required to obtain the motor parameters.

Table 3–3 Troubleshooting in SVC mode

Problem	Solution
Overload or overcurrent during motor start	Set motor parameters F1-01 to F1-05 according to the motor nameplate. Perform auto-tuning (F1-37) on motor parameters. If possible, select dynamic complete auto-tuning.
Slow torque/speed response and motor oscillation occur at a frequency below 5 Hz.	Increase the value of F2-00 (Speed loop proportional gain) by the step value of 10 or decrease the value of F2-01 (Speed loop integral time) by the step value of 0.05 to improve the torque/speed response. If oscillation occurs, decrease the value of F2-00 and increase the value of F2-01.
Slow torque/speed response and motor oscillation occur at a frequency above 5 Hz.	Increase the value of F2-03 (Speed loop proportional gain) by the step value of 10 or decrease the value of F2-04 (Speed loop integral time) by the step value of 0.05 to improve the torque/speed response. If oscillation occurs, decrease the value of F2-03 and increase the value of F2-04.
Low speed accuracy	If the speed deviation is too large when the motor runs with load, increase the value of F2-06 (Vector control slip compensation gain) by the step value of 10%.
Obvious speed fluctuation	Increase the value of A9-05 (Speed filter time) by the step value of 0.001s when motor speed fluctuates abnormally.
Loud motor noise	Increase the value of F0-15 (Carrier frequency) by the step value of 1.0 kHz. Note that increasing the carrier frequency will lead to an increase in the motor leakage current.
Insufficient motor torque or force	Check whether the torque upper limit is too low. If yes, increase the value of F2-10 (Torque upper limit in speed control mode) in the speed control mode or the value of the torque reference in the torque control mode.

- FVC mode (F0-01 = 1)
  This mode is applicable to scenarios with an encoder for speed feedback. In this mode, you need to set the encoder pulses per revolution, encoder type, and encoder direction correctly and perform auto-tuning on motor parameters.

Table 3–4 Troubleshooting in FVC mode

Problem	Solution
Overload or overcurrent fault during start	Set the encoder pulses per revolution, encoder type, and encoder direction correctly.
Overload or overcurrent is detected during motor running.	Set motor parameters F1-01 to F1-05 according to the motor nameplate. Perform auto-tuning (F1-37) on motor parameters. If possible, select dynamic complete auto-tuning.
Slow torque/speed response and motor oscillation occur at a frequency below 5 Hz.	Increase the value of F2-00 (Speed loop proportional gain) by the step value of 10 or decrease the value of F2-01 (Speed loop integral time) by the step value of 0.05 to improve the torque/speed response. If oscillation occurs, decrease the value of F2-00 and F2-01.
Slow torque/speed response and motor oscillation occur at a frequency above 5 Hz.	Increase the value of F2-03 (Speed loop proportional gain) by the step value of 10 or decrease the value of F2-04 (Speed loop integral time) by the step value of 0.05 to improve the torque/speed response. If oscillation occurs, decrease the value of F2-03 and F2-04.
Obvious speed fluctuation	Increase the value of F2-07 (Speed filter time) by the step value of 0.001s when motor speed fluctuates abnormally.
Loud motor noise	Increase the value of F0-15 (Carrier frequency) by the step value of 1.0 kHz. Note that increasing the carrier frequency will lead to an increase in the motor leakage current.
Insufficient motor torque or force	Check whether the torque upper limit is too low. If yes, increase the value of F2-10 (Torque upper limit in speed control mode) in the speed control mode or the value of the torque reference in the torque control mode.

- V/f control mode (F0-01 = 2)
  This mode applies to applications without an encoder for speed feedback. You only need to set the rated motor voltage and rated motor frequency correctly.

Table 3–5 Troubleshooting in V/f control mode

Problem	Solution
Motor oscillation during operation	Decrease the value of F3-11 (Oscillation suppression gain in V/f mode) by the step value of 5. The minimum value is 5.
Overcurrent at startup with high power	Decrease the value of F3-01 (Torque boost) by the step value of 0.5%.
Excessively high current during operation	Set F1-02 (Rated motor voltage) and F1-04 (Rated motor frequency) correctly. Decrease the value of F3-01 (Torque boost) by the step value of 0.5%.
Loud motor noise	Increase the value of F0-15 (Carrier frequency) by the step value of 1.0 kHz. Note that increasing the carrier frequency will lead to an increase in the motor leakage current.

Problem	Solution
Overvoltage during deceleration or when heavy load is suddenly removed	Set F3-23 Overvoltage stall suppression) to 1 (Enable). Increase the value of F3-24/F3-25 (Frequency gain/Voltage gain for overvoltage stall suppression, 30 by default) by the step value of 10 gradually. The permissible maximum value is 100. Decrease the value of F3-22 (Overvoltage stall suppression action voltage, default: 770 V) by the step value of 10 V. The permissible minimum value is 700 V.
Overcurrent during acceleration or when heavy load is suddenly added	Increase the value of F3-20 (Overcurrent stall suppression gain, default: 20) by the step value of 10. The permissible maximum value is 100. Decrease the value of F3-18 (Overcurrent stall suppression action current, default: 150%) by the step value of 10%. The permissible minimum value is 50%.

3.2 List of Faults and Alarms

For complete information on fault and alarm codes, see *MD520 Series General-Purpose AC Drive Parameter Guide.*

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