INOVANCE

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MD810 Series AC Drive (Multidrive System)

Function Guide

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

Data code 19011963A00

Preface

Thank you for purchasing the MD810 series AC drive developed and manufactured by Inovance.

The MD810 series is a new-generation low-voltage AC drive (multi-drive system). It is also a common DC bus drive system consisting of a power supply unit and multiple drive units, which can meet requirements of a single mechanical device with multiple drive points and continuous production line system. It is widely used in metal products, printing and packaging, textile printing and dyeing, chemical fiber and plastics, small-sized papermaking, hoisting and other industries.

The MD810 series AC drive consists of the MD810 power supply unit and MD810 drive unit. This guide describes the product information, installation, troubleshooting, and parameters of both the power supply unit and drive unit.

The MD810 series power supply unit comes into five structures and can be classified into the booksize unit with identical width and height and the vertical tower unit. The MD810 series drive unit also comes into five structures and can be classified into the booksize unit with identical width and height and the vertical tower unit. The drive unit can be a single-axis or dual-axis drive unit.

Type		Structure	Width	Power Range
Power supply unit		Booksize	50 mm	22 kW
			100 mm	45 kW
			200 mm	110 kW
			300 mm	160 kW
		Vertical tower	180 mm	355 kW
Drive unit	Single-axis	Booksize	50 mm	1.5 kW to 7.5 kW
			100 mm	11 kW to 37 kW
			200 mm	45 kW to 75 kW
			300 mm	90 kW to 160 kW
		Vertical tower	230 mm	200 kW to 355 kW
	Double-axis	Booksize	50 mm	1.5 kW to 5.5 kW
			100 mm	7.5 kW to 18.5 kW

§ Initial Use

Read through this user guide carefully before use for the first time. If you have any question concerning product functions or performance, contact Inovance for technical support.

§ Standards Compliance

The following table lists the certifications and standards that the product may comply with. For details about the acquired certificates, see the certification marks on the product name-plate.

Certification	Directive		Standard
CE certification	EMC Directive	2014/30/EU	EN 61800-3
	LVD Directive	2014/35/EU	EN 61800-5-1
	RoHS Directive	2011/65/EU	EN 50581
cULus certification	-		UL61800-5-1 CSA C22.2 NO. 274-17
Safe Torque Off (STO) function certification	Machinery Directive	2006/42/EC	EN 61800-5-2:2016 EN 62061 :2005/A2:2015 EN ISO 13849-1 :2015 EN 61508 eC.2:2010

§ Safety Performance

Item	Performance
SIL	SIL3, IEC61508 SILCL3, IEC/EN62061
PFHd	PFHd $\leqslant 1.5 \times 10^{-10}$ [1/h]
Cat.	3, EN ISO 13849–1
PL	e, EN ISO 13849–1
MTTFd	36824 years (high)
DCavg	0 (Troubleshooting strategy is adopted, so DC is not applicable)
HFT	1
SC	3
Application mode	High demand or continuous mode
Response time	< 20 ms

- The preceding standards are complied with only when the EMC-related requirements described in this user guide are observed.
- The integrator who integrates the drive into other devices and attaches the CE mark to the final assembly has the responsibility of ensuring compliance with CE standards and European standards.
- The 160 kW to 355 kW vertical tower drive unit meets C3 and does not meet C2. Other models meet C2 with the filter and meet C3 without the filter.
- For more information on product certifications, contact Inovance agent.

Contents

Preface..... 1

Revision History..... 7

Fundamental Safety Instructions..... 8

1 Commissioning Tools..... 13

1.1 LED Keypad..... 13

1.1.1 Indicators..... 13

1.1.2 LED Display..... 14

1.1.3 Keys..... 14

1.1.4 Parameter View and Modification Methods..... 15

1.1.5 Parameter View..... 16

1.2 External LCD Operating Panel..... 20

1.2.1 Appearance and Interface..... 20

1.2.2 Wiring..... 22

1.2.3 Status View..... 23

1.2.4 Parameter Settings..... 24

1.2.5 Auto-tuning (Drive Unit)..... 25

1.2.6 Jogging (Drive Unit)..... 26

1.2.7 Parameter Copy..... 26

1.2.8 Fault Query..... 27

1.3 InoDriverShop..... 28

1.3.1 Software Acquisition..... 28

1.3.2 Wiring Before Commissioning..... 29

1.3.3 Basic Procedure for Software Running... 29

2 Basic Operations and Trial Run..... 31

2.1 Quick Commissioning Flowchart..... 31

2.2 Detailed Commissioning Flowchart..... 31

2.3 Precautions Before Power-on..... 34

2.4 Status Display After Power-on..... 34

2.5 Parameter Initialization..... 34

2.6 Motor Control Modes..... 35

2.7 Main Frequency Source..... 35

2.7.1 Digital Setting Through LED Keypad..... 36

2.7.2 Analog Input..... 36

2.7.3 Digital Pulse Input..... 37

2.7.4 Communication Setting..... 38

2.7.5 Multi-reference..... 38

2.8: Start/Stop Command..... 40

2.8.1 Start/Stop Through External LCD Operating Panel/Software..... 40

2.8.2 Start/Stop Through Terminal..... 40

2.8.3 Start/Stop Through Communication..... 42

2.9 Start Process Setting..... 43

2.9.1 Start Mode Selection..... 43

2.9.2 Start Frequency..... 44

2.10 Stop Process Setting..... 45

2.10.1 Stop Mode Selection..... 45

2.10.2 DC Braking for Stop..... 45

2.11 Acceleration/Deceleration Time Setting..... 47

2.12 Running Status View..... 48

2.12.1 Digital Output..... 48

2.12.2 Analog Output..... 48

2.13 Motor Auto-tuning..... 49

2.13.1 Auto-tuning mode..... 49

2.13.2 Auto-tuning Procedure..... 51

2.13.3 Auto-tuning Flowchart Through LED Keypad..... 53

2.13.4 Jogging Flowchart Through LED Keypad..... 54

3 Drive Unit Parameters..... 55

3.1 Operation Command Source Settings..... 55

3.2 Frequency Reference Source Settings..... 61

3.2.1 Selecting Input Method of Main Frequency Reference..... 61

3.2.2 Setting Main Frequency Through Keypad (Digital Setting)..... 63

3.2.3 Setting Main Frequency Through AI..... 63

3.2.4 Setting Main Frequency Through Pulse... 69

3.2.5 Setting Main Frequency Through Multi-reference..... 69

3.2.6 Setting Main Frequency Through Simple PLC..... 72

3.2.7 Setting Main Frequency Through PID..... 75

3.2.8 Setting Main Frequency Through Communication..... 81

3.2.9 Selecting Input Method for Auxiliary Frequency Reference..... 82

3.2.10 Setting Channel Selection for Main and Auxiliary Frequency Superposition Reference..... 83

3.2.11 Frequency Reference Limit..... 87

3.2.12 Running Mode When Frequency Reference Is Below Lower Limit..... 88

3.3 Start and Stop Modes..... 88

3.3.1 Start Modes..... 88

3.3.2 Stop Mode..... 91

3.3.3 Acceleration/Deceleration Time and Curve Setting..... 93

3.4 Motor Auto-tuning..... 94

3.5 Control Performance..... 98

3.5.1 V/f Curve Settings..... 98

3.5.2 Output Current (Torque) Limit..... 102
3.5.3 Overvoltage Stall Suppression..... 103
3.5.4 Improving V/f Operation Performance.. 105
3.5.5 Speed Loop..... 106
3.5.6 Slip Adjustment in Vector Control Mode..... 107
3.5.7 Overexcitation in Vector Control Mode..107
3.5.8 Torque Limit..... 107
3.5.9 Torque Control..... 109
3.5.10 Descriptions of Current Loop Parameters..... 112
3.5.11 Improving Field Weakening Area Performance..... 112
3.5.12 Operation and Performance Improvement in FVC Mode..... 113
3.5.13 Auxiliary Control Parameters..... 116
3.5.14 Encoder Signal Processing..... 116
3.6 Protection Functions..... 117
3.6.1 Startup Protection..... 117
3.6.2 Motor Overload Protection..... 117
3.6.3 Phase Loss Protection..... 119
6.6.4 Fault Reset..... 120
3.6.5 Fault Protection Action Selection..... 121
3.6.6 Motor Overheat Protection..... 123
3.6.7 Power Dip Ride-through..... 124
3.6.8 Load Loss Protection..... 125
3.6.9 Overspeed Protection..... 126
3.6.10 Protection Against Excessive Speed Deviation..... 126
3.6.11 Undervoltage and Overvoltage Threshold and Fast Current Limit Protection..... 126
3.6.12 Short Circuit to Ground Detection..... 126
3.7 Monitoring..... 127
3.8 Input/Output Terminals..... 136
3.8.1 DI Functions..... 137
3.8.2 DO Functions..... 142
3.8.3 Virtual DI Functions..... 145
3.8.4 AIs..... 147
3.8.5 AOs and Pulse Output Terminals..... 148
3.9 Auxiliary Functions..... 150
3.9.1 Jog..... 150
3.9.2 Jump Frequency, Dead-Zone Time of Forward/Reverse Run Switchover, and Reverse Run Prohibition..... 151
3.9.3 User-defined Parameters..... 154
3.9.4 Frequency Detection (FDT)..... 154
3.9.5 Detection Frequency Amplitude..... 155
3.9.6 Frequency for Acceleration/Deceleration Time Switchover..... 155
3.9.7 Detection Frequency..... 156
3.9.8 Zero Current Detection..... 157
3.9.9 Output Current Overlimit..... 157
3.9.10 Detection Current..... 158
3.9.11 Timing Function..... 158
3.9.12 AI1 Input Voltage Upper/Lower Limit.. 159
3.9.13 Module Temperature..... 159
3.9.14 Cooling Fan..... 160
3.9.15 Hibernation and Wakeup..... 160
3.9.16 Current Running Time Reach..... 160
3.9.17 Emergency Stop Deceleration Time.... 161
3.10 Positioning control..... 161
3.10.1 Group B3: Pulse Synchronization Function Parameters..... 161
3.10.2 Group B4: Position Control Function Parameters..... 165
3.10.3 Group B5: Multi-position Reference Parameters..... 191
3.10.4 Group U2: Position Control Monitoring Parameters..... 197
3.11 DI and DO Functions..... 201
3.11.1 Position Control DI Functions..... 201
3.11.2 Position Control DO Functions..... 203

4 Parameters of the Power Supply Unit..... 204
4.1 Basic Information..... 204
4.2 Parameter Settings of Basic Functions..... 204
4.3 Settings of Information Exchange Between Power Supply Unit and Drive Unit..... 207
4.4 Input Terminal Functions..... 209
4.5 Relay Output Terminal Functions..... 211
4.6 Fault Record Group..... 213
4.7 Parameter Management..... 215
4.8 Monitoring Parameters..... 216

5 Process Application..... 219
5.1 Tension Control..... 219
5.1.1 Control Mode Selection..... 223
5.1.2 Roll Diameter Calculation..... 224
5.1.3 Linear Speed..... 230
5.1.4 Tension Reference..... 231
5.1.5 PID Closed-Loop Adjustment..... 231
5.1.6 Frequency and Torque Limit..... 232
5.1.7 Inertia and Friction Compensation..... 234
5.1.8 Taper..... 239
5.1.9 Pre-charge..... 240
5.1.10 I/O Functions..... 242
5.1.11 Monitoring Parameters..... 243
5.1.12 Function Diagram..... 244
5.2 Wobble Control..... 253

5.3 Fixed Length Control..... 255
5.4 Counting..... 256
5.5 PID Adjustment Methods..... 257
5.6 Synchronization Control..... 260
5.6.1 Speed/Position Synchronization..... 261
5.6.2 Load Distribution..... 263
5.6.3 Droop Control..... 264
5.6.4 Combination of Synchronous Control Modes..... 265

6 Troubleshooting..... 267
6.1. Safety Precautions..... 267
6.2 Troubleshooting During Trial Run of the Drive Unit..... 267
6.3 Fault Display and Solution..... 270
6.4 Fault List and Solution..... 271
6.4.1 Fault List for the Power Supply Unit..... 271
6.4.2 Fault List of the Drive Unit (Non-G53X Models)..... 274
6.4.3 Fault List of the Drive Unit (G53X Models)..... 287
6.5 Common Faults and Solutions..... 299

7. Maintenance and Inspection..... 302
7.1 Routine Inspection..... 303
7.2 Periodic Inspection..... 303
7.2.1 Periodic Check Items..... 303
7.2.2 Insulation Test on the Main Circuit..... 304
7.3 Replacing Fans..... 305
7.3.1 Quantity of Fans..... 305
7.3.2 Removing and Installing Fans..... 307
7.4 Warranty Agreement 316

Appendix A Communication..... 317
A.1 Parameter Communication Address..... 317
A.1.1 MD810 Parameter Introduction..... 317
A.1.2 Descriptions of Parameter Communication Address..... 317
A.1.3 Modbus-specific Parameter Communication Addresses..... 318
A.2 Modbus Communication..... 320
A.2.1 Networking..... 320
A.2.2 Terminal Descriptions..... 321
A.2.3 Communication Performance..... 321
A.2.4 Related Parameters..... 321
A.2.5 Modbus Communication Protocol..... 322
A.2.6 Communication Data Frame Structure. 324
A.3 CANopen/CANlink Communication..... 327
A.3.1 Networking..... 327
A.3.2 Terminal Descriptions..... 327
A.3.3 CAN Bus Topology..... 328
A.3.4 CAN Transmission Distance..... 328
A.3.5 Related Parameters..... 328
A.3.6 Descriptions of CANopen Communication Protocol..... 330
A.3.7 CANopen Communication Protocol..... 338
A.4 PROFIBUS DP Communication..... 341
A.4.1 Networking..... 341
A.4.2 Terminal Descriptions..... 341
A.4.3 Baud Rate and Communication Distance..... 342
A.4.4 Related Parameters..... 342
A.4.5 Descriptions of PROFIBUS DP Communication Protocol..... 342
A.5 EtherCAT Communication..... 353
A.5.1 Networking..... 353
A.5.2 Terminals Descriptions..... 353
A.5.3 Communication Performance..... 354
A.5.4 Related Parameters..... 354
A.5.5 Descriptions of EtherCAT Communication Protocol..... 357
A.6 PROFIBUS DP-to-CANopen Gateway..... 360
A.6.1 Networking..... 360
A.6.2 Terminal Descriptions..... 360
A.6.3 Communication Performance..... 361
A.6.4 Related Parameters..... 361
A.6.5 Fault Descriptions..... 363
A.6.6 Application Descriptions..... 364
A.6.7 CANopen Slave Configuration Description..... 368
A.6.8 PLC Fault Diagnosis..... 370
A.7 PROFINET-to-CANopen Gateway..... 371
A.7.1 PROFINET Introduction..... 371
A.7.2 Configuration Preparations..... 372
A.7.3 Configuring the Process Data on the Drive..... 372
A.7.4 Configurations on the STEP7 376
A.7.5Configuration on the TIA Portal..... 379
A.7.6 Auxiliary Functions..... 381
A.7.7 Error Report and Diagnosis Mechanism381
A.7.8 Monitoring Function..... 382
A.7.9 Configuration of the PN gateway with Siemens PLC S1500..... 382
A.8 Communication Positioning..... 394
A.8.1 Communication Control..... 394
A.8.2 Other Parameter Addresses..... 395

Appendix B Parameter List of the Drive Unit..... 397
B.1 Parameter List of the Drive Unit (Non G53X Models)..... 397

B.2 Parameter List of the Drive Unit (G53X Models)..... 450

Appendix C Parameter List of the Power Supply Unit.....541

Revision History

Date	Version	Description
October 2024	A00	First release

Fundamental Safety Instructions

Safety Precautions

- Read the safety precautions before installing, operating, and maintaining this equipment.
- To ensure personal and equipment safety, follow all safety precautions marked on the product and described in the guide when installing, operating, and maintaining this equipment.
- "CAUTION", "WARNING", and "DANGER" in the user guide only indicate some of the precautions that need to be followed; they just supplement the safety precautions.
- Use this equipment according to the designated environment requirements. Damage caused by improper use is not covered by warranty.
- Inovance shall not be liable for any physical injuries or property loss caused by improper use.

Safety Levels and Definition

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

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

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

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

WARNING

- 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.

CAUTION

- 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 are signs of damage, rust, or bumping on the surface of the equipment or accessories.
- Check whether the package contents are consistent with the packing list before unpacking.

Storage and Transportation

WARNING

- 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 block are secured firmly with screws. Loosely-connected components may fall off and result in personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is being hoisted by the hoisting equipment.
- When hoisting the equipment with a steel rope, ensure the equipment is hoisted at a constant speed without suffering from vibration or shock. Do not turn the equipment over or let the equipment stay hanging in the air. Failure to comply may result in personal injuries or equipment damage.

CAUTION

- Handle the equipment with care during transportation and mind your steps to prevent personal injuries or equipment damage.
- When carrying the equipment with bare hands, hold the equipment casing firmly with care to prevent parts from falling. Failure to comply may result in personal injuries.
- Store and transport the equipment based on the storage and transportation requirements. Failure to comply will result in equipment damage.
- Avoid storing or transporting the equipment in environments with water splash, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing the product for more than 3 months. When the product needs to be stored for an extended period, take more strict protection and necessary inspection.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport the equipment with other equipment or materials that may harm or have negative impacts on this equipment.

Installation

DANGER

- The equipment must be operated only by professionals with electrical knowledge. Non-professionals are not allowed.

WARNING

- Read through the guide and safety instructions before installation.
- Do not install 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 equipments with strong electromagnetic interference, such as a transformer, install a shielding equipment 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 the installation is completed, remove the protective guard. Failure to comply will block the vent and affect heat dissipation, causing overheat of the product.
- 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. Measure the direct voltage of the main circuit and ensure that the voltage is within the safety range. Failure to comply will result in an electric shock.
- 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 electric shock.

WARNING

- Do not connect the input power supply to the output end of the equipment. Failure to comply will result in equipment damage or even a fire.
- When connecting a drive to the motor, check that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Cables used for wiring must meet cross sectional area and shielding requirements. The shield of the cable must be reliably grounded at one end.
- 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 an electric shock or equipment damage.

Power-on

DANGER

- Before power-on, check that the equipment is installed properly with reliable wiring and the motor can be restarted.
- Before power-on, make sure that the power supply meets product requirements to prevent product damage or even 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.

Operation

DANGER

- The equipment must be operated only by professionals. Failure to comply can result in death or personal injury.
- Do not touch any connecting terminals or disassemble any unit or component of the equipment during operation. Failure to comply can result in an electric shock.

WARNING

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

Maintenance

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals.
- Do not perform maintenance with power ON. Failure to comply can result in electric shock.
- Before maintenance, disconnect 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. Failure to comply will result in an electric shock.

WARNING

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

Repair

DANGER ◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed only by professionals. ◆ Do not repair the equipment with power ON. Failure to comply can result in electric shock. ◆ Before inspection and repair, disconnect 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 earth leakage current breaker (ELCB) trips, wait for at least the time designated on the equipment warning label before power-on or further operations. Failure to comply may result in death, personal 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 use 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 injuries, or even death. ◆ Recycle retired equipment by observing industry waste disposal standards to avoid environmental pollution.

Safety Labels

To guarantee safe operations and maintenance of the equipment, follow the safety labels on the equipment. Do not damage or remove the safety labels. The following table describes the meaning of the safety labels.

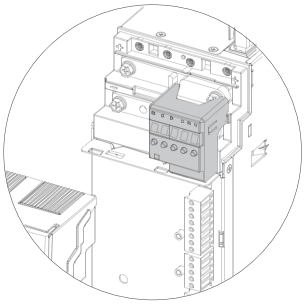
Safety Label	Description
	◆ Read through the safety instructions before operating the equipment. Failure to comply may result in death, personal injuries, or equipment damage. ◆ Do not touch the terminals or remove the cover with power ON or within 10 min after power-off. Failure to comply will result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

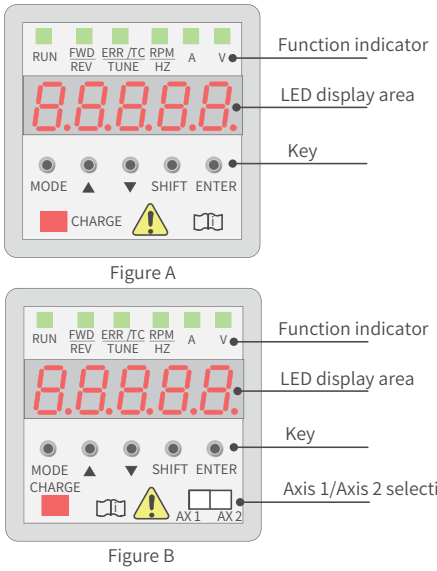
1 Commissioning Tools

The commissioning tools of the MD810 AC drive mainly include the LED keypad, the external LCD operating panel, and the commissioning software.

1.1 LED Keypad

The LED keypad is used to set/modify parameters, monitor the status of the power supply unit and the drive unit, and automatically tune motor parameters. The following figure shows the appearance and keys of the LED keypad.





Note:
Figure A shows the single-axis LED keypad.
Figure B shows the dual-axis LED keypad.

Figure 1-1 Appearance and keys of the LED keypad

1.1.1 Indicators

In the following table, indicates "on", indicates "off", and indicates "blinking".

Table 1-1 Indicator descriptions

Indicator Status		Description
RUN Operation indicator	RUN	Off: Stop
	RUN	On: Running
FWD/REV Forward/Reverse operation indicator	FWD/REV	Off: Forward operation
	FWD/REV	On: Reverse operation

Indicator Status		Description
ERR/TC/TUNE Fault/Torque control/Auto-tuning indicator		Off: Speed control mode
		On (green): Torque control mode
		Blinking one time per second (green): Auto-tuning
		Blinking four times per second (red): Faulty state
		Speed/Frequency unit: rpm/Hz
		Current unit: A
		Voltage unit: V
		Parameter unit: %

1.1.2 LED Display

The LED keypad provides 5-digit LED display to indicate the frequency reference, output frequency, various monitoring data, and fault codes.

Table 1-2 LED display and actual data

LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data	LED Display	Actual Data
0	0	7	7	d	D	o	o
1	1	8	8	E	E	P	P
2	2	9	9, g	F	F	r	R
3	3	A	A	H	H	T	T
4	4	b	B	J	J	U	U
5	5, S	C	C	L	L	u	u
6	6	c	c	n	N		

1.1.3 Keys

Table 1-3 Functions of the keys

Key	Name	Function
	Programming key	Enter or exit menus, and switch parameter query modes.
	Increment key	Increase the data or parameter.
	Decrement key	Decrease the data or parameter.
	Shift key	Select the displayed parameters in turn in the stop or operation state, and select the digit to be modified when modifying parameters.
	Confirmation key	Enter the menu interfaces level by level, and confirm the parameter setting.

Key	Name	Function
AX1 AX2	AX1/AX2 selection key	Select AX1 (axis 1) or AX2 (axis 2) as the main axis. By default, AX1 is selected. This key is available only for the drive unit.

1.1.4 Parameter View and Modification Methods

The LED keypad uses a three-level menu structure to support operations such as parameter settings. After entering a menu, you can press ▲ or ▼ to modify the flashing bit of the displayed value. The following figure shows the operation flowchart.

Figure 1-2 Operation procedure of the three-level menu

Example: Change the value of F3-02 from 10.00 Hz to 15.00 Hz.

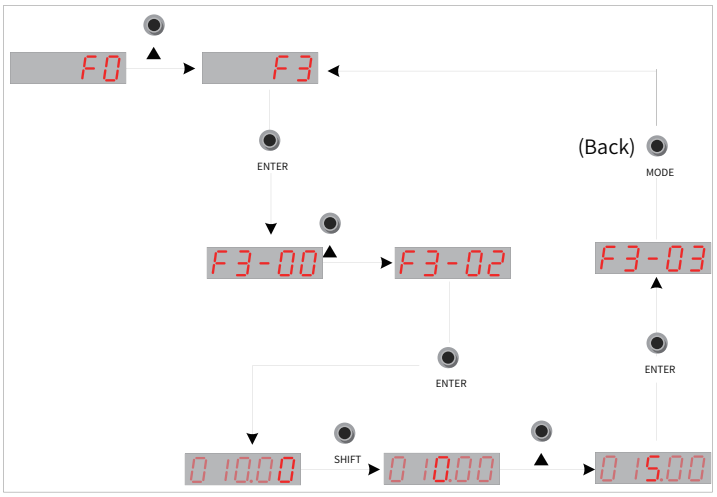


Figure 1-3 Parameter modification

a) You can press MODE or ENTER to back to a level-2 menu when performing operations in a level-3 menu . The difference between the two keys is as follows:

Pressing ENTER is to save a set parameter and then back to a level-2 menu and automatically shift to the next parameter. Pressing MODE is to give up the current parameter modification and directly back to the level-2 menu of the current parameter No.

b) If a parameter does not include a flashing digit in a level-3 menu, the parameter cannot be changed. There are two possible reasons:

(1) The parameter is an unmodifiable parameter such as the drive type, actual measurement, and running record.

(2) The parameter cannot be modified when the AC drive is in the running status. You can modify these types of parameters only when the AC drive is in the stop status.

1.1.5 Parameter View

The keypad supports three modes for viewing parameters. The basic mode is enabled by default, in which all parameters are listed for viewing. You can switch to other quick-view modes by setting FP-03 as needed.

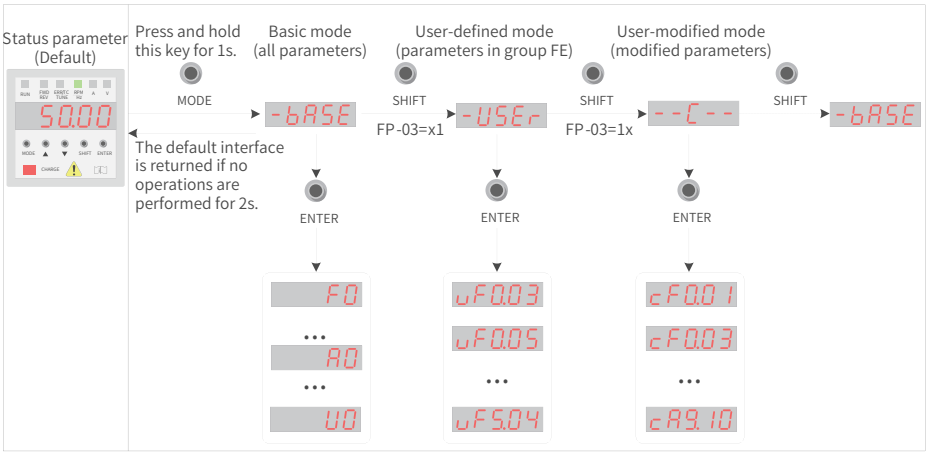


Figure 1-4 Parameter view methods

As shown in the preceding figure, the parameter display form such as uF3.02 in the customized mode menu indicates the parameter F3-02. The method of modifying parameters in the customized menu is the same as that in the ordinary programming state. You can view the following types of parameters.

Parameter Type	Display	Description
User-defined parameters	-USEr	You can view user-defined parameters.
User-modified parameters	--C--	You can view parameters different from defaults.
All parameters	-bASE	You can view all parameters.

◆ Basic view method

The basic parameter list includes all parameters of the drive. You can query or modify these parameters by using the method described in “1.1.4 Parameter View and Modification Methods”. Press MODE on the keypad to switch display of the three types of parameters. After entering parameter groups, you can view or modify parameters in the same way as described in

"1.2 External LCD Operating Panel".

◆ Quick view method

To view user-defined parameters or user-modified parameters, set FP-03 to 11.

Parameter Code	Parameter Name	Default	Value Range	Description
FP-03	Display of function parameter groups	11	Ones: Display of the -USEr group 0: Not displayed 1: Displayed Tens: Display of the --C-- group 0: Not displayed 1: Displayed	This parameter determines whether to display user-defined parameters and user-modified parameters.

◆ Viewing user-defined parameters

Long press MODE on the keypad to enter the "user-defined parameter" mode -USEr and view user-defined parameters.

Method of defining parameters: You can define up to 32 commonly used parameters in group FE (FE-00 to FE-31). There are 16 user-defined parameters (FE-00 to FE-15) in group FE by default. You can modify these default parameters as required. If a parameter in group FE is set to F0.00, no user-defined parameter is configured.

If nNULL is displayed when you long press MODE to enter a menu, the user-defined menu is empty. The following table shows the default parameters in a user-defined menu.

Table 1-4 Commonly-used parameters in the user-defined menu

Parameter Code	User-defined Parameter	Name	Parameter Code	User-defined Parameter	Name
FE-00	F0-01	Control mode	FE-01	F0-02	Operation command source
FE-02	F0-03	Main frequency reference input selection	FE-03	F0-07	Frequency source superposition
FE-04	F0-08	Preset frequency	FE-05	F0-17	Acceleration time
FE-06	F0-18	Deceleration time	FE-07	F3-00	V/f curve setting
FE-08	F3-01	Torque boost	FE-09	F4-00	DI1 function selection
FE-10	F4-01	DI2 function selection	FE-11	F4-03	DIO1 function selection
FE-12	F5-04	DO1 function selection	FE-13	F5-07	AO function selection
FE-14	F6-00	Start mode	FE-15	F6-10	Stop mode

◆ Viewing user-modified parameters

Long press MODE on the keypad to enter the "user-modified parameter" mode --C-- and view parameters different from defaults.

This mode allows you to access modified parameters quickly. The list of user-modified parameters include user-modified parameters that are set to values different from defaults. The list of user-modified parameters is automatically generated by the drive.

◆ Viewing state parameter

In the stop or operation state, you can view multiple status parameters by switching every bit of F7-03, F7-04, and F7-05 through the key SHIFT on the keypad.

In the operation state, 32 operating status parameters are available. F7-03 (Parameter 1 displayed during operation) and F7-04 (Parameter 2 during operation) determine whether to display the parameter corresponding to each binary bit. In the stop state, 13 stop status parameters are available. F7-05 (Parameter displayed at stop) determines whether to display the parameter corresponding to each binary bit.

Example

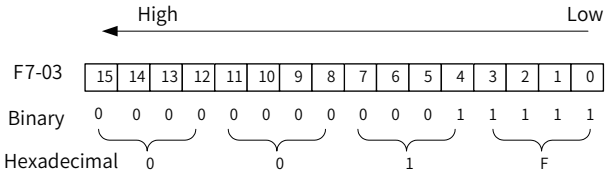
To view parameters (such as running frequency, bus voltage, output voltage, output current, output power, and PID settings) in the running state through the keypad, do as follows:

1. Each bit of F7-03 (Parameter 1 displayed during operation) corresponds to one parameter. Set the corresponding bit to 1.

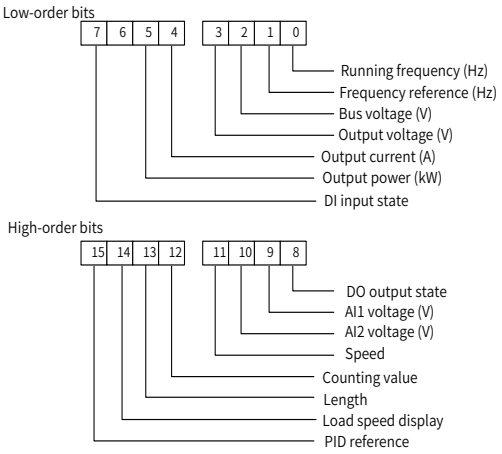
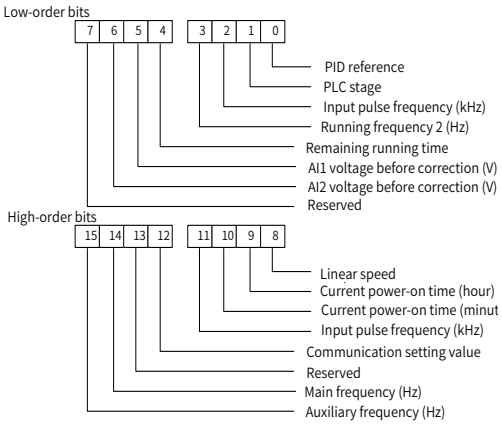
2. Convert the binary value to a hexadecimal value and set F7-03 to this hexadecimal value. Use the keypad to set the value that is displayed as

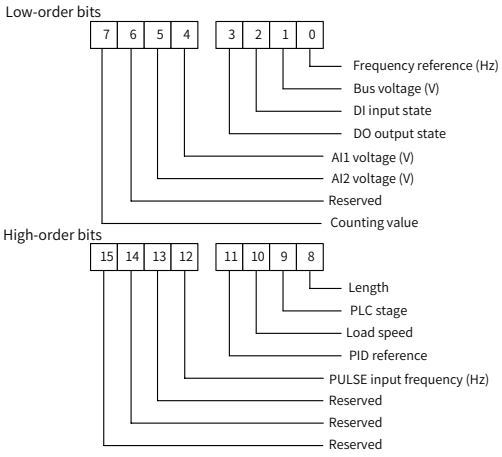
.

3. View related parameter values by switching every bit of F7-03 through the key SHIFT on the keypad. The following figure shows the setting.



You can view other state parameters in the same way as F7-03. The following table describes the relationship between the state parameters and bits of F7-03, F7-04, and F7-05.

Parameter Code	Parameter Name	Default	Value Range	Description
F7-03	Parameter 1 displayed during operation	1F	0000 to FFFF	If a parameter needs to be displayed during running, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-03 to the hexadecimal number.  Note: The parameters with shading are displayed by default.
F7-04	Parameter 2 displayed during operation	0	0000 to FFFF	If a parameter needs to be displayed during running, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-04 to the hexadecimal number. 

Parameter Code	Parameter Name	Default	Value Range	Description
F7-05	Stop display parameter	0	0000 to FFFF	If a parameter needs to be displayed when the AC drive stops, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-05 to the hexadecimal number.  Note: The parameters with shading are displayed by default.

NOTE

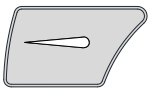
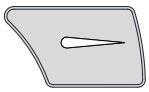
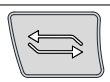
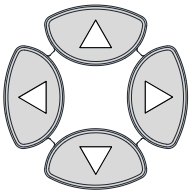
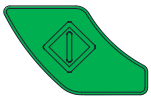
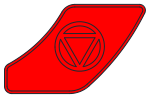
- When the drive is powered off and powered on again, the parameters that are selected before power-off are displayed.

1.2 External LCD Operating Panel

The external LCD operating panel (model SOP-20) is a new-generation commissioning tool of Inovance for the AC drive. Supporting a wide power supply range and multi-bus, the operating panel applies to single-drive/multi-drive systems. It provides various functions such as parameter settings, state monitoring, simple oscilloscope, parameter copy, fault analysis and locating, program download, and USB relay.

1.2.1 Appearance and Interface

Figure 1-5 Appearance of the external LCD operating panel

Name	Key	Function Description
Left soft key		It is used to select the menu displayed in the lower left corner of the screen.
Right soft key		It is used to select the menu displayed in the lower right corner of the screen.
Shift key		It is used to quickly enter the equipment list page. On some interfaces where operations cannot be interrupted, the quick model switchover function is disabled and this key is invalid.
Direction keys		The up and down arrow keys are used to select options in a menu or list, scroll up and down a text page, and adjust a value (such as setting time, inputting a password or changing a parameter value). The left and right keys are used to move the cursor left and right.
Help key		It is used to open a help interface. A help interface varies with the context (such as the current menu or view). For more information about the help page, see "Help".
Operation key		It is used to start up the drive in the local control mode.
Stop key		It is used to stop the drive in the local control mode. When the equipment is faulty, the stop key is used to reset the equipment.
Loc/Rem switchover key		It is used to switch between the local control mode and the remote control mode.

Main interface display:

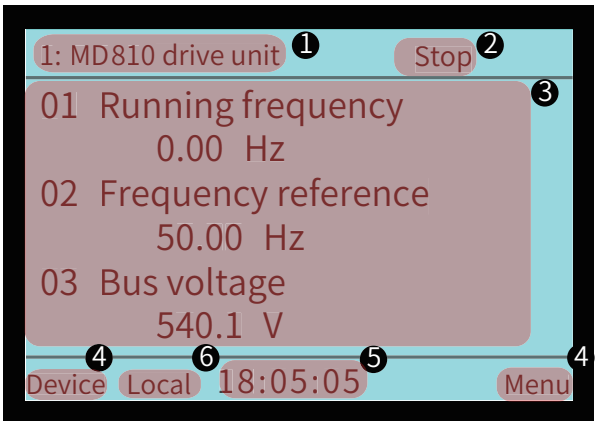


Figure 1-6 Main interface of the external LCD operating panel

❶ Current equipment information: The number in the front is the station No. The following description is a specific equipment name.

❷ Equipment status and fault information: It displays the running status of the current equipment. When the equipment fails, fault information flashes and the running status is not displayed.

❸ Content area: It displays actual content in this area. The content varies with different interfaces. The preceding example view is the main interface.

❹ Soft key: It displays the soft key function in the given context.

❺ Clock: It displays the current time.

❻ Control position (drive unit):

Loc: Local control by using the external LCD operating panel is enabled.

Rem: Remote control by I/O terminal or bus is enabled.

Blank: This function is unavailable on the equipment.

1.2.2 Wiring

To implement commissioning, connect the RJ45 interface at the back of the external LCD operating panel to the RJ45B interface at the top of the MD810 drive unit or power supply unit using a standard network cable. The following figure shows the interface of the MD810 drive unit or power supply unit.

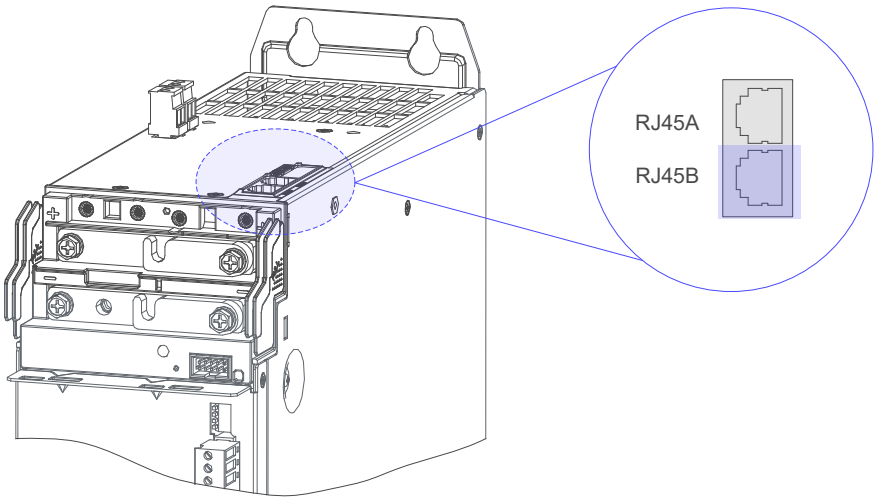


Figure 1-7 Connection between the LCD operating panel and unit

NOTE

- The preceding figure takes the single-axis unit (100-mm width) as an example. The RJ45 interface position may vary depending on models.

1.2.3 Status View

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

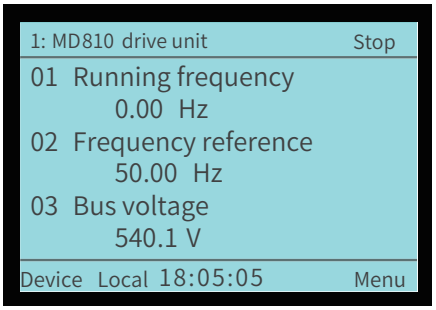
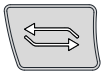
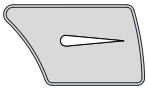


Figure 1-8 Status interface

Press  to enter the equipment list interface. Press and to move the cursor. After selecting the equipment to be viewed, press  to enter the status interface of the equipment.

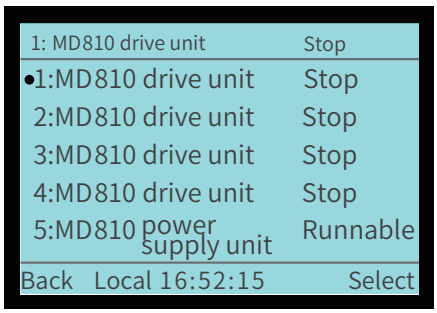
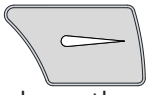


Figure 1-9 Equipment list interface

1.2.4 Parameter Settings

Press  in the main interface to enter the parameter setting interface. The following figure shows the setting procedure.

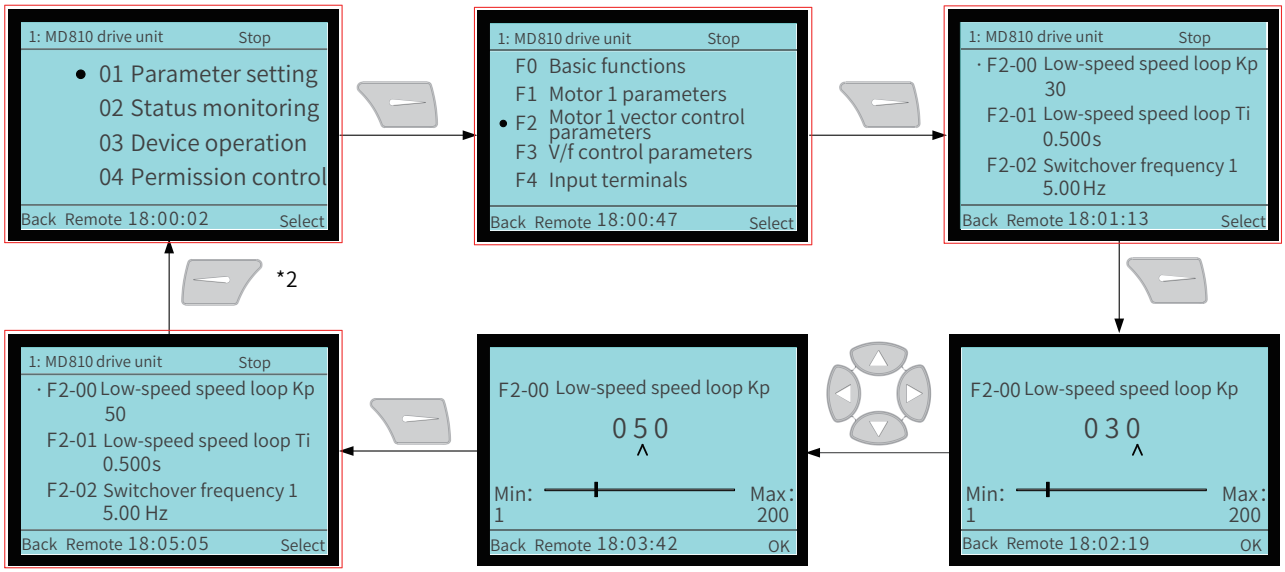
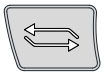


Figure 1-10 Parameter setting

NOTE

- To set parameters of other equipment, press  on an interface with the box to directly enter the equipment list page and select the equipment.

1.2.5 Auto-tuning (Drive Unit)

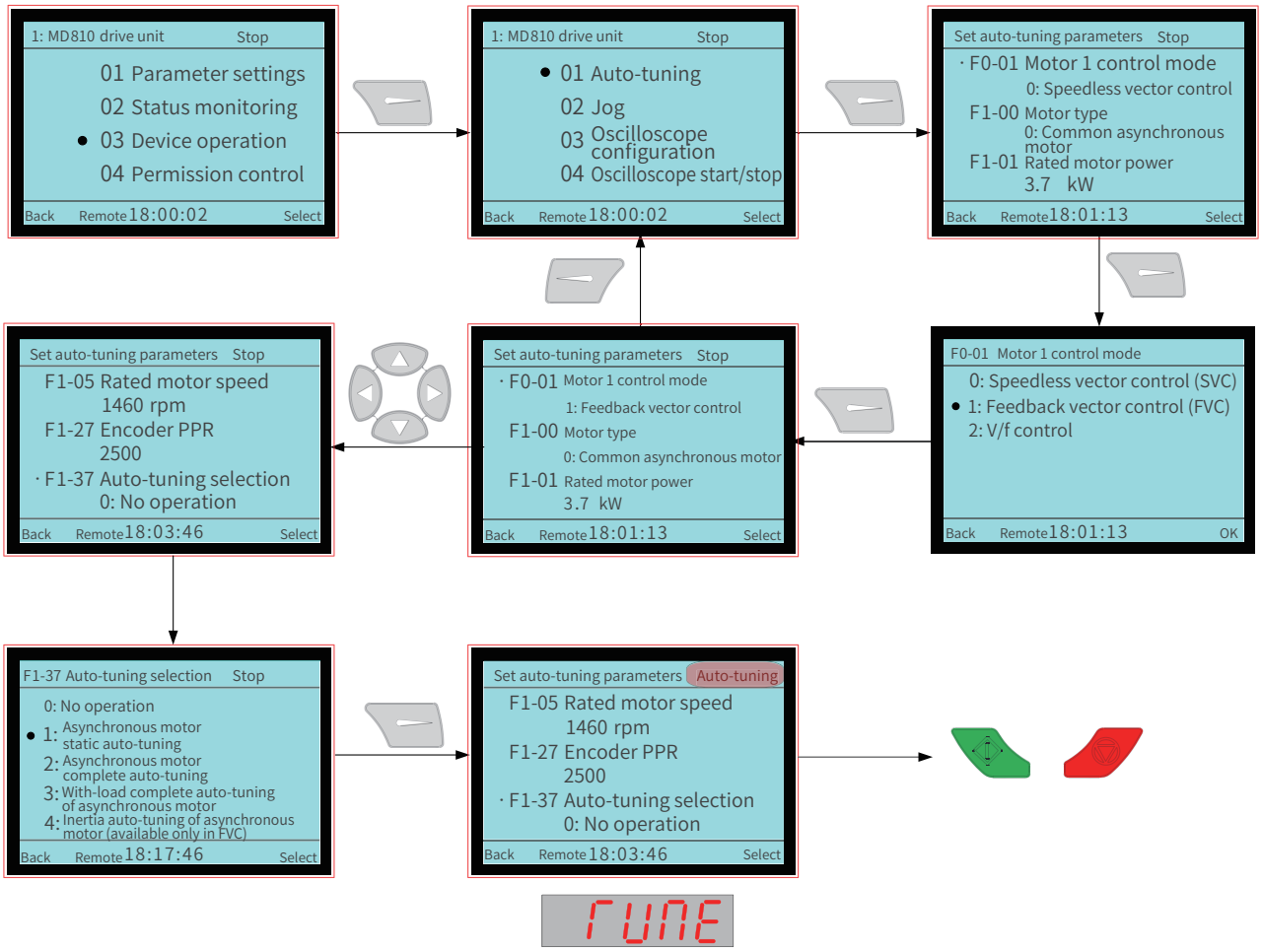


Figure 1-11 Auto-tuning

NOTE

- To set the auto-tuning function of other equipment, press on an interface with the box to directly enter the equipment list page and select the equipment.

1.2.6 Jogging (Drive Unit)

The jogging function of the motor can be implemented by pressing the operation key and the stop key only in the local control mode.

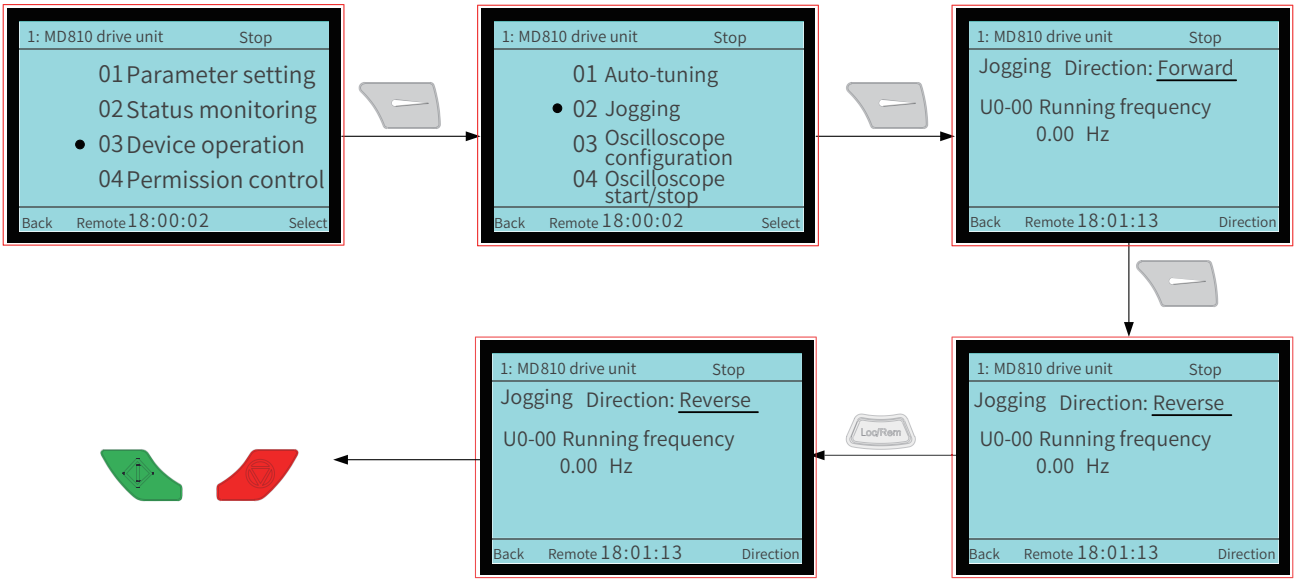


Figure 1-12 Jogging

NOTE

- To set the jogging function of other equipment, press on an interface with the box to directly enter the equipment list page and select the equipment.

1.2.7 Parameter Copy

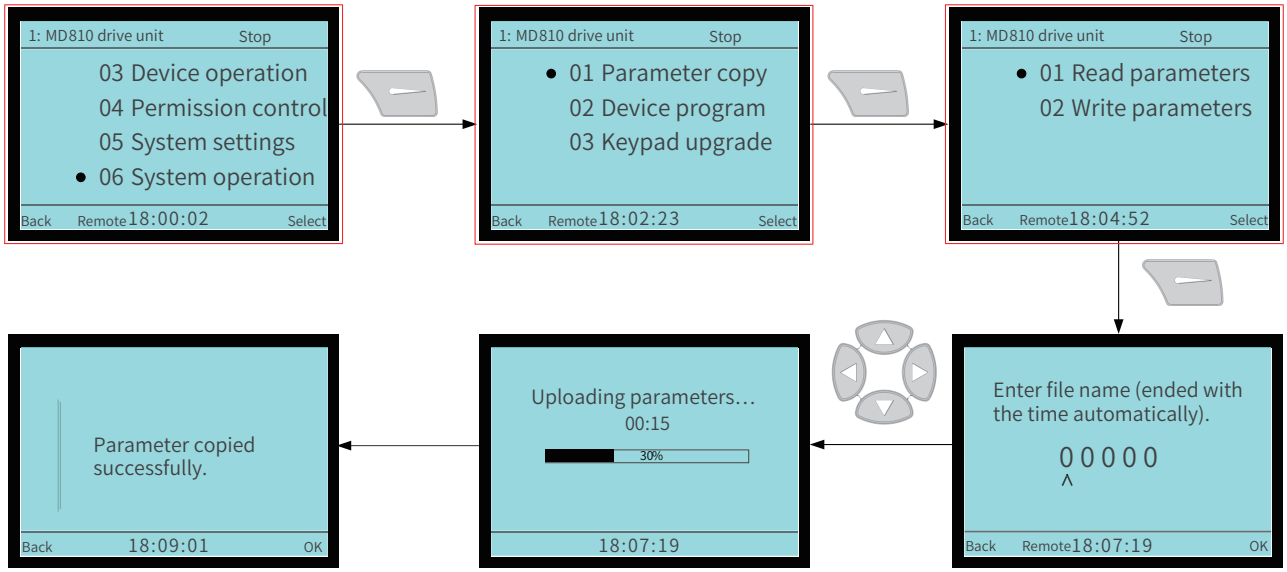


Figure 1-13 Parameter uploading

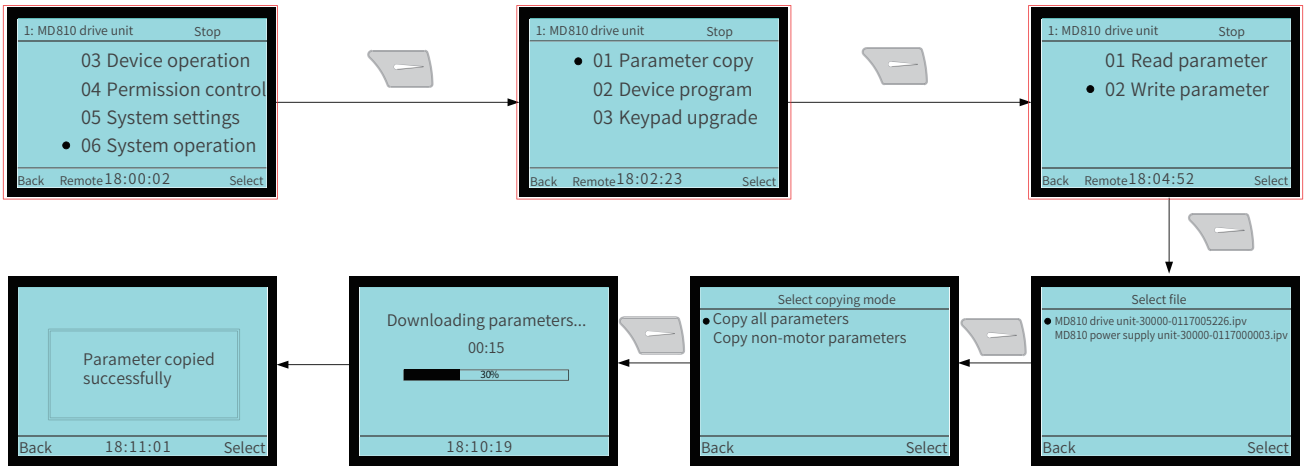


Figure 1-14 Parameter downloading

NOTE

- To perform parameter copy or programing on other equipment, press on an interface with the box to directly enter the equipment list page and select the equipment.

1.2.8 Fault Query

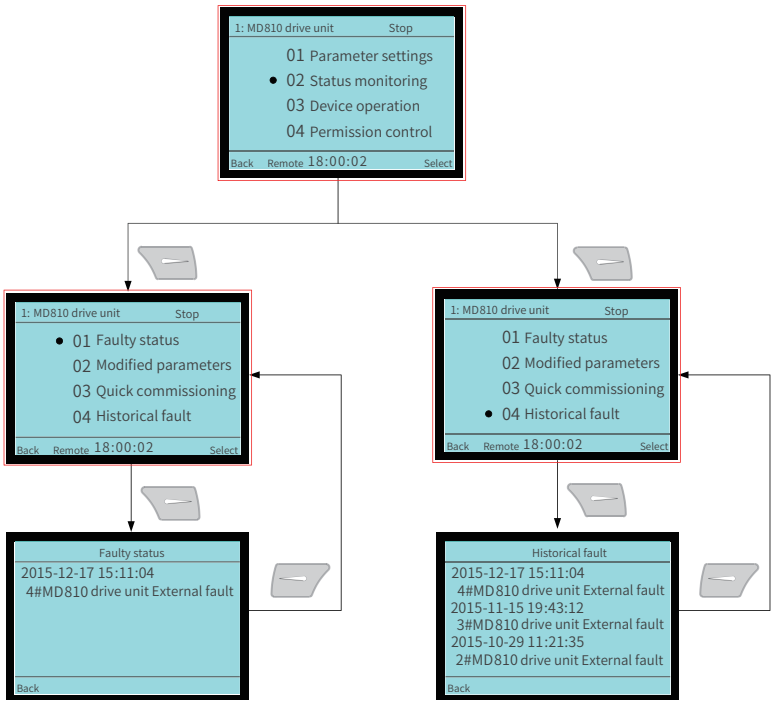


Figure 1-15 Checking faults

NOTE

- The fault state interface displays the current fault information list. The historical fault interface displays the historical fault information list.
- To check faults of other equipment, press on an interface with the box to directly enter the equipment list page and select the equipment.

1.3 InoDriverShop

The InoDriverShop, a commissioning software tool developed for MD810, supports real-time monitoring on the drive, parameter configuration, oscilloscope, and emergency stop through the PC. The commissioning process is as follows.

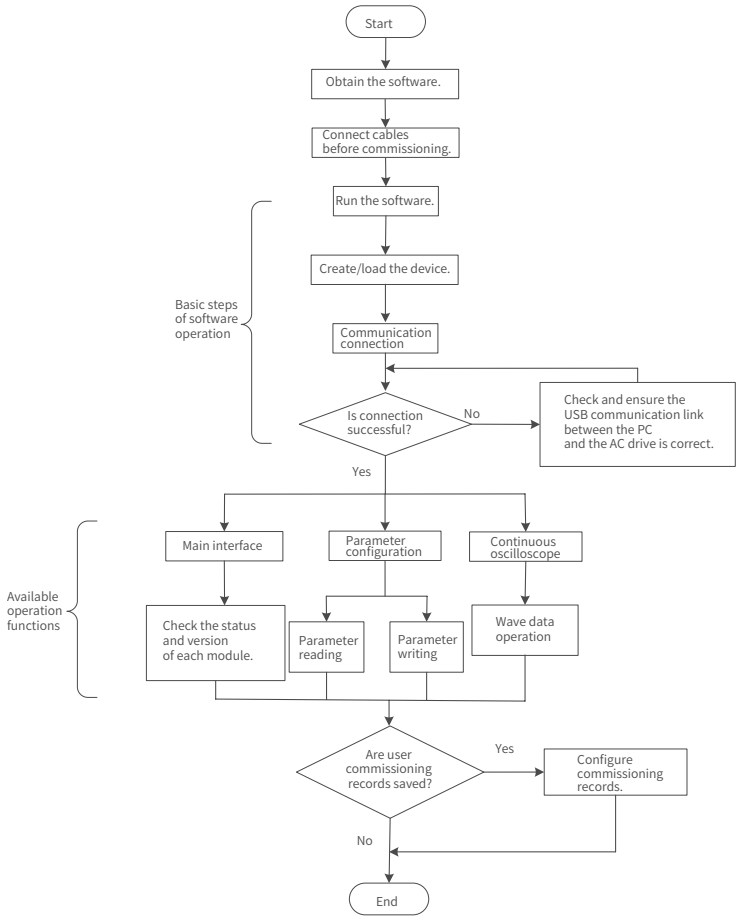


Figure 1-16 Commissioning process through InoDriverShop

1.3.1 Software Acquisition

You can obtain the InoDriverShop installation package in the following ways for free:

- From Inovance agents

- From Service and Support > Downloads interface at Inovance official website (www.inovance.com)

Note: Products and documents are under continuous improvement. Update the software version as needed.

1.3.2 Wiring Before Commissioning

Before running the InoDriverShop, ensure that the USB communication link between the drive and the PC is properly connected.

- Connection through the external LCD operating panel (SOP-20)

Use the USB cable to connect the mini USB port on the SOP-20 external operating panel (optional) to the host controller. Connect the RJ45 port on the back of the SOP-20 to that on the power supply unit (or drive unit), as shown in the following figure.

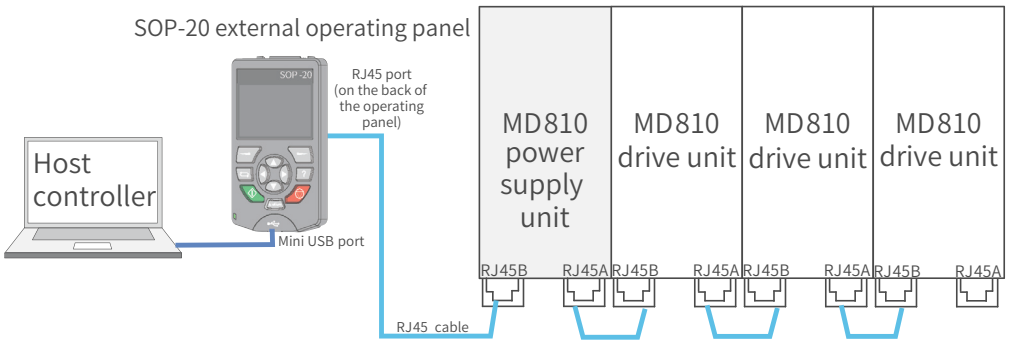


Figure 1-17 Software commissioning connection through the SOP-20

- Connection through Inolink

Use the USB cable to connect the mini USB port on the Inolink (optional) to the host controller. Connect the RJ45 port on the back of the Inolink to that on the power supply unit (or drive unit), as shown in the following figure.

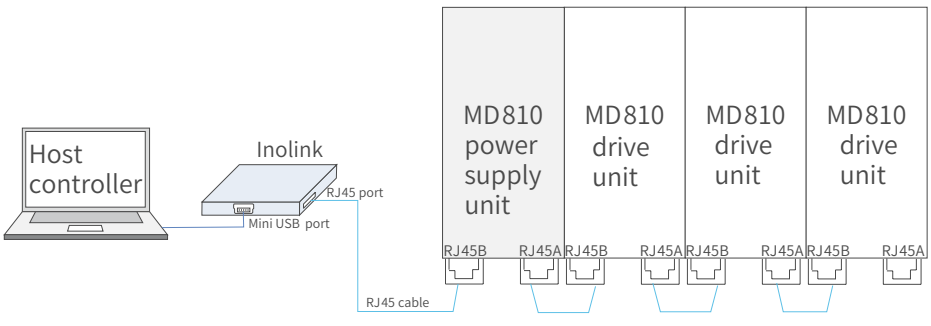


Figure 1-18 Software commissioning connection through Inolink

1.3.3 Basic Procedure for Software Running

The following figure describes the main interface of the InoDriverShop. For details on how to use the InoDriverShop, obtain the InoDriverShop Software Operation Guide in the help menu of the InoDriverShop.

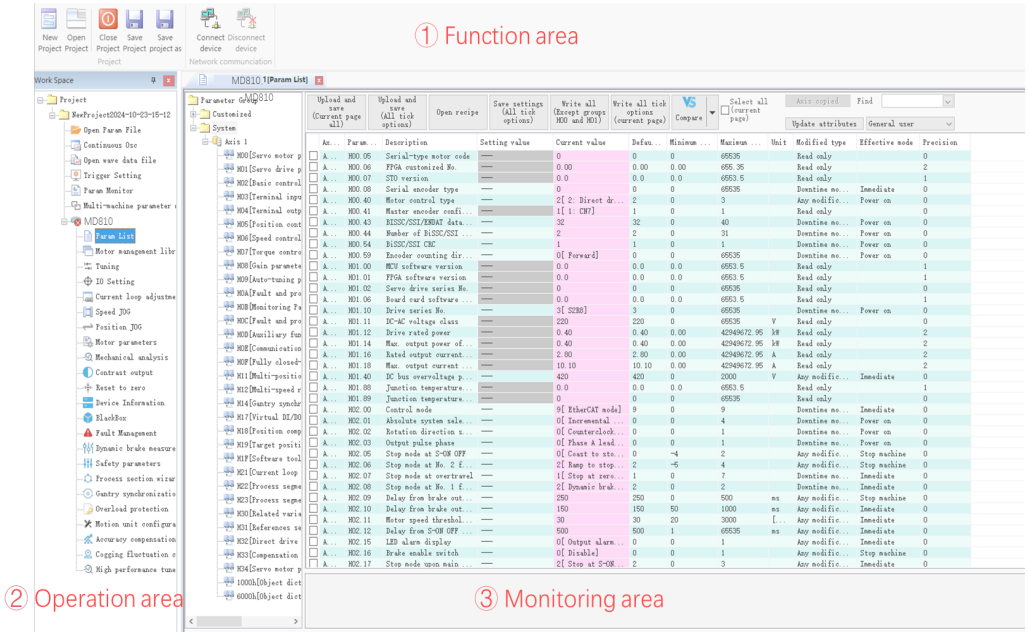


Figure 1-19 Main interface of the InoDriverShop

2 Basic Operations and Trial Run

This chapter introduces the basic commissioning procedure of the AC drive, including setting the frequency reference and starting and stopping the AC drive, based on which you can conduct a trial run to control the motor by using the AC drive.

2.1 Quick Commissioning Flowchart

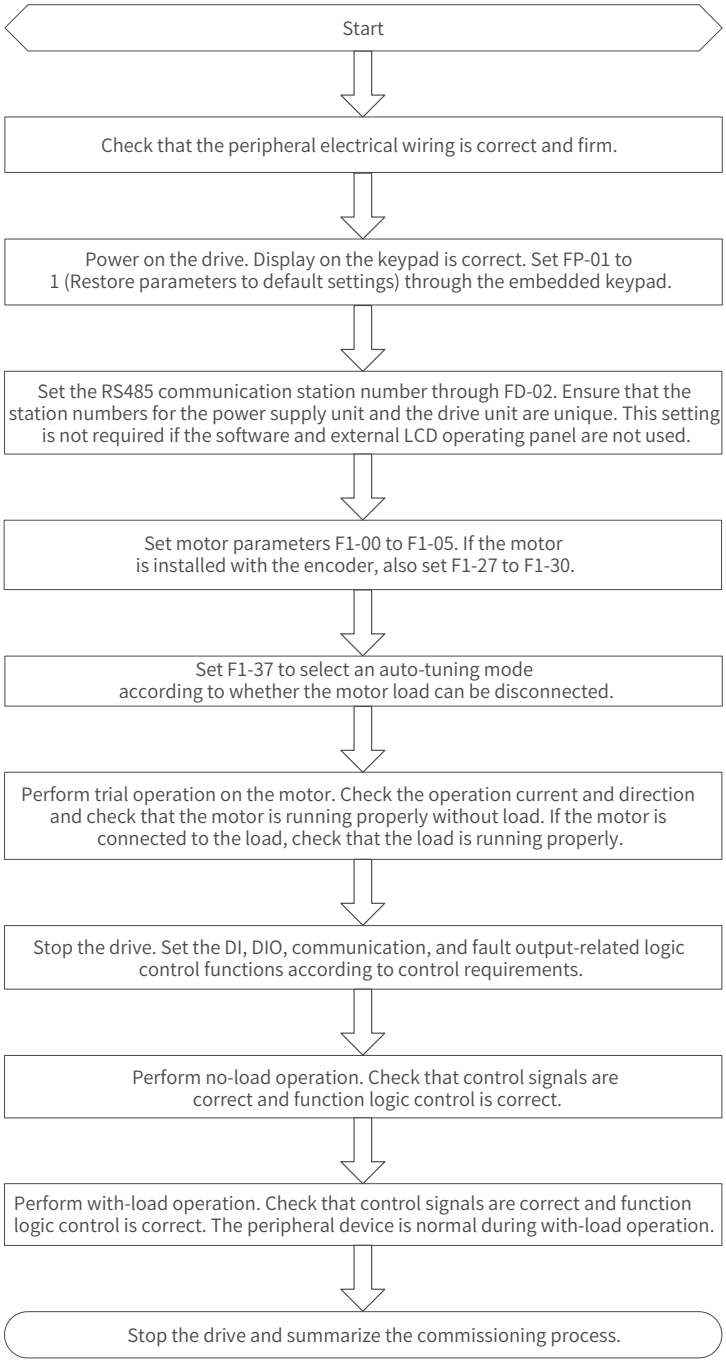


Figure 2-1 Quick commissioning flowchart

2.2 Detailed Commissioning Flowchart

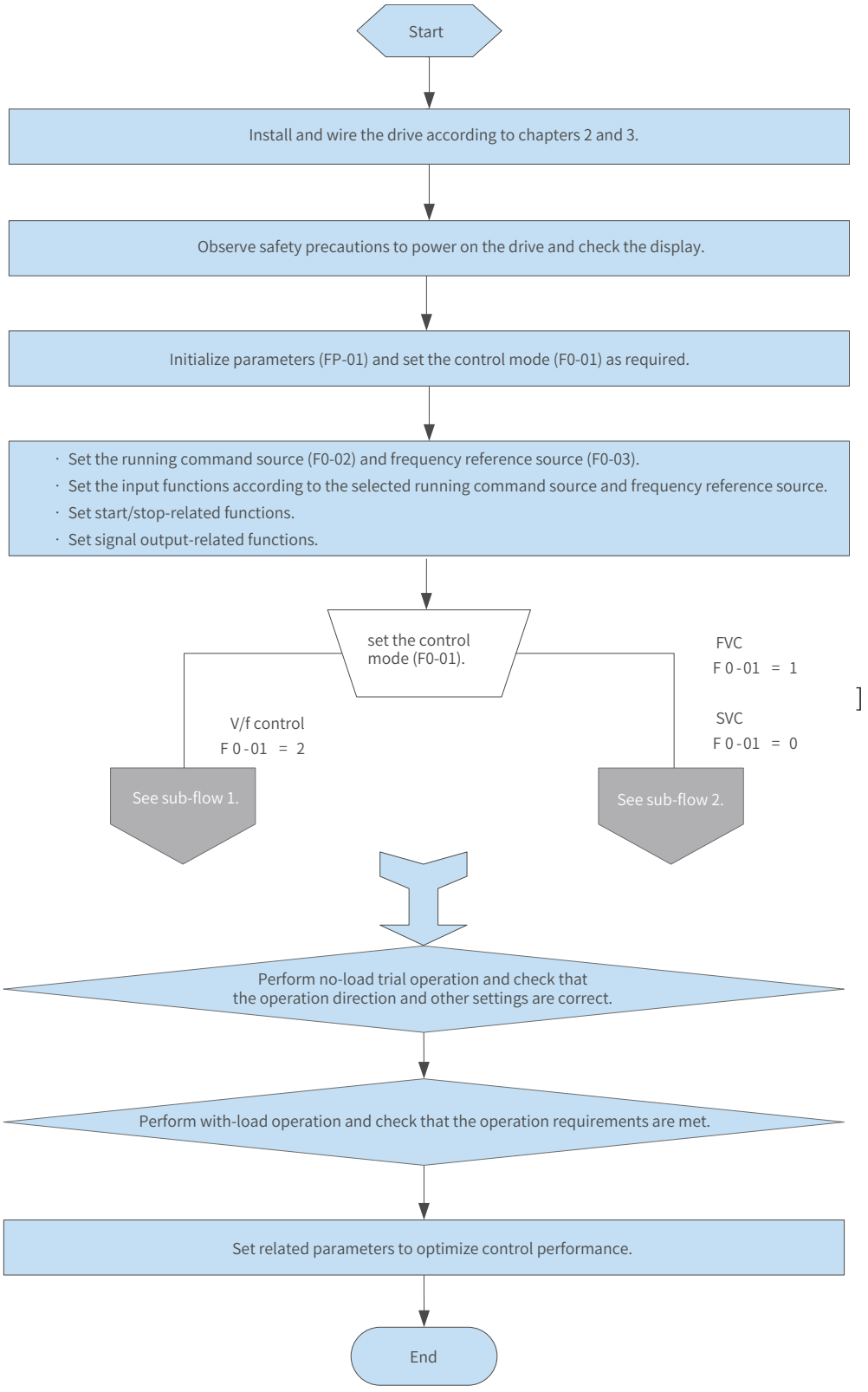


Figure 2-2 Overall commissioning flowchart

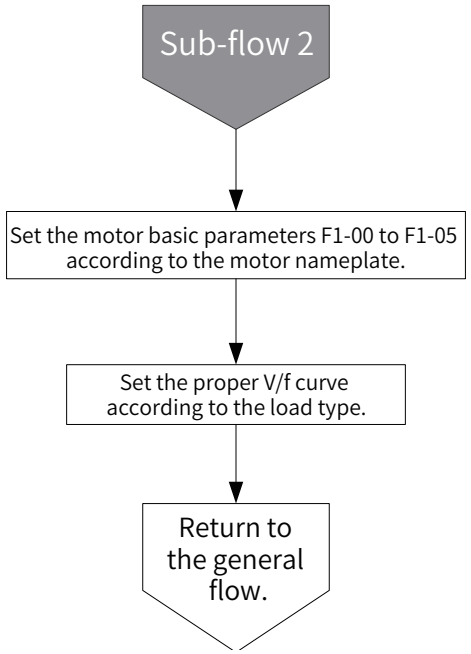


Figure 2-3 Commissioning sub-flowchart (V/f control mode)

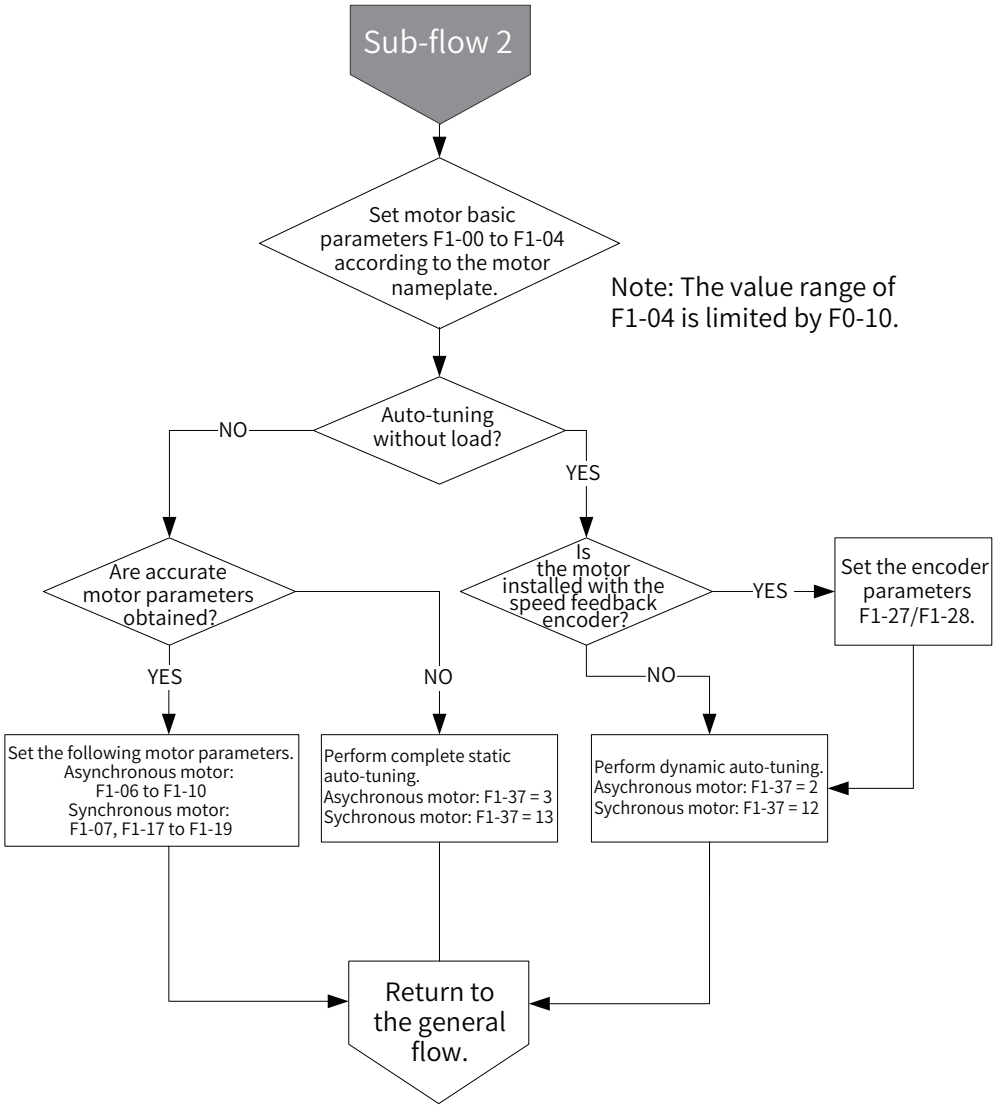


Figure 2-4 Commissioning sub-flowchart (vector control mode)

2.3 Precautions Before Power-on

Check the following items before power-on.

Item	Description
Power supply voltage	Check that the power supply voltage is correct (380 VACto 480 VAC, 50 Hz/60 Hz (47 Hz to 63 Hz)).
	Check that the power supply input terminals (R/S/T) are connected properly.
	Check that the drive and the motor are grounded properly.
Connection between the drive output terminals and motor terminals	Check that the drive output terminals U, V, and W are firmly connected to the motor terminals.
Connection of control circuit terminals	Check that the drive control circuit terminals are firmly connected to other control devices.
Control terminal status	Check that the drive control circuit terminals are in the OFF state (that is, the drive is not running).
Load	Check that the motor is in no-load status and unconnected to the mechanical system.

2.4 Status Display After Power-on

After power-on, the keypad displays the following information.

Status	Display	Description
Normal		The digital setting 50.00 Hz is displayed by default.
Faulty		When a fault occurs, the drive is in the stopped state and the fault type is displayed.
Warning		The drive encounters a warning. If it is not handled timely, a fault may be incurred.

2.5 Parameter Initialization

The function of parameter initialization is used to restore the drive settings to defaults. After initialization is done, FP-01 is set to 0 automatically.

Parameter Code	Parameter Name	Value Range	Default
FP-01	Parameter initialization	0: Disable 1: Restore parameters excluding motor parameters to default settings 2: Clear records 4: Back up current user parameters 501: Restore user parameters from backup	0

1: Restore parameters excluding motor parameters to default settings

When FP-01 is set to 1, all parameters are restored to default settings except motor parameters, frequency reference resolution (F0-22), maximum frequency (F0-10), fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), cumulative power consumption (F7-14), and heatsink temperature of the drive unit (F7-07).

2: Clear records

The fault records, cumulative running time (F7-09), cumulative power-on time (F7-13), and cumulative power consumption (F7-14) are cleared.

4: Back up current user parameters

The current parameter setting is backed up, helping you to restore the setting after performing incorrect parameter setting.

501: Restore user backup parameters

The user parameter setting that is backed up previously (FP-01 =4) can be restored.

2.6 Motor Control Modes

Parameter Code	Description	Application
F0-01	F0-01 = 0: Sensorless vector control (SVC)	It indicates open-loop vector control mode, which is applicable to high-performance control applications where 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.
	F0-01 = 1: Feedback vector control (FVC)	It indicates closed-loop vector control mode. An encoder must be installed for a motor, and the MD810 supports the ABZ incremental encoder and 23-bit encoder. 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.
	F0-01 = 2: Voltage/ frequency control (V/ f)	It indicates the speed open-loop control mode, which is applicable to scenarios without high requirements on load control performance, such as fans and pumps. In this mode, one AC drive can control multiple motors.

2.7 Main Frequency Source

Parameter Code	Parameter Name	Value Range	Default
F0-03	Main frequency source	0: Digital setting (preset frequency F0-08 modified by the UP or DOWN key, non-retentive at power failure) 1: Digital setting (preset frequency F0-08 modified by the UP or DOWN key, retentive at power failure) 2: AI1 3: AI2 4: Reserved 5: Pulse setting (DIO1) 6: Multi-reference 7: PLC 8: PID 9: Communication 10: Synchronization control	0

2.7.1 Digital Setting Through LED Keypad

F0-03 = 0: Digital setting (non-retentive at power failure)

The initial value of the frequency is the value of F0-08 (Preset frequency). The frequency can be changed by using the ▲ and ▼ keys on the keypad or the multi-functional input terminal functioning as the UP/DOWN key. When the AC drive is powered on again after a power failure, the frequency reference is restored to the value of F0-08.

F0-03 = 1: Digital setting (retentive at power failure)

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 ▼ on the keypad or the multi-functional input terminal functioning as the UP/DOWN key remain effective.

2.7.2 Analog Input

The MD810 control board provides two analog input terminals (AI1 and AI2).

Table 2-5 Characteristics of the AI

Terminal	Name	Type	Input Range	Input Impedance
AI1-GND[1]	Control board AI1	Voltage type	–10 VDC to +10 VDC10V	22 kΩ
AI2-GND[1]	Control board AI2	Voltage type[2]	0 VDC to 10 VDC	22 kΩ
		Current type[2]	0 mA to 20 mA	500 Ω (F4-40 = 1) 250 Ω (F4-40 = 2)

[1]: For details on terminal wiring, see MD810 Series AC Drive (Multi-drive System) Hardware Guide.

[2]: You can set F4-40 to select voltage input or current input.

Table 2-6 Procedure for setting the AI as the frequency reference

Procedure	Parameter	Description	
Select the AI for setting the frequency reference based on terminal characteristics.	F0-03	F0-03 = 2	AI1 is used.
		F0-03 = 3	AI2 is used.
Select any one from the five curves for the AI voltage[1] and frequency.	F4-33	Generally, F4-33 is set to the default value 321. That is, AI1 uses curve 1 and AI2 uses curve 2.	
Curve between AI voltage [1] and frequency: Set the relationship between AI voltage inputs and the set values.	F4-13 to F4-16 [2]	Curve 1 setting	Typical curve [3]
	F4-18 to F4-21	Curve 2 setting	Typical curve [4]
	A6-00 to A6-07	Curve 4 setting	-
	A6-08 to A6-15	Curve 5 setting	
	F4-34	Selection when AI value < minimum input value[2]	
	F0-10	When the AI is used as the frequency reference source, the value 100% of the voltage/current input corresponds to the value of F0-10 (Maximum frequency).	

Procedure	Parameter	Description
AI filter time	F4-17	The default value is 0.1s. Set this parameter to balance the response speed and anti-interference capability. If quick response is required, reduce the setpoint of F4-17. If the interference on site is strong, increase the setpoint of F4-17.

[1] For the current-type AI curve, 1 mA current corresponds to 0.5 V voltage. That is, 20 mA corresponds to 10 V.

[2] When the analog input voltage exceeds the maximum value (F4-15), the maximum value is used as the analog voltage. When the analog input voltage is smaller than the minimum value (F4-13), the value set by F4-34 (Setting for AI less than minimum input) is used, that is, minimum input value or 0.0%.

[3] The typical curve of AI1 is shown in the following figure.

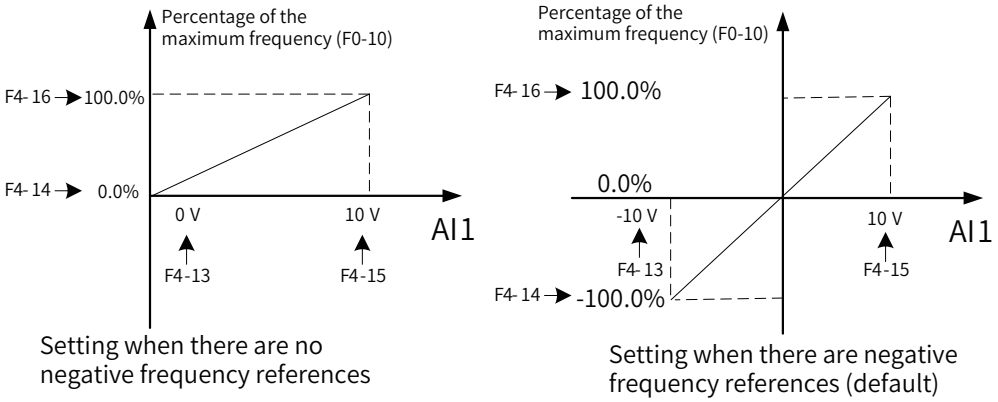


Figure 2-5 Typical curve of AI1

[4] The typical curve of AI2 for voltage input is consistent with that of AI1. When AI2 is used for current input, set 4 mA to 20 mA, which corresponds to 0 Hz to 50 Hz or -50 Hz to 50 Hz.

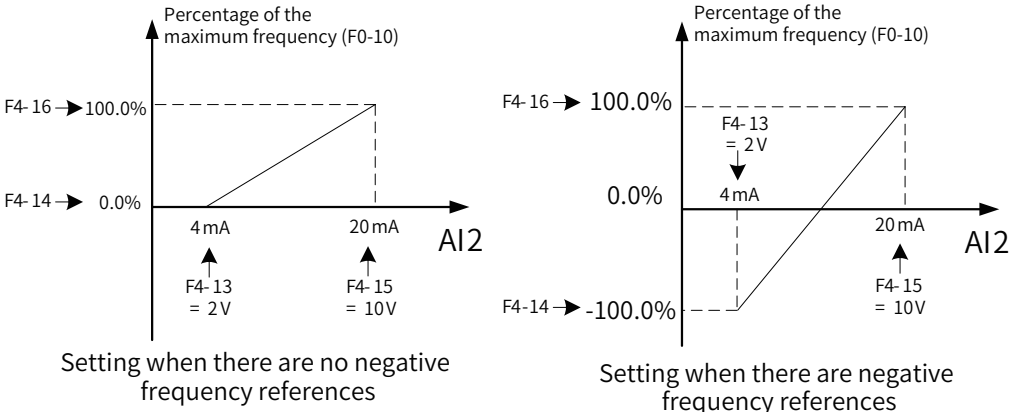


Figure 2-6 Typical curve of AI2

2.7.3 Digital Pulse Input

The frequency is set by DIO1 (high-speed pulse).

The signal specifications set by pulse are 9 V to 30 V (voltage) and 0 kHz to 100 kHz (frequency).

Table 2-7 Procedure when the digital pulse input terminal (DIO1) is used as the frequency source

Procedure	Parameter	Description
Set the digital pulse input terminal (DIO1) as the frequency source.	F0-03 F4-03	Set the ones place of F4-41 to 0, and configure the input function (default) for DIO1. Set F0-03 to 5 to select "Pulse setting (DIO1)" as the main frequency source.
Set the curve representing the relationship between the pulse frequency and the set frequency.	F4-28 to F4-31	Typical curve [1]
	F0-10	When the digital pulse input terminal is used as the frequency source, the percentage 100.0% corresponds to the maximum frequency F0-10.
Set the filter time of the set frequency.	F4-32	/

[1]: The following figure shows the curve when digital pulse input is used as the frequency reference.

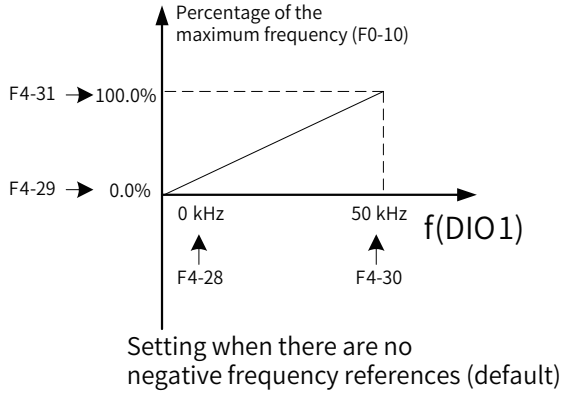


Figure 2-7 Typical set curve when DIO1 is used as the frequency source

2.7.4 Communication Setting

The MD810 supports four protocols to communicate with the host controller: Modbus, PROFIBUS DP, CANopen, and CANlink. You can set communication as the main frequency source by setting F0-03. For details, refer to the following table.

Procedure	Parameter	Description
Select communication as the frequency reference.	F0-03	F0-03 = 9

2.7.5 Multi-reference

If multi-reference is selected as the frequency reference source, frequency references are input through different state combinations of the DIs.

Table 2-8 Using multi-reference as the frequency reference source

Procedure	Parameter	Description
Select multi-reference as the frequency reference source.	F0-03	F0-03 = 6

Determine the number of multi-references.	/	A total of 16 multi-references are supported, which requires four DIs. The relationship between the number of multi-references and the number of DIs is as follows: 2 multi-references: One DI (K1) 3-4 multi-references: Two DIs (K1 and K2) 5-8 multi-references: Three DIs (K1, K2, and K3) 9-16 multi-references: Four DIs (K1, K2, K3, and K4)	
Assign the multi-reference function to the DI.	F4-00 to F4-09	Multi-reference terminal K1	Set it to 12.
		Multi-reference terminal K2	Set it to 13.
		Multi-reference terminal K3	Set it to 14.
		Multi-reference terminal K4	Set it to 15.
Set the frequency for each multi-reference.[Note]	FC-00 to FC-15	The frequency corresponding to each speed reference is set to a percentage value. 100% corresponds to the maximum frequency (F0-10).	
	F0-10	If the frequency reference source is set to multi-reference, the value 100% of FC-00 to FC-15 corresponds to the value of F0-10 (Maximum frequency).	

[Note]: The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values. The following table lists the details.

Table 2-9 State combinations of the four multi-reference terminals

K4	K3	K2	K1	Reference	Percentage to Maximum Frequency
OFF	OFF	OFF	OFF	Multi-reference 0	FC-00
OFF	OFF	OFF	ON	Multi-reference 1	FC-01
OFF	OFF	ON	OFF	Multi-reference 2	FC-02
OFF	OFF	ON	ON	Multi-reference 3	FC-03
OFF	ON	OFF	OFF	Multi-reference 4	FC-04
OFF	ON	OFF	ON	Multi-reference 5	FC-05
OFF	ON	ON	OFF	Multi-reference 6	FC-06
OFF	ON	ON	ON	Multi-reference 7	FC-07
ON	OFF	OFF	OFF	Multi-reference 8	FC-08
ON	OFF	OFF	ON	Multi-reference 9	FC-09
ON	OFF	ON	OFF	Multi-reference 10	FC-10
ON	OFF	ON	ON	Multi-reference 11	FC-11
ON	ON	OFF	OFF	Multi-reference 12	FC-12
ON	ON	OFF	ON	Multi-reference 13	FC-13
ON	ON	ON	OFF	Multi-reference 14	FC-14
ON	ON	ON	ON	Multi-reference 15	FC-15

2.8: Start/Stop Command

Parameter Code	Parameter Name	Value Range	Default
F0-02	Command source	0: External LCD operating panel/Software 1: Terminal Control commands (such as FWD, REV, JOGF, and JOGR) are input using multi-function input terminals. 2: Communication	0

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.

2.8.1 Start/Stop Through External LCD Operating Panel/Software

You can start and stop the AC drive by the RUN and STOP/RES keys on the operating panel or by the start/stop button on the software.

2.8.2 Start/Stop Through Terminal

Parameter Code	Parameter Name	Value Range		Default
F4-11	Terminal command mode	0: Two-wire mode 1 1: Two-wire mode 2	2: Three-wire mode 1 3: Three-wire mode 2	0

This parameter defines the mode in which the AC drive is controlled by external terminals.

There are four multi-functional input terminals: DI1, DI2, DIO1, and DIO2. The following section takes DI1, DI2, and DIO1 as examples to describe these modes. F4-00, F4-01, and F4-03 are used to set the functions of DI1, DI2 and DIO1, respectively. For details, see the description of F4-00 to F4-09.

0 (Two-wire mode 1): This is the most commonly used two-wire mode. In this mode, the forward/reverse rotation of the motor is determined by DI1 and DI2.

The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	0	Two-wire mode 1
F4-00	DI1 function selection	1	Forward running (FWD)
F4-01	DI2 function selection	2	Reverse running (REV)

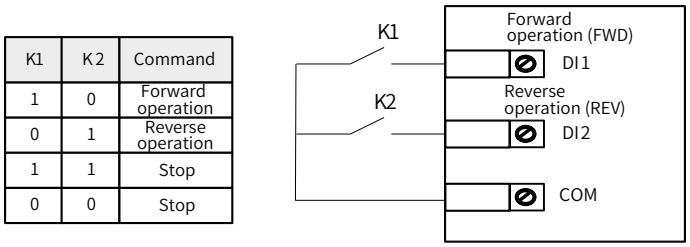


Figure 2-8 Two-wire mode 1

As shown in the preceding figure, in this control mode, when K1 is closed, the AC drive runs in the forward direction. When K2 is closed, the AC drive runs in the reverse direction. When both K1 and K2 are closed or open, the AC drive stops running.

1 (Two-wire mode 2): In this mode, DI1 is assigned with the running enabling function, and DI2 determines the running direction.

The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	1	Two-wire mode 2
F4-00	DI1 function selection	1	Forward running (FWD)
F4-01	DI2 function selection	2	Reverse running (REV)

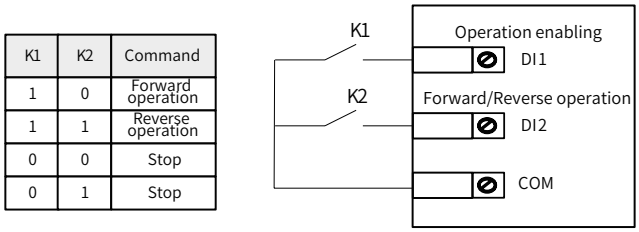


Figure 2-9 Two-wire mode 2

As shown in the preceding figure, when K1 is closed and K2 is open, the AC drive runs in the forward direction. When K2 is closed, the AC drive runs the in the reverse direction. When K1 is open, the AC drive stops running.

2 (Three-wire mode 1): In this mode, DI3 is assigned with the running enabling function, and DI1 and DI2 determine the direction.

The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	2	Three-wire mode 1
F4-00	DI1 function selection	1	Forward running (FWD)
F4-01	DI2 function selection	2	Reverse running (REV)
F4-03	DIO1 function selection	3	Three-wire control

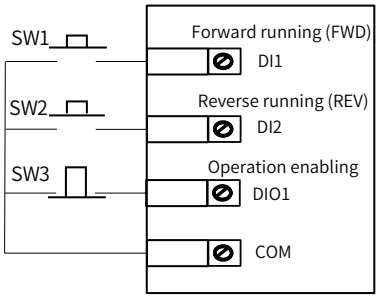


Figure 2-10 Three-wire mode 1

As shown in the preceding figure, when SW3 and SW1 are closed, the AC drive runs in the forward direction. When SW3 and SW2 are closed, the AC drive runs in the reverse direction. The AC drive stops immediately when SW3 is open. During normal startup and running, SW3 must remain closed. The commands by SW1 and SW2 become active at the moment when these button become closed. The AC drive running state is determined by the final actions on SW1, SW2 and SW3.

3 (Three-wire control mode 2): In this mode, DIO1 is assigned with the enabling function, DI1 is used to send the operation command , and DI2 determines the direction.

The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	3	Three-wire mode 2
F4-00	DI1 function selection	1	Running enabling
F4-01	DI2 function selection	2	Forward/reverse running direction
F4-03	DIO1 function selection	3	Three-wire control

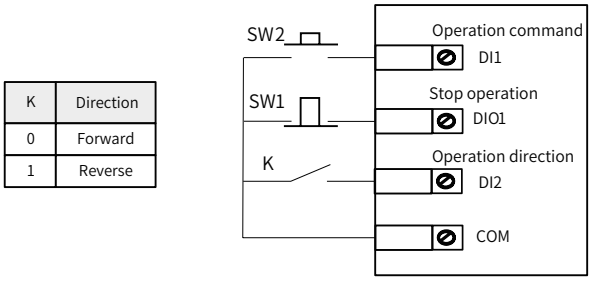


Figure 2-11 Three-wire control mode 2

As shown in the preceding figure, when SW1 and SW2 are closed, the AC drive starts running. When SW1 is closed and K is open, the AC drive runs in the forward direction. When SW1 and K are closed, the AC drive runs in the reverse direction. The AC drive stops immediately when SW1 is open. During normal startup and running, SW1 must remain closed. The command by SW2 becomes active at the moment when this button becomes closed.

2.8.3 Start/Stop Through Communication

In this mode, the running command is given by the host controller through communication.

Procedure	Parameter	Description	
Select communication as the frequency reference.	F0-02	F0-02 = 2	
Select the communication mode.	Fd-10	CANopen communication	Fd-10 = 1
		CANlink communication	Fd-10 = 2
PROFIBUS DP and Modbus are always enabled and no setting is required.			

2.9 Start Process Setting

2.9.1 Start Mode Selection

Parameter Code	Parameter Name	Value Range	Default
F6-00	Start mode	0: Direct start 1: Flying start (asynchronous AC motor) 2: Pre-excitation startup (asynchronous AC motor)	0

0: Direct start

If the DC braking time is set to 0, the AC drive starts to run at the start frequency. If the DC braking time is not 0, the drive performs DC braking first and then start at the start frequency.

This mode is applicable to most small inertia load. The start process frequency curve is shown in the following figure. DC braking before the startup is applicable to loads such as elevators and cranes. Start frequency is applicable to equipment that requires start torque with impact, such as cement mixer.

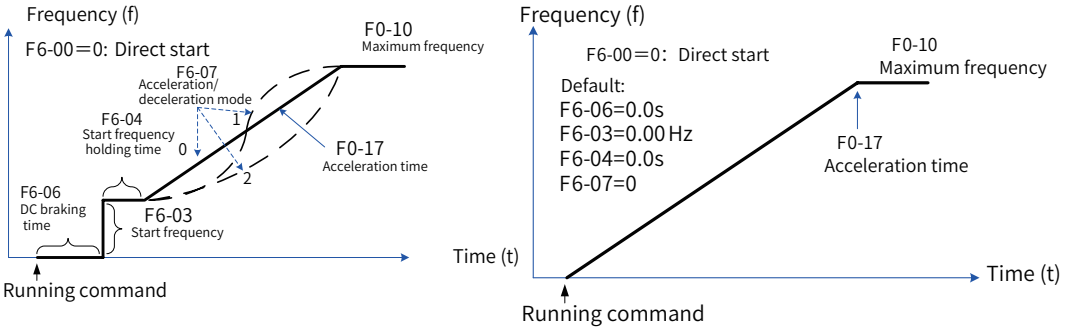


Figure 2-12 Direct start

1: Flying start

This mode applies to drives with high-inertia mechanical loads. The following figure shows the frequency curve during startup. If the motor is still rotating due to inertia upon start of the AC drive, this start mode can prevent overcurrent upon startup.

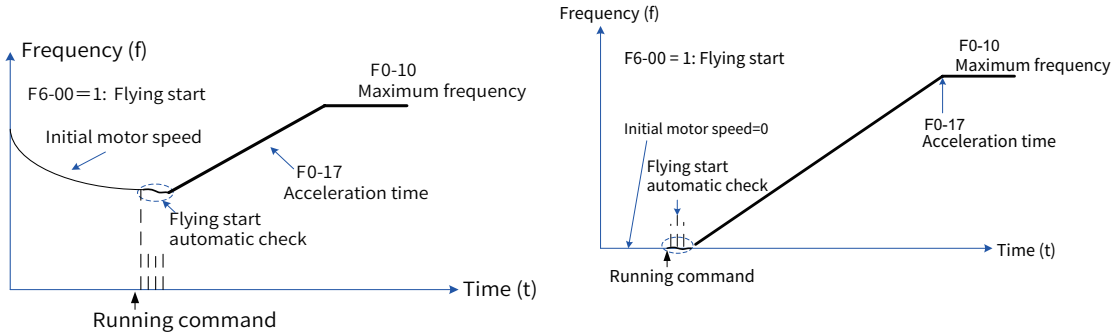


Figure 2-13 Flying start

2: Pre-excitation start

This mode applies only to induction asynchronous motors in the SVC and FVC mode. Performing pre-excitation on the motor before start improves the response speed of the motor and meets application requirements on short acceleration time. The following figure shows the frequency curve during startup.

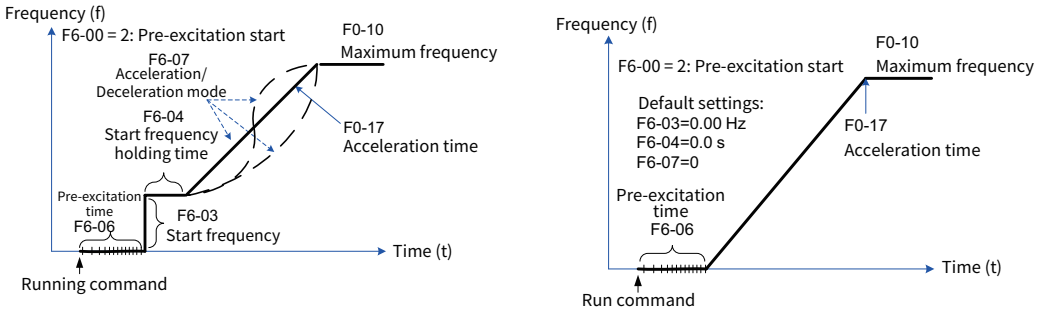


Figure 2-14 Pre-excitation start

2.9.2 Start Frequency

Parameter Code	Parameter Name	Value Range	Default
F6-03	Start frequency	0.00 Hz to 10.00 Hz	0.00 Hz
F6-04	Start frequency holding time	0.0s to 100.0s	0.0s

A proper start frequency is required to ensure the motor torque at start. To set up sufficient flux during startup, hold the start frequency for a period of time.

The start frequency (F6-03) is not restricted by the frequency lower limit. When the set target frequency is lower than the start frequency, the AC drive will start at the start frequency.

The start frequency holding time is not included in the acceleration time, but it is included in the running time of the simple PLC.

2.10 Stop Process Setting

The AC drive supports two stop modes, that is, decelerate to stop and coast to stop, which are set by F6-10. You can select whether to enable the DC braking function at the end segment.

2.10.1 Stop Mode Selection

Parameter Code	Parameter Name	Value Range	Default
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0

0: Decelerate to stop

Once the stop command becomes valid, the drive decreases the output frequency according to the deceleration time and stops when the frequency decreases to 0.

1: Coast to stop

Once the stop command takes effect, the drive immediately stops output, and the motor and load coast to stop according to mechanical inertia.

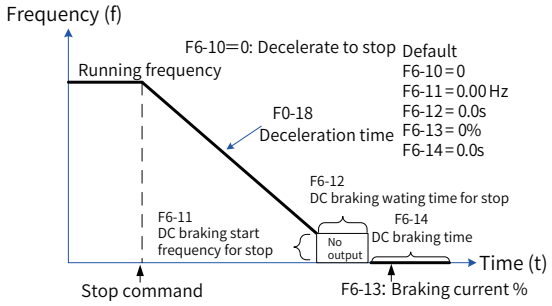


Figure 2-15 Decelerate to stop

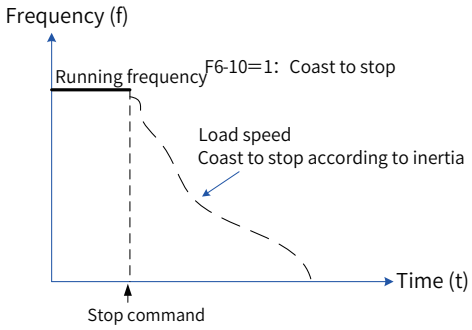


Figure 2-16 Coast to stop

2.10.2 DC Braking for Stop

Parameter Code	Parameter Name	Default	Value Range	Description
F6-11	Start frequency of DC braking for stop	0.00 Hz	0.00 Hz to max. frequency	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	0.0s to 100.0s	When the running frequency decreases to the value set by F6-11, the AC 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%	0% to 100%	The base value varies depending on the following two conditions: 1. The motor rated current is the base value of the percentage, based on which the output DC braking current is set. The maximumcurrent does not exceed 80% of the rated current of the drive. 2. When FVC is selected as the motor control mode, the DC braking current for stop is inactive. When the torque upper limit is not reached, the drive runs at 0 Hz.
F6-14	DC braking time for stop	0.0s	0.0s to 100.0s	This parameter specifies the holding time of DC braking. If it is set to 0, DC braking is disabled.

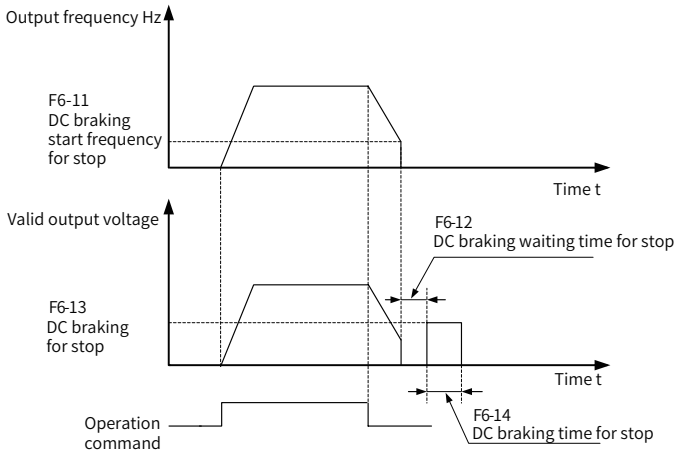


Figure 2-17 DC braking for stop

2.11 Acceleration/Deceleration Time Setting

Parameter Code	Parameter Name	Value Range	Default
F0-17	Acceleration time 1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent
F0-18	Deceleration time 1	0.00s to 650.00s (F0-19 = 2) 0.0s to 6500.0s (F0-19 = 1) 0s to 65000s (F0-19 = 0)	Model dependent
F0-25	Base frequency for acceleration/ deceleration time	0: F0-10 (Maximum frequency) 1: Frequency reference 2: 100 Hz	0

Acceleration time indicates the time required by the AC drive to accelerate from 0 Hz to the acceleration/deceleration time base frequency (F0-25), that is, t1 in the following figure.

Deceleration time indicates the time required by the AC drive to decelerate from the acceleration/deceleration base frequency (F0-25) to 0 Hz, that is, t2 in the following figure.

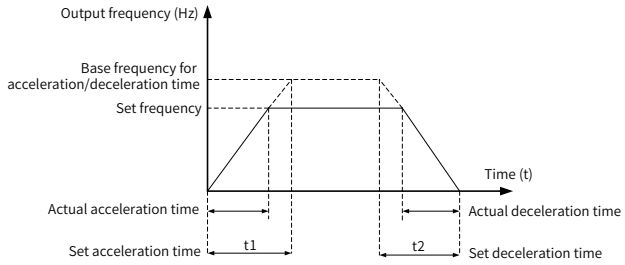


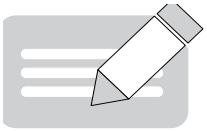
Figure 2-18 Acceleration/Deceleration time

The MD810 provides four groups of acceleration/deceleration time for selection. You can perform switchover by using a DI with functions 16 and 17 assigned. The four groups acceleration/deceleration time are set through the following parameters.

Group 1: F0-17, F0-18 (default); Group 2: F8-03, F8-04; Group 3: F8-05, F8-06; Group 4: F8-07, F8-08

Parameter Code	Parameter Name	Value Range	Default
F0-19	Acceleration/ Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s	1

To satisfy requirements of different applications, the MD810 provides three acceleration/deceleration time units, namely, 1s, 0.1s, and 0.01s.



NOTE

- Modifying parameter F0-19 will make the decimal places of displayed acceleration/deceleration time change and corresponding acceleration/deceleration time also change.

2.12 Running Status View

2.12.1 Digital Output

The control board provides three DOs, namely DIO1, DIO2, and TA/TB/TC. DIO1 and DIO2 are transistor outputs and can drive 24 VDC low-voltage circuit; TA/TB/TC is relay output, and can drive 250 VAC control circuit.

Configure F4-41 to set DIO1 and DIO2 to DO output.

You can define the functions of the DOs by setting F5-01 and F5-05 to indicate the running state and alarm information of the AC drive. There are a total of 40 functions.

Terminal Name	Parameter	Output Characteristics
DIO1-COM	Set the ones place of F5-04 and F4-41 to 1.	Transistor; driving capacity: 24 VDC, 50 mA
DIO2-COM	When F5-00 is set to 0, set the tens place of F5-06 and F4-41 to 1.	Transistor; high-frequency pulse output: 10 Hz to 100 kHz; drive capacity: 24 VDC, 50 mA
	When F5-00 is set to 1, set the tens place of F5-01 and F4-41 to 1.	Transistor; driving capacity: 24 VDC, 50 mA
TA/TB/TC	F5-02	Relay; drive capacity: 250 VAC, 3 A

When F5-00 is set to 0, the DIO2 is in the high-speed pulse output mode. The frequency of the output pulse indicates the value of the internal running parameters. The larger the value is, the higher the output pulse frequency will be. The value 100% corresponds to the maximum FMP output frequency defined by F5-09. The attribute of the internal parameter to be indicated is defined by F5-06.

2.12.2 Analog Output

The drive supports one AO. The AO can be used to indicate the internal running parameters in the analog mode. The attribute of parameter indicated is defined by F5-10 and F5-11.

Terminal	Input Signal Feature	
AO-GND	F5-23 = 0 (voltage output)	F5-23 = 1 (current output)

Parameter Code	Parameter Name	Value Range	Default
F5-10	AO zero offset coefficient	-100.0% to +100.0%	0.0%

F5-11	AO gain	-10.00 to +10.00	1.00

The preceding parameters can be used to define the AO curve as needed.

If "b" represents the zero offset, "k" represents the gain, "Y" represents the actual output, and "X" represents the standard output, the actual output is: Y = kX + b.

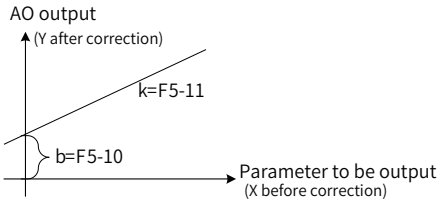


Figure 2-19 AO signal correction characteristic curve

The zero offset coefficient 100% of the AO corresponds to 10 V (or 20 mA). The standard output refers to the value corresponding to the analog output of 0 V to 10 V (or 0 mA to 20 mA) with no zero offset or gain correction.

Assume that the AO outputs the running frequency, and the corrected output needs to be 8 V when frequency is 0 Hz and 4 V when frequency is 40 Hz. The value of F5-11 (AO gain) is -0.5 and the value of F5-10 (AO zero offset coefficient) is 80%.

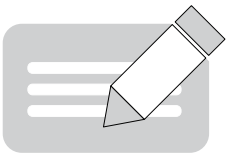
2.13 Motor Auto-tuning

2.13.1 Auto-tuning mode

Internal electrical parameters of the controlled motor can be obtained through auto-tuning. The following table takes the asynchronous motor as an example to describe the auto-tuning modes.

Auto-tuning Mode	Applicable Occasion	Related Parameter
Static partial auto-tuning for asynchronous motor	It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed.	F1-06 (Asynchronous motor stator resistance) F1-07 (Asynchronous motor rotor resistance) F1-08 (Asynchronous motor leakage inductance)

Auto-tuning Mode	Applicable Occasion	Related Parameter
Static complete auto-tuning for asynchronous motor	It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed.	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) Note that the tuned values of F1-09 and F1-10 are less accurate than those in the dynamic auto-tuning mode.
Dynamic complete auto-tuning for asynchronous motor	It applies to scenarios where the motor and the system can run at a high speed. Auto-tuning is supported in no-load and pure inertia load applications.	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)
Inertia auto-tuning for asynchronous motor	It applies to scenarios where the motor and the system can run at a high speed. In the FVC mode, auto-tuning is supported in no-load, light load (below 80% of load), and pure inertia load applications.	/



NOTE

The preceding table takes auto-tuning of the asynchronous motor as an example. If you need to tune the synchronous motor, set F1-37 to 11, F1-37 to 12, F1-37 to 13, and F1-37 to 14 to set different auto-tuning modes.

Auto-tuning Mode	Applicable Occasion	Auto-tuning Effect
Partial no-load auto-tuning of synchronous motor (excluding back EMF) F1-37 = 11	It applies to scenarios where the motor cannot be disconnected from the load and dynamic auto-tuning is not allowed. After auto-tuning is completed, you need to manually set the back EMF (SVC, PMVVC) and Encoder phase sequence.	Good
Dynamic no-load auto-tuning of synchronous motor F1-37 = 12	It applies to scenarios where the motor can be disconnected from the load.	Best
Complete static auto-tuning of synchronous motor F1-37 = 13	It applies to occasions where the motor cannot be disconnected from the load easily and motor rotation is not allowed. After auto-tuning is completed, you need to manually set the back EMF (SVC, PMVVC), encoder zero position angle (FVC), and encoder phase sequence (FVC).	Normal
Synchronous motor inertia auto-tuning (only in FVC mode) F1-37 = 14	It applies to the FVC mode. The drive can run dynamically. In this mode, the motor is tested for acceleration/deceleration and motor inertia is tuned.	Good

2.13.2 Auto-tuning Procedure

The following section takes the asynchronous motor as an example to describe how to perform motor auto-tuning. The synchronous motor can be auto-tuned in the same way as the asynchronous motor with parameters changed.

Step 1: If the motor can be disconnected from the load, cut off the power, and disconnect the motor from the load to run the motor without load.

Step 2: After power-on, set F0-02 to 0.

Step 3: Enter the motor nameplate parameters (such as F1-00 to F1-05) correctly and enter the following parameters based on the actually selected motor.

Motor Selection	Parameter	
Motor	F1-00: Motor type selection F1-01: Rated motor power F1-02: Rated motor voltage	F1-03: Rated motor current F1-04: Rated motor frequency F1-05: Rated motor speed

If there is an encoder, enter the encoder parameters (F1-27, F1-28, and F1-30).

Step 4: For an asynchronous motor, set F1-37 to 2 (Asynchronous motor dynamic auto-tuning). For a synchronous motor, set F1-37 to 12 (Dynamic no-load auto-tuning of synchronous motor). Press **ENTER**. "TUNE" is displayed, as shown in the following figure.

The drive will drive the motor to accelerate/decelerate, and the RUN indicator lights up. The auto-tuning process lasts for about two minutes. When the preceding information disappears and the keypad returns to the normal parameter display status, auto-tuning is done.

If complete auto-tuning is performed on the asynchronous motor, the drive automatically calculates the following parameters of the motor.

Motor Selection	Parameter	
Motor	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

If the synchronous motor is tuned, the drive automatically calculates the following parameters of the motor.

Motor Selection	Parameter	
Motor	F1-06: Synchronous motor stator resistance F1-17: Synchronous motor D-axis inductance	F1-18: Axis-Q inductance of synchronous motor F1-19: Back EMF of synchronous motor

If the motor cannot be disconnected from the load, set F1-37 to 3 (With-load complete auto-tuning of asynchronous motor) for the asynchronous motor or set F1-37 to to 13 (Complete static auto-tuning of synchronous motor) for the synchronous motor. Then start motor auto-tuning.

2.13.3 Auto-tuning Flowchart Through LED Keypad

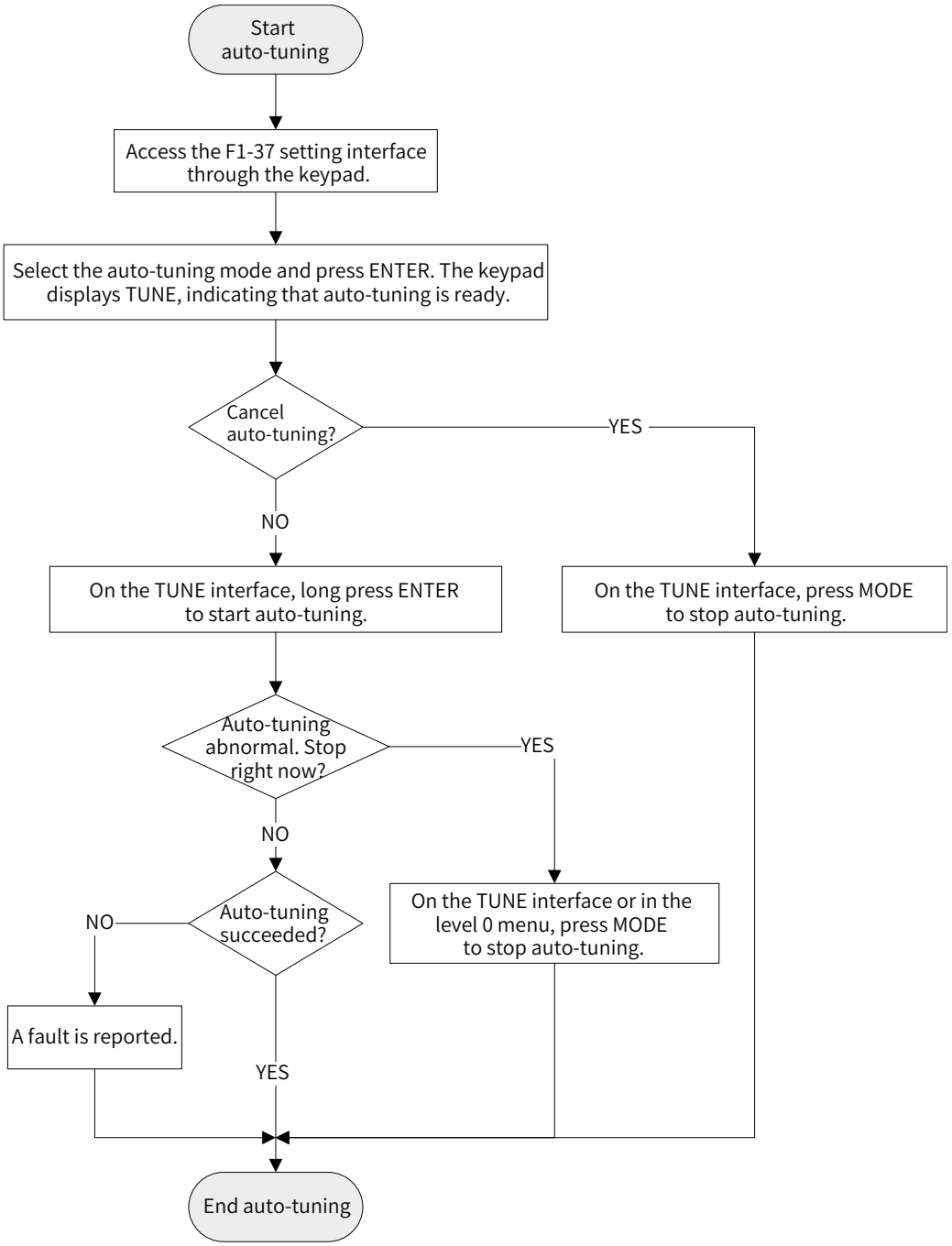


Figure 2-20 Auto-tuning flowchart through the LED keypad

2.13.4 Jogging Flowchart Through LED Keypad

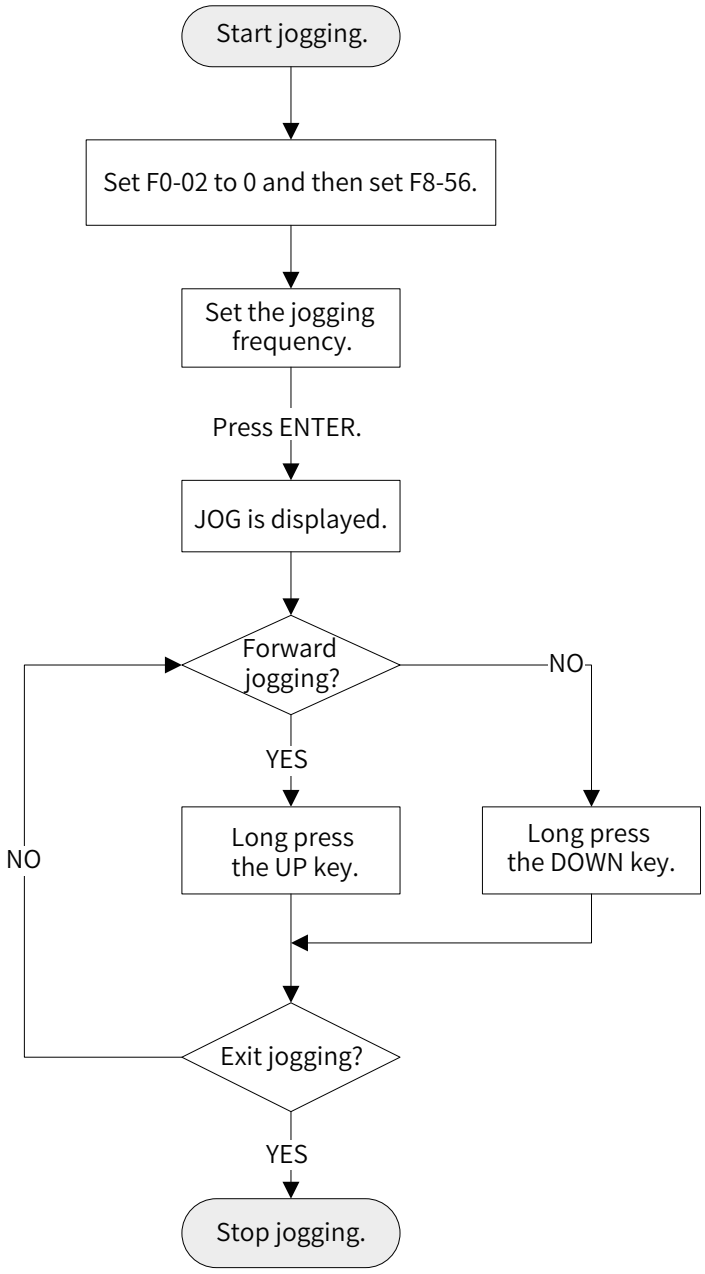


Figure 2-21 Jogging flowchart through the LED Keypad

3 Drive Unit Parameters

3.1 Operation Command Source Settings

Operation commands are used to control the start, stop, forward running, and reverse running of the drive. Three operation command sources are available: operating panel, terminal, and communication. Select the operation command setting mode through F0-02.

Parameter Code	Parameter Name	Default	Value Range	Description
F0-02	Operation command source	0	0	LCD operating panel/Software
			1	Terminal
			2	Communication

1) Setting operation commands through an external LCD operating panel

Set F0-02 to 0 and use and on the operating panel to start and stop the drive. Press to start the drive. The RUN indicator turns on. When the drive is running, press to stop the drive. The RUN indicator turns off. For detailed operation of the external LCD operating panel, see "1.2 External LCD Operating Panel".

2) Setting operation commands through terminals

Set F0-02 to 1 to start and stop the drive through terminals.

F4-11 is used to set the terminal control mode. Four terminal control modes are available, including two-wire mode 1, two-wire mode 2, three-wire mode 1, and three-wire mode 2.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-11	Terminal command mode	0	0: Two-wire mode 1 1: Two-wire mode 2 2: Three-wire mode 1 3: Three-wire mode 2	This parameter defines the mode in which the AC drive is controlled by external terminals.

You can select the multi-function input terminals DI1, DI2, DIO1, and DIO2 as external input terminals. If DIO1 and DIO2 are used, set the function of the DIO by F4-41.Set F4-00 to F4-04 to select the input function of the DIx. For details, see descriptions of F4-00 (DI1) to F4-04 (DIO2) in "B.1 Parameter List of the Drive Unit (Non G53X Models)".

Parameter Code	Parameter Name	Default	Value Range	Description

F4-41	DIO type	00	Ones place: DIO1 type 0: DI/PulseIn 1: DO Tens place: DIO2 type 0: DI 1: DO/FMP	PulseIn: pulse input FMP: pulse output

- Two-wire mode 1: Set F4-11 to 0 to select this mode, which is the most commonly used mode.

For example, DI1 is allocated with forward running and DI2 is allocated with reverse running. Connect the forward running switch to DI1 and the reverse running switch to DI2.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	0	Two-wire mode 1
F4-00	DI1 function selection	1	Forward running (FWD)
F4-01	DI2 function selection	2	Reverse running (REV)

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

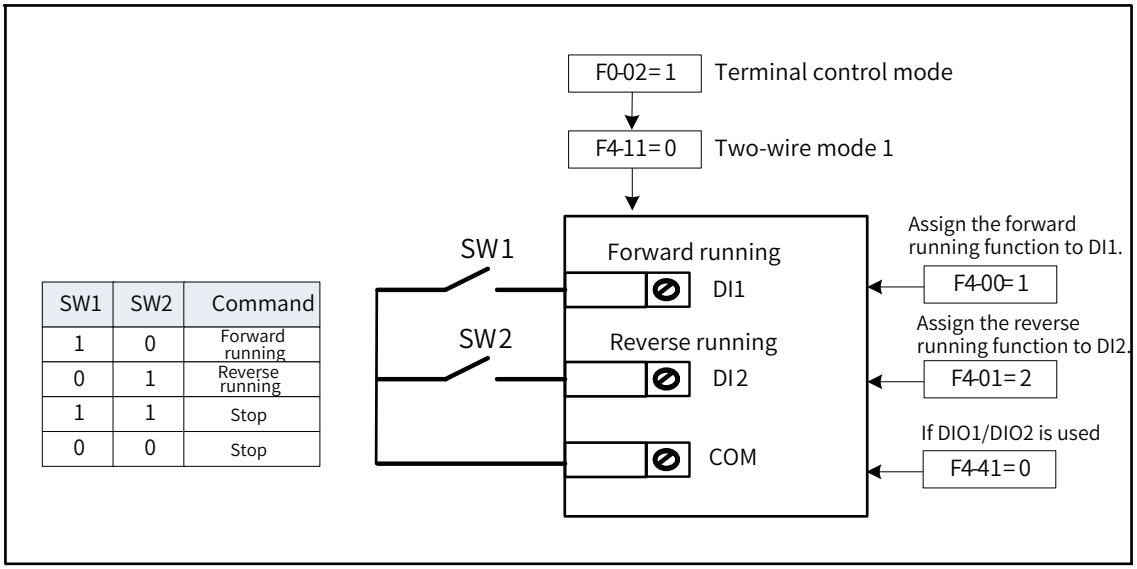


Figure 3-1 Wiring and parameter settings for two-wire mode 1

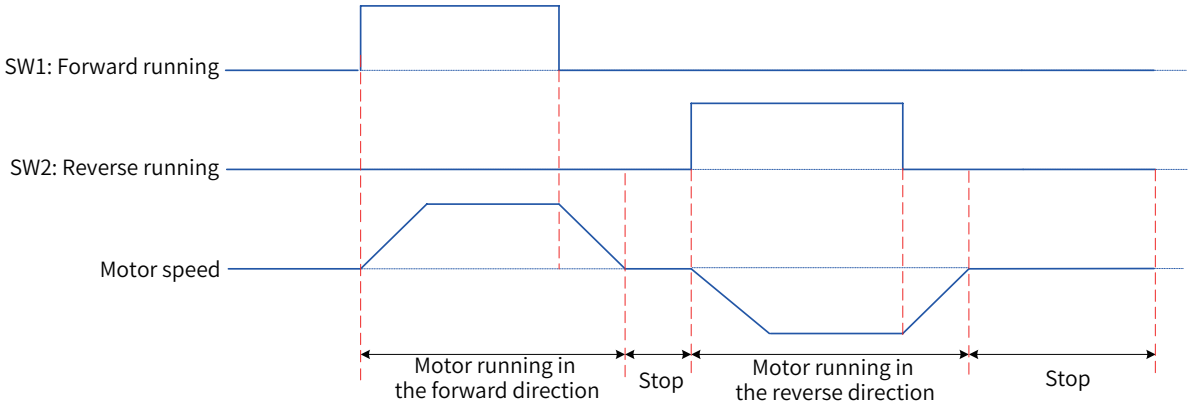


Figure 3-2 Time sequence (normal) for two-wire mode 1

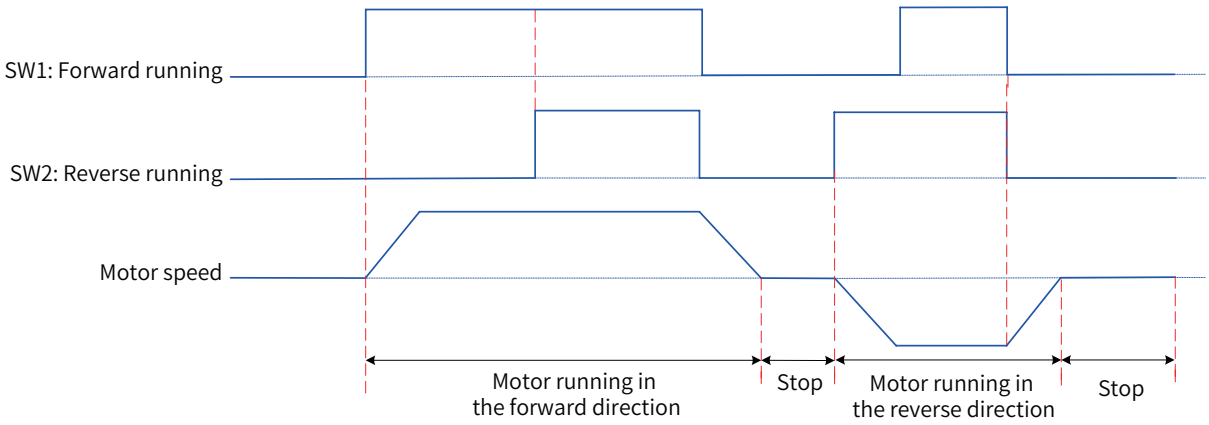


Figure 3-3 Time sequence (abnormal) for two-wire mode 1

- Two-wire mode 2: F4-11 = 1

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

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	1	Two-wire mode 2
F4-00	DI1 function selection	1	Operation command
F4-01	DI2 function selection	2	Forward/reverse running direction

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

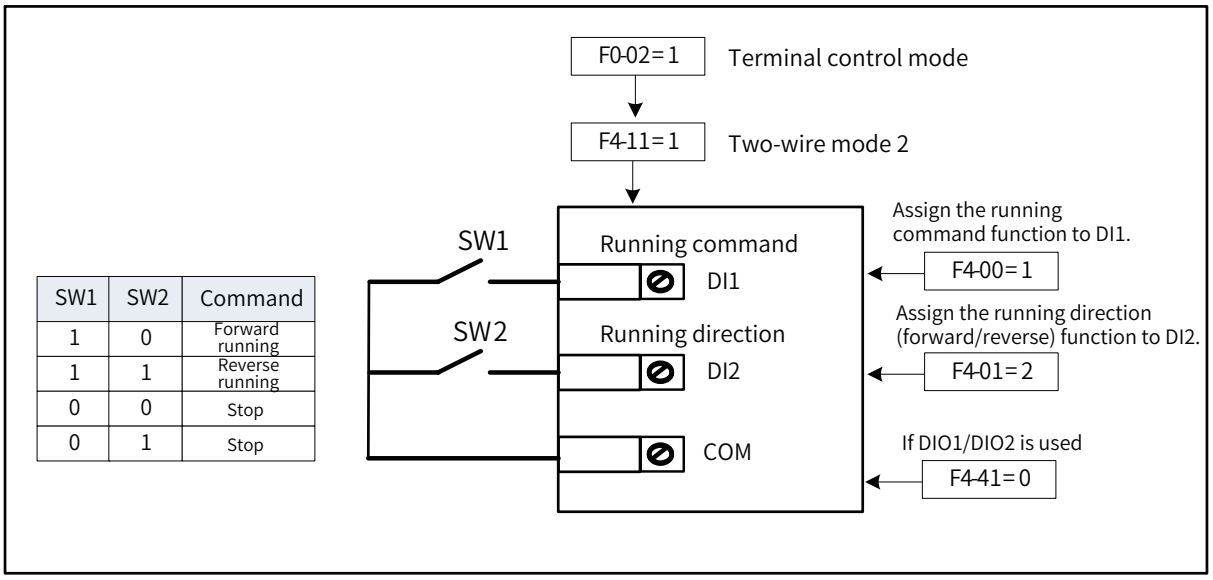


Figure 3-4 Wiring and parameter settings for two-wire mode 2

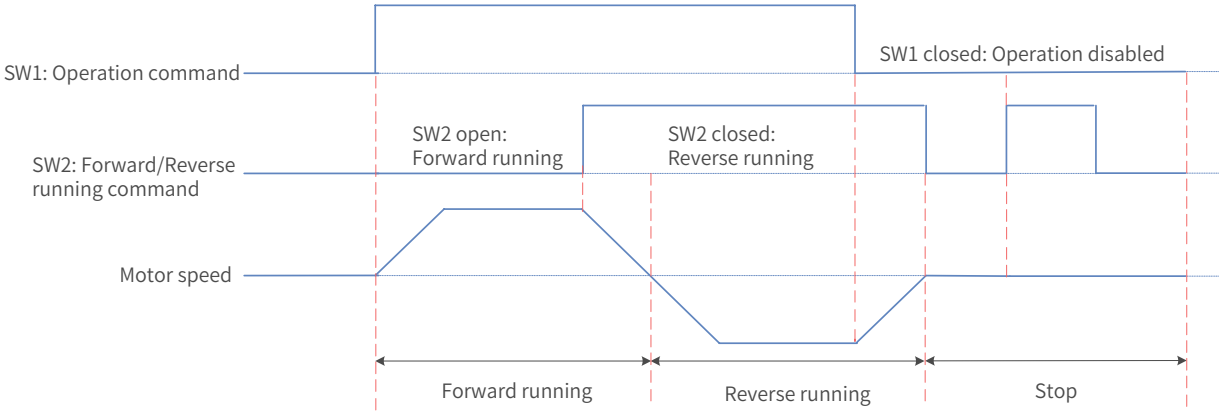


Figure 3-5 Time sequence for two-wire mode 2

- Three-wire mode 1: F4-11 = 2

For example, DIO1 is allocated with the operation control function, DI1 is allocated with the forward running function, and DI2 is allocated with the reverse running function. In this control mode, keys are required to function as the start/stop switch. Connect the forward running key, reverse running key, and start/stop key to DI1, DI2, and DIO1, respectively. The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	2	Three-wire mode 1
F4-00	DI1 function selection	1	Forward running (FWD)
F4-01	DI2 function selection	2	Reverse running (REV)
F4-03	DIO1 function selection	3	Three-wire control

SW3 is a normally closed (NC) button, whereas SW1 and SW2 are normally open (NO) buttons. If SW3 is closed, the motor rotates in the forward direction when you press down SW1, and rotates in the reverse direction when you press down SW2. The motor stops immediately when

SW3 is open. SW3 must remain closed during normal start and running. A signal from SW1 or SW2 takes effect once SW1 or SW2 is closed.

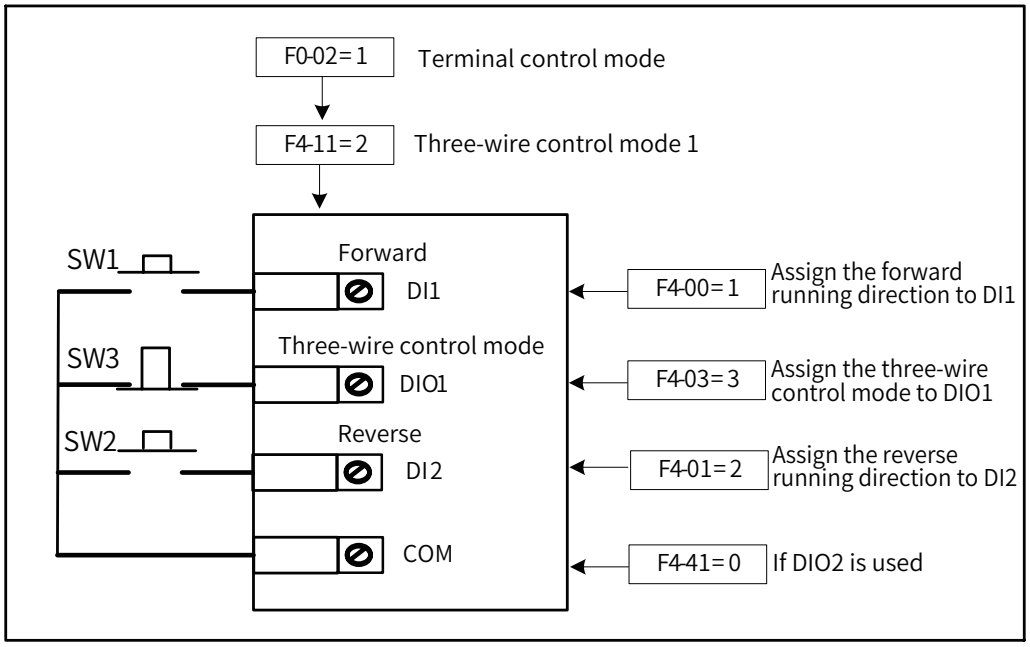


Figure 3-6 Wiring and parameter settings for three-wire mode 1

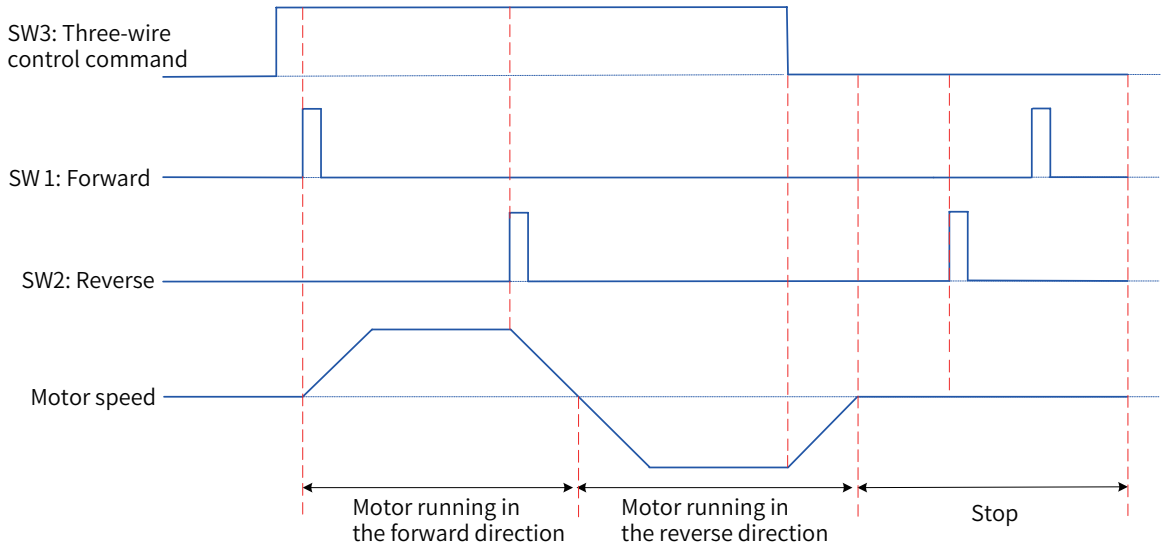


Figure 3-7 Time sequence for three-wire mode 1

- Three-wire mode 2: F4-11 = 3

For example, DIO1 is assigned with the three-wire operation control function, DI1 is assigned with the operation command function, and DI2 is assigned with the running direction function. Connect the operation enabling key, forward/reverse running direction key, and start/stop key to DI1, DI2, and DIO1, respectively. The parameters are set as follows.

Parameter Code	Parameter Name	Value	Description
F4-11	Terminal command mode	3	Three-wire mode 2

F4-00	DI1 function selection	1	Operation command
F4-01	DI2 function selection	2	Forward/reverse running direction
F4-03	DIO1 function selection	3	Three-wire control

When SW3 is closed, the drive starts to run after you press SW1. If SW2 is open, the drive rotates in the forward direction. If SW2 is closed, the drive rotates in the reverse direction. The drive stops immediately when SW3 becomes open. SW3 must remain closed during normal start and running. A signal from SW1 takes effect once SW1 is closed.

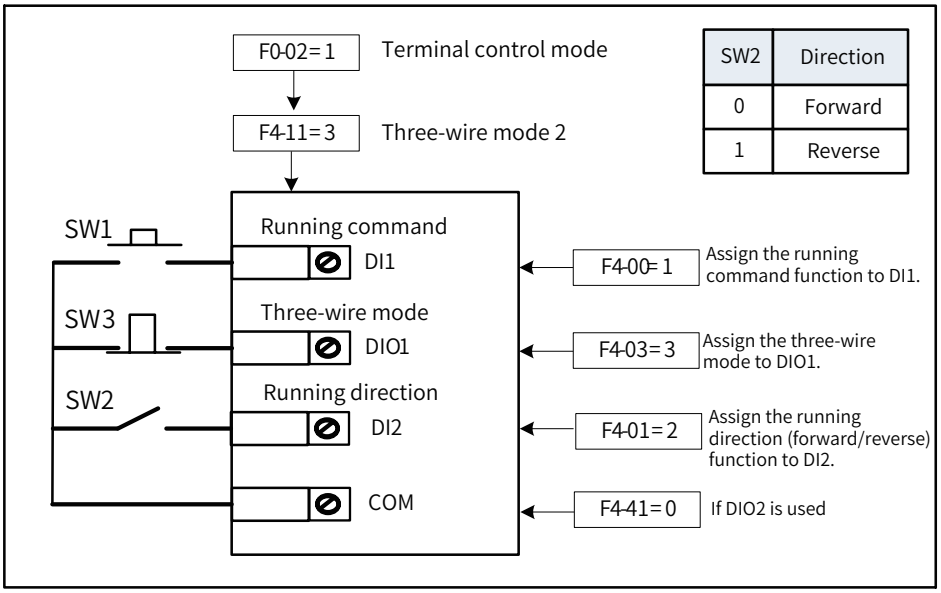


Figure 3-8 Wiring and parameter settings for three-wire mode 2

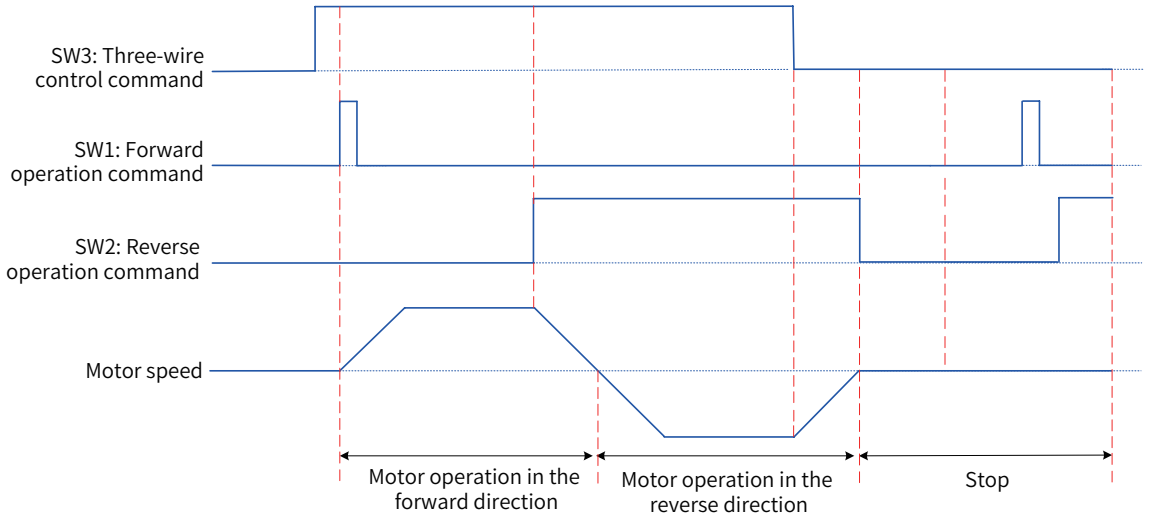


Figure 3-9 Timing diagram for three-wire control mode 2

3) Setting operation commands through communication

Set F0-02 to 2 to use communication as the operation command source. Start, stop, and other related commands can be transferred through communication. For detailed settings, see "Appendix A Communication".

3.2 Frequency Reference Source Settings

The AC drive supports three frequency reference sources, including main frequency reference, auxiliary frequency reference, and main and auxiliary frequency superposition.

3.2.1 Selecting Input Method of Main Frequency Reference

Set F0-03 to select the input method of the main frequency reference. A total of ten input methods are available for the main frequency reference, including digital setting (non-retentive at power failure), digital setting (retentive at power failure), AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication setting, and synchronization control.

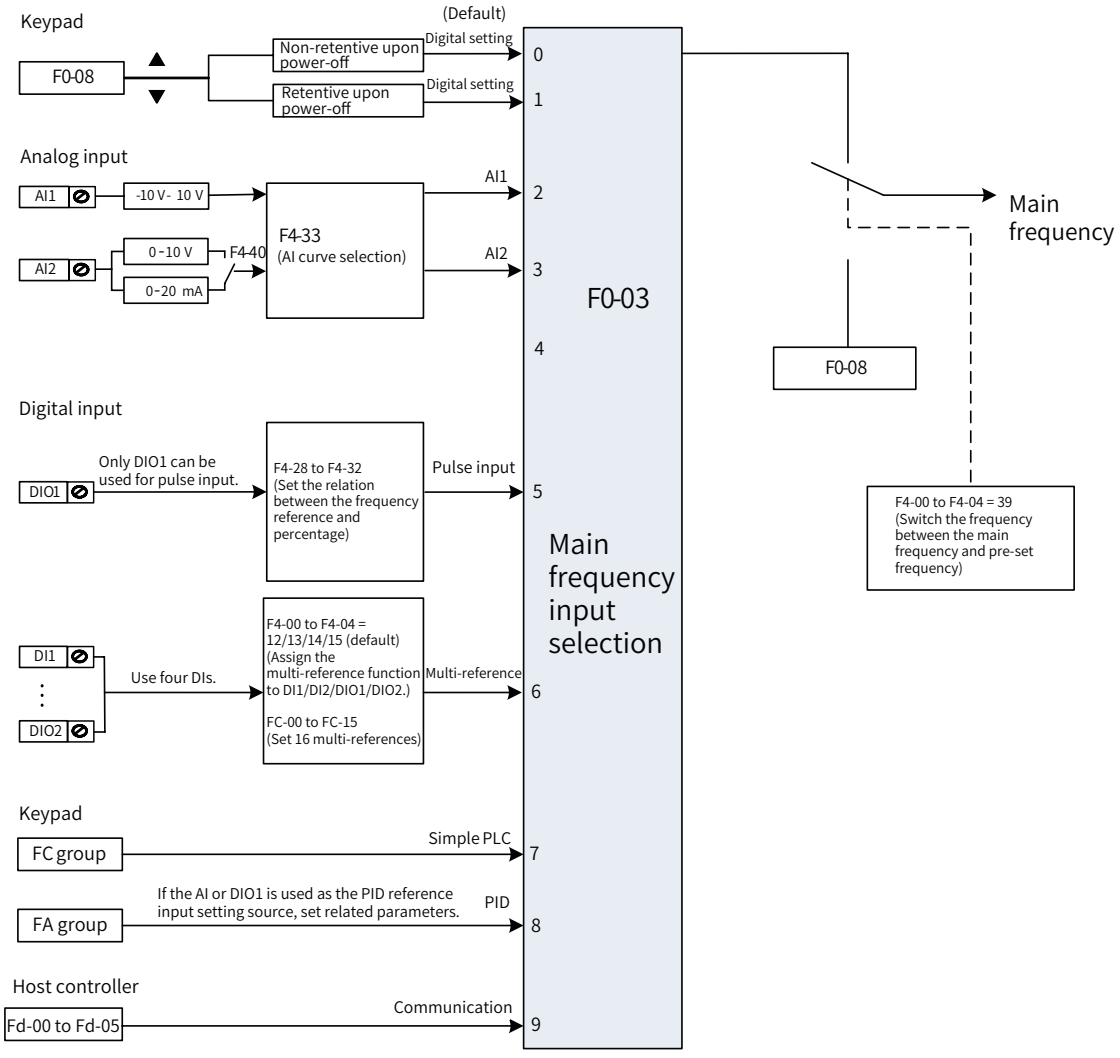


Figure 3-10 Main frequency source selection

Parameter Code	Parameter Name	Value Range	Default
F0-03	Main frequency source	0: Digital setting (preset frequency F0-08 modified by the UP or DOWN key, non-retentive at power failure) 1: Digital setting (preset frequency F0-08 modified by the UP or DOWN key, retentive at power failure) 2: AI1 3: AI2 4: Reserved 5: Pulse setting (DIO1) 6: Multi-reference 7: PLC 8: PID 9: Communication 10: Synchronization control	0

3.2.2 Setting Main Frequency Through Keypad (Digital Setting)

There are two situations for setting the main frequency through the keypad.

- F0-03 = 0 (non-retentive at power failure): When the AC drive is powered on again after stop or power failure, the frequency reference is restored to the preset frequency (F0-08). You can change the preset frequency (F0-08) by pressing ▲ and ▼ on the keypad or through the multi-functional input terminal functioning as the UP or DOWN key.
- F0-03 = 1 (retentive at power failure): When the AC drive is powered on again after stop or power failure, the preset frequency is restored to the value memorized at the moment of the last power failure.

Parameter Code	Parameter Name	Default	Value Range
F0-08	Preset frequency	50.00 Hz	0.00 Hz to maximum frequency (F0-10)
F0-10	Maximum frequency	50.00 Hz	5.00 Hz to 600.00 Hz

NOTE

- Note that F0-23 (Retention of digital-set frequency at stop) differs from F0-03. F0-23 determines whether the changed frequency is retained when the AC drive stops. F0-23 is related to the stop state, rather than power failures.
- If F0-23 is set to 0, the frequency is not retentive at stop. Set F0-08 (Preset frequency) using the keypad first, and correct the frequency through keys ▲ and ▼ or the terminal functioning as the UP/DOWN key. After the AC drive stops, the corrected value is cleared.
- If F0-23 is set to 0, the frequency is retentive at stop. Set F0-08 (Preset frequency) using the keypad first, and correct the frequency through keys ▲ and ▼ or the terminal functioning as the UP/DOWN key. After the AC drive stops, the corrected value is retained.

Example: F0-08 (Preset frequency) is set to 40 Hz. Adjust the value of F0-08 to 45 Hz using the key ▲ on the keypad. If F0-23 is set to 0 (non-retentive at power failure), the frequency is restored to 40 Hz (value of F0-08) after the AC drive stops. If F0-23 is set to 1 (retentive at power failure), the frequency is still 45 Hz after the AC drive stops.

Parameter Code	Parameter Name	Default	Value Range
F0-23	Retention of digit-set frequency upon stop	0	0: Non-retentive 1: Retentive

3.2.3 Setting Main Frequency Through AI

The main frequency can be set through AI1 or AI2. When F0-03 is set to 2, AI1 is used as the main frequency reference source. When F0-03 is set to 3, AI2 is used as the main frequency reference source.

When the AI is used as the frequency source, each AI supports five types of AI curves. Therefore, this section first describes the setting of AI curves, and then introduces how to select corresponding AI curves for AIs. Follow the steps below to set AI curves.

<table>
<tr><th>Procedure</th><th>Parameter</th><th colspan="2">Description</th></tr>
<tr><td rowspan="6">(Step 1) Set the AI curve.
Set the relationship between AI voltage/current inputs and the set values.</td><td>F4-13 to F4-16</td><td>Curve 1 setting</td><td>Commonly-used</td></tr>
<tr><td>F4-18 to F4-21</td><td>Curve 2 setting</td><td>Commonly-used</td></tr>
<tr><td>F4-23 to F4-27</td><td>Curve 3 setting</td><td>Commonly-used</td></tr>
<tr><td>A6-00 to A6-07</td><td>Curve 4 setting</td><td></td></tr>
<tr><td>A6-08 to A6-15</td><td>Curve 5 setting</td><td></td></tr>
<tr><td>F4-34</td><td colspan="2">Selection when AI value < minimum input value</td></tr>
<tr><td rowspan="2">Step 2: Select the AI curve for the AI.
Select the AI curve and set the filter time.</td><td>F4-33</td><td colspan="2">This parameter is used to select the AI curve. You can select any AI curve for an AI. The default value 321 of F4-33 is used. That is, select curve 1 for AI1 and curve 2 for AI2.</td></tr>
<tr><td>F4-17, F4-22</td><td colspan="2">Filter time of AI1 and AI2</td></tr>
<tr><td rowspan="2">Step 3: Select the AI as the frequency reference source.
Select the AI for setting the frequency reference based on terminal characteristics.</td><td rowspan="2">F0-03 (Main frequency source)</td><td>F0-03 = 2</td><td>AI1 is used.</td></tr>
<tr><td>F0-03 = 3</td><td>AI2 is used. Select the input mode (voltage or current) by setting F4-40.</td></tr>
</table>

NOTE

- When the AI is used as the frequency reference source, the value 100% of the voltage/current input corresponds to the value of F0-10 (Maximum frequency).

◆ AI curve setting methods

There are five types of AI curves in total. Curves 1, 2, and 3 are two-point curves, with relevant parameters being F4-13 to F4-27. Curves 4 and 5 are four-point curves. The related parameters are in group A6. To set an AI curve, you need to set the relationship between the AI voltage (or AI current) and the corresponding setting.

This part takes the setting of AI curve 1 as an example. The related parameters are F4-13 to F4-16. The following figure shows the AI curve 1 with the factory values. Detailed parameters and descriptions are given in the following table.

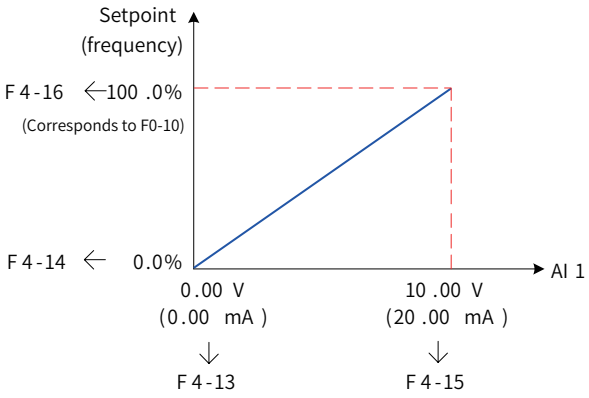


Figure 3-11 Setting AI curve 1

Parameter Code	Parameter Name	Default	Value Range	Description
F4-13	Minimum input of AI curve 1	0.00 V	-10.00 V to F4-15	When the AI voltage is lower than the minimum input set by F4-13, the minimum input or 0.0% is used for calculation according to the setting of F4-34.
F4-14	Percentage corresponding to minimum input of AI curve 1	0.0%	-100.00% to 100.0%	
F4-15	Maximum input of AI curve 1	10.00 V	F4-13 to 10.00 V	When the AI voltage is higher than the maximum input set by F4-15, the maximum input is used for calculation.
F4-16	Percentage corresponding to the maximum input of AI curve 1	100.0%	-100.00% to 100.0%	

NOTE

- When the AI is used as the frequency setting source, the voltage/current input 100% corresponds to the value of F0-10 (maximum frequency). When current mode 1 is selected for analog input, current of 1 mA corresponds to voltage of 0.5 V, and current of 0 mA to 20 mA corresponds to voltage of –10 V to +10 V.
- Curve 2 and curve 3 are set in a similar way as curve 1. F4-18 to F4-21 are used to set curve 2. F4-23 to F4-26 are used to set curve 3. Figure 9-13 shows the setting of AI curve 2.

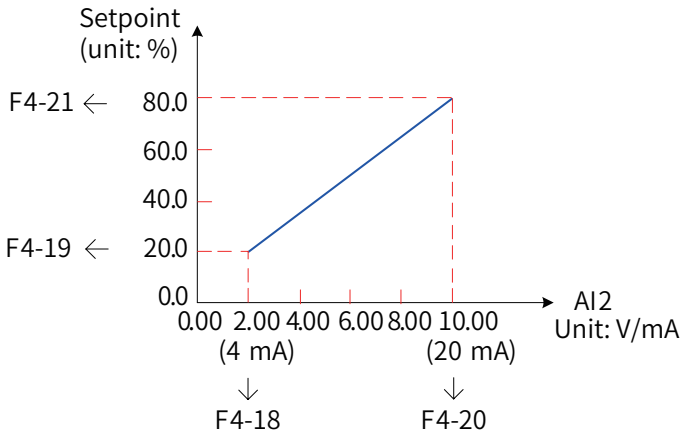


Figure 3-12 Setting AI curve 2

Parameter Code	Parameter Name	Default	Value Range	Description
F4-18	Minimum input of AI curve 2	0.00 V	0.00 V to F4-20	-
F4-19	Percentage corresponding to minimum input of AI curve 2	0.0%	-100.00% to 100.0%	-
F4-20	Maximum input of AI curve 2	10.00 V	F4-18 to 10.00 V	-
F4-21	Percentage corresponding to maximum input of AI curve 2	100.0%	-100.00% to 100.0%	-
F4-23	Minimum input of AI curve 3	0.00 V	-10.00 V to F4-25	-
F4-24	Percentage corresponding to minimum input of AI curve 3	0.0%	-100.00% to 100.0%	-
F4-25	Maximum input of AI curve 3	10.00 V	F4-23 to 10.00 V	-
F4-26	Percentage corresponding to maximum input of AI curve 3	100.0%	-100.00% to 100.0%	-

The function of curve 4 and curve 5 is similar to that of curve 1 to curve 3, but curve 1 to curve 3 are straight lines, and curve 4 and curve 5 are 4-point curves. The following figure shows the schematic diagram of curve 4 and curve 5.

NOTE

- When setting curve 4 and curve 5, the minimum input voltage, inflection point 1 voltage, inflection point 2 voltage, and maximum input voltage must be increased in ascending order.

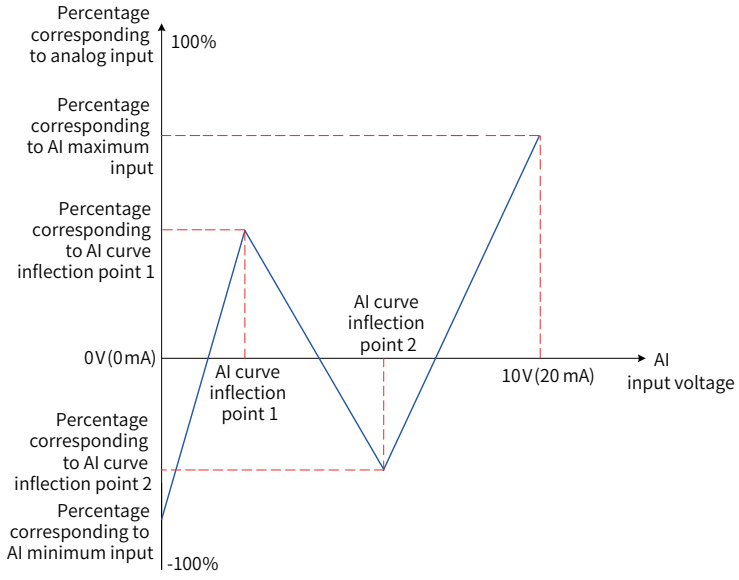


Figure 3-13 Schematic diagram for curve 4 and curve 5

Parameter Code	Parameter Name	Default	Value Range	Description
A6-00	Minimum input of AI curve 4	0.00 V	-10.00 V to A6-02	-
A6-01	Percentage corresponding to minimum input of AI curve 4	0.0%	-100.00% to 100.0%	-

A6-02	Inflection point 1 input of AI curve 4	3.00 V	A6-00 to A6-04	-
A6-03	Percentage corresponding to inflection point 1 input of AI curve 4	30.0%	-100.0% to 100.0%	-
A6-04	Inflection point 2 input of AI curve 4	6.00 V	A6-02 to A6-06	-
A6-05	Percentage corresponding to inflection 2 input of AI curve 4	60.0%	-100.0% to 100.0%	-
A6-06	Maximum input of AI curve 4	10.00 V	A6-04 to 10.00 V	-
A6-07	Percentage corresponding to maximum input of AI curve 4	100.0%	-100.0% to 100.0%	-
A6-08	Minimum input of AI curve 5	-10.00 V	-10.00 V to A6-10	-
A6-09	Percentage corresponding to minimum input of AI curve 5	-100.0%	-100.0% to 100.0%	-
A6-10	Inflection point 1 input of AI curve 5	-3.00 V	A6-08 to A6-12	-
A6-11	Percentage corresponding to inflection point 1 input of AI curve 5	-30.0%	-100.0% to 100.0%	-
A6-12	Inflection point 2 input of AI curve 5	3.00 V	A6-10 to A6-14	-
A6-13	Percentage corresponding to inflection 2 input of AI curve 5	30.0%	-100.0%~100.0%	-
A6-14	Maximum input of AI curve 5	10.00 V	A6-12 to 10.00 V	-
A6-15	Percentage corresponding to maximum input of AI curve 5	100.0%	-100.0% to 100.0%	-

◆ AI curve selection

The ones and tens places of F4-33 are used to set the curve for AI1 and AI2, respectively. The two AIs can use any of the five curves.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-33	AI curve selection	21	Ones: AI1 curve 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: AI2 curve selection (1 to 5, same as above) Hundreds: Reserved	If F4-33 is 321, it indicates that curve 1 is selected for AI1, and curve 2 is selected for AI2.
F4-17	AI1 filter time	0.10s	0.00s to 10.00s	These parameters are used to set the software filter time of the AIs.
F4-22	AI2 filter time	0.10s	0.00s to 10.00s	

The longer the AI input filter time, the stronger the anti-interference capability, but the slower the adjustment response. The shorter the filter time, the quicker the adjustment response, but the weaker the anti-interference capability. If the analog signal is prone to interference, increase the filter time to stabilize the detected analog signal. However, increasing the filter time will slow the response speed of analog detection. Set the filter time properly based on actual conditions.

◆ AI as the main frequency reference source

The MD810 control board provides two AIs, namely AI1 and AI2. AI1 supports voltage input of –10 V to +10 V. AI2 supports voltage input of 0 V to 10 V or current input of 0 mA to 20 mA, which can be selected by F4-40. The following describes the setting of each AI used as the main frequency reference source.

For example, assume that curve 1 is selected for AI1 (the ones place of F4-33 is set to 1) and voltage-type AI1 is used as the main frequency reference source. To make input voltage of 2 V to 10 V correspond to frequency of 10 Hz to 40 Hz, set as follows.

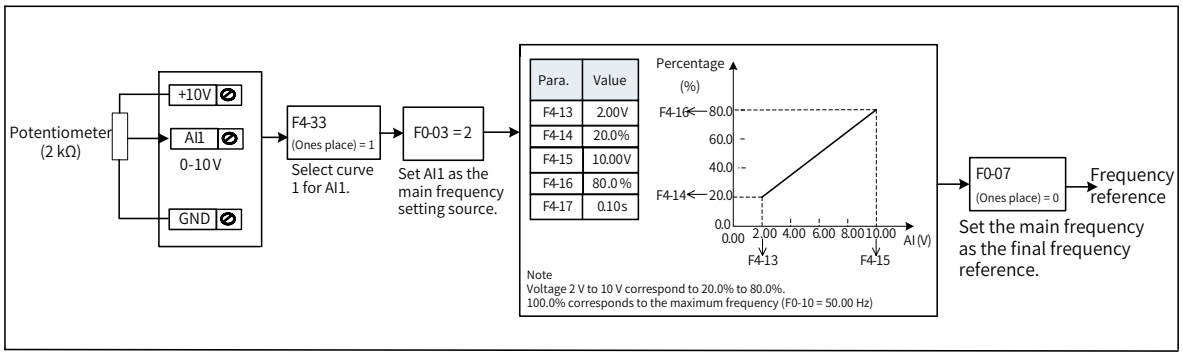


Figure 3-14 Parameter settings for voltage-type AI1 to be used as the main frequency reference source

AI2 supports analog voltage input (0 V to 10 V) or analog current input (0 mA to 20 mA).

When AI2 is used for analog current input, input current of 0 mA to 20 mA corresponds to input voltage of 0 V to 10 V. If the input current ranges from 4 mA to 20 mA, current of 4 mA corresponds to voltage of 2 V, and current of 20 mA corresponds to voltage of 10 V.

For example, assume that curve 2 is selected for AI2 (the tens place of F4-33 is set to 2) and current-type AI2 is used as the main frequency reference source. To make input current of 4 mA to 20 mA correspond to frequency of 0 Hz to 50 Hz, set as follows.

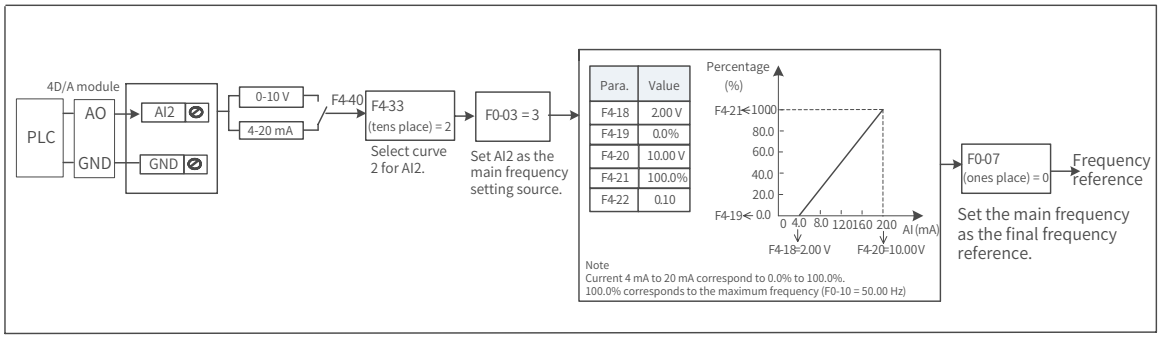


Figure 3-15 Parameter settings for current-type AI2 to be used as the main frequency reference source

3.2.4 Setting Main Frequency Through Pulse

Select the input pulse as the main frequency source by setting F0-03 to 5. In this mode, the pulse reference must be input only from multi-functional input terminal DIO1. The signal specifications set by pulse are 9 V to 30 V (voltage) and 0 kHz to 100 kHz (frequency).

Parameter Code	Parameter Name	Default	Value Range	Description
F4-28	Pulse input minimum frequency	0.00 kHz	0.00 kHz to F4-30	
F4-29	Percentage corresponding to pulse input minimum frequency	0.0%	-100.0% to 100.0%	Percentage of maximum frequency (F0-10)
F4-30	Pulse input maximum frequency	50.00 kHz	F4-28 to 100.00 kHz	
F4-31	Percentage corresponding to pulse input maximum frequency	100.0%	-100.0% to 100.0%	Percentage of maximum frequency (F0-10)
F4-32	Pulse input filter time	0.10s	0.00s to 10.00s	

You can set the percentage corresponding to the pulse frequency input from DIO1 through F4-28 to F4-31. The correspondence between the pulse frequency input and corresponding percentage is 2-point linear. The corresponding setting of pulse input indicates the percentage of the maximum frequency (F0-10). The settings are shown in the following figure.

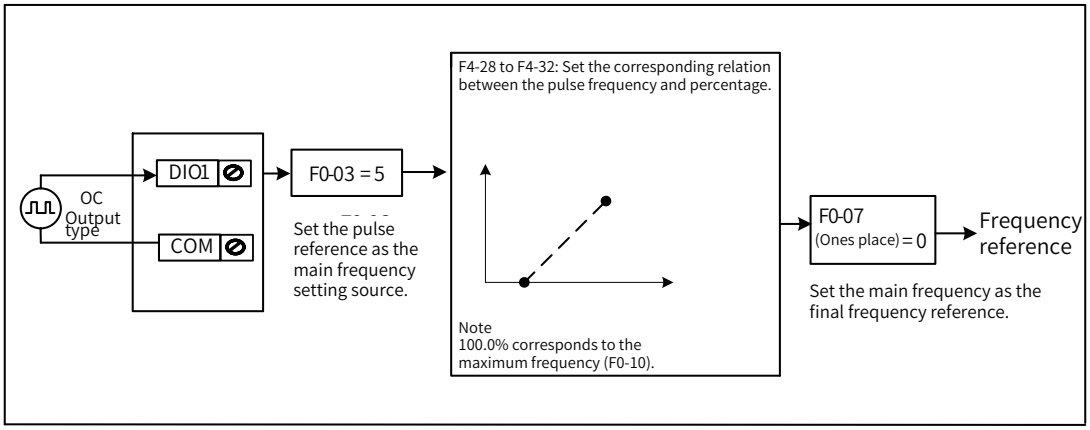


Figure 3-16 Parameters used to set the main frequency through pulse input

3.2.5 Setting Main Frequency Through Multi-reference

When F0-03 is set to 6, multi-reference is selected as the main frequency reference source. This mode is suitable for applications where the operating frequency of the drive does not require continuous adjustment, and only several frequency values need to be used.

The drive supports up to 16 frequency references in multi-reference operation mode, which can be set through combinations of input signals from four DIs. You can also use fewer than four DIs as the multi-reference source. In this case, missing digits are populated with 0.

The corresponding relationship between the number of multi-references and the number of DIs are as follows:

2 multi-references: one DI K1;
3 to 4 multi-references: two DIs K1 and K2;
5 to 8 multi-references: three DIs K1, K2, and K3;
9 to 16 multi-references: four DIs K1, K2, K3, and K4 The multiple references are set by parameters in group FC.

Parameter Code	Parameter Name	Default	Value Range	Description
FC-00	Multi-reference 0	0.0%	-100.0% to 100.0%	The multi-reference range is a percentage and the actual multi-reference value is the percentage of the maximum frequency. The positive and negative values of the parameter determine the operating direction of the drive. A negative value indicates reverse running. The default acceleration time and deceleration time are the values of F0-17 and F0-18, respectively.
FC-01	Multi-reference 1	0.0%	-100.0% to 100.0%	
FC-02	Multi-reference 2	0.0%	-100.0% to 100.0%	
FC-03	Multi-reference 3	0.0%	-100.0% to 100.0%	
FC-04	Multi-reference 4	0.0%	-100.0% to 100.0%	
FC-05	Multi-reference 5	0.0%	-100.0% to 100.0%	
FC-06	Multi-reference 6	0.0%	-100.0% to 100.0%	
FC-07	Multi-reference 7	0.0%	-100.0% to 100.0%	
FC-08	Multi-reference 8	0.0%	-100.0% to 100.0%	
FC-09	Multi-reference 9	0.0%	-100.0% to 100.0%	
FC-10	Multi-reference 10	0.0%	-100.0% to 100.0%	
FC-11	Multi-reference 11	0.0%	-100.0% to 100.0%	
FC-12	Multi-reference 12	0.0%	-100.0% to 100.0%	
FC-13	Multi-reference 13	0.0%	-100.0% to 100.0%	
FC-14	Multi-reference 14	0.0%	-100.0% to 100.0%	
FC-15	Multi-reference 15	0.0%	-100.0% to 100.0%	
FC-51	Multi-reference 0 setting mode	0	0 to 6	0: FC-00 1: AI1 2: AI2 3: Reserved 4: Pulse reference 5: PID 6: F0-08 (Preset frequency), which can be modified by UP/DOWN key

To set multi-reference as the main frequency reference source, assign functions 12 to 15 to the DIs.

Parameter Code	Parameter Name	Value	Description
F4-00	DI1 function selection	12	Multi-reference terminal 1
F4-01	DI2 function selection	13	Multi-reference terminal 2
F4-03	DIO1 function selection	14	Multi-reference terminal 3
F4-04	DIO2 function selection	15	Multi-reference terminal 4
F4-41	DIO type	00	DIO1 and DIO2 are assigned with the input function.

In the following figure, DI1, DI2, DIO1, and DIO2 are used as the multi-reference input terminals, which form a four-bit binary number. The state combinations of these terminals represent different frequencies. When values of DI1, DI2, DIO1, and DIO2 are 0, 0, 1, and 0, they constitute a value of 2. In this case, the frequency set through FC-02 is selected. For details, see table 7-1. The target operating frequency is automatically calculated from "FC-02 x F0-10". The following figure shows the detailed settings.

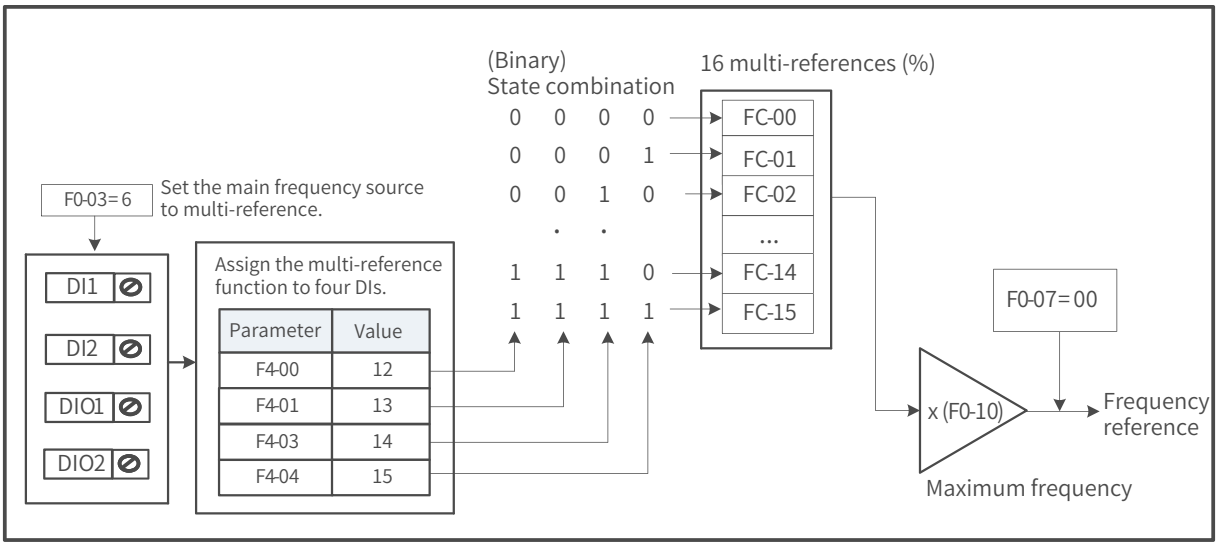


Figure 3-17 Multi-reference setting

[4]: The four multi-reference terminals can make up 16 state combinations, corresponding to 16 frequency reference values. The following table lists the details.

Table 3-1 Description of multi-reference function

K4	K3	K2	K1	Reference	Parameter
OFF	OFF	OFF	OFF	Multi-reference 0	FC-00 (FC-51 = 0)
OFF	OFF	OFF	ON	Multi-reference 1	FC-01
OFF	OFF	ON	OFF	Multi-reference 2	FC-02
OFF	OFF	ON	ON	Multi-reference 3	FC-03
OFF	ON	OFF	OFF	Multi-reference 4	FC-04
OFF	ON	OFF	ON	Multi-reference 5	FC-05
OFF	ON	ON	OFF	Multi-reference 6	FC-06
OFF	ON	ON	ON	Multi-reference 7	FC-07
ON	OFF	OFF	OFF	Reference 8	FC-08
ON	OFF	OFF	ON	Multi-reference 9	FC-09

ON	OFF	ON	OFF	Multi-reference 10	FC-10
ON	OFF	ON	ON	Multi-reference 11	FC-11
ON	ON	OFF	OFF	Multi-reference 12	FC-12
ON	ON	OFF	ON	Multi-reference 13	FC-13
ON	ON	ON	OFF	Multi-reference 14	FC-14
ON	ON	ON	ON	Multi-reference 15	FC-15

NOTE

- Except for the main frequency source, the multi-reference can also act as the voltage source for V/f separation (for details, see F3-13 descriptions in "3.5.1 V/f Curve Settings") and the setting source for process PID (for details, see FA-00 descriptions in "3.2.7 Setting Main Frequency Through PID").

3.2.6 Setting Main Frequency Through Simple PLC

Select the simple PLC as the main frequency source by setting F0-03 to 7.

When the simple PLC acts as the main frequency source, FC-00 to FC-15 must be set (for details, see "3.2.5 Setting Main Frequency Through Multi-reference"). FC-18 to FC-49 are used to set the running time and acceleration/deceleration time of each reference. See the following for the parameter settings.

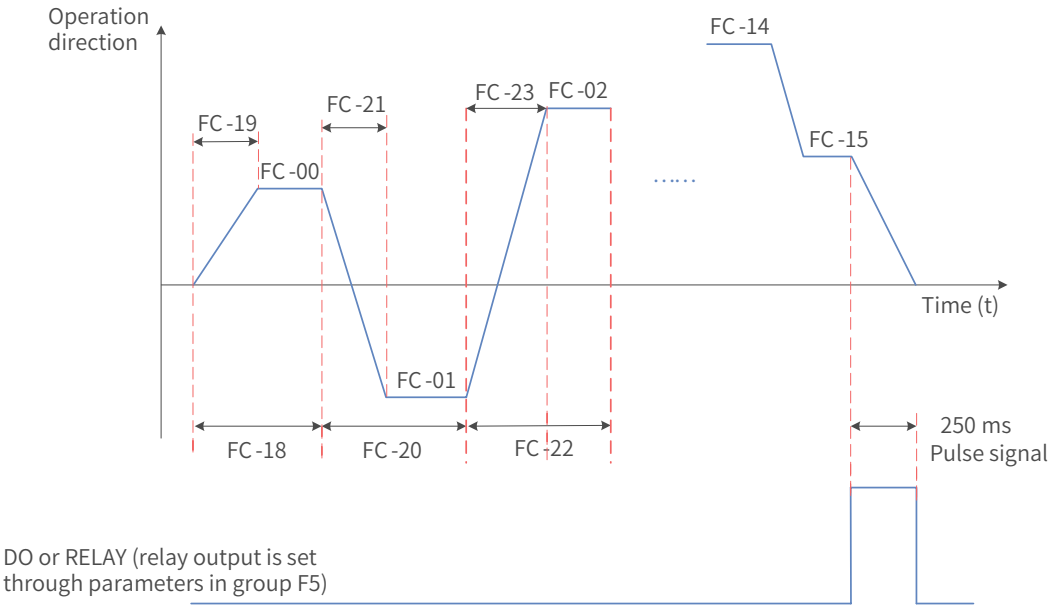


Figure 3-18 Use of simple PLC as the main frequency source

Parameter Code	Parameter Name	Default	Value Range	Description
FC-18	Running time of multi-reference 0 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-

Parameter Code	Parameter Name	Default	Value Range	Description
FC-19	Acceleration/Deceleration time of multi-reference 0 set by simple PLC	0	0 to 3	-
FC-20	Running time of multi-reference 1 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-21	Acceleration/Deceleration time of multi-reference 1 set by simple PLC	0	0 to 3	-
FC-22	Running time of multi-reference 2 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-23	Acceleration/Deceleration time of multi-reference 2 set by simple PLC	0	0 to 3	-
FC-24	Running time of multi-reference 3 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-25	Acceleration/Deceleration time of multi-reference 3 set by simple PLC	0	0 to 3	-
FC-26	Running time of multi-reference 4 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-27	Acceleration/Deceleration time of multi-reference 4 set by simple PLC	0	0 to 3	-
FC-28	Running time of multi-reference 5 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-29	Acceleration/Deceleration time of multi-reference 5 set by simple PLC	0	0 to 3	-
FC-30	Running time of multi-reference 6 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-31	Acceleration/Deceleration time of multi-reference 6 set by simple PLC	0	0 to 3	-
FC-32	Running time of multi-reference 7 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-33	Acceleration/Deceleration time of multi-reference 7 set by simple PLC	0	0 to 3	-
FC-34	Running time of simple PLC reference 8	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-35	Acceleration/Deceleration time of multi-reference 8 set by simple PLC	0	0 to 3	-
FC-36	Running time of multi-reference 9 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-37	Acceleration/Deceleration time of multi-reference 9 set by simple PLC	0	0 to 3	-
FC-38	Running time of multi-reference 10 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-39	Acceleration/Deceleration time of multi-reference 10 set by simple PLC	0	0 to 3	-

Parameter Code	Parameter Name	Default	Value Range	Description
FC-40	Running time of multi-reference 11 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-41	Acceleration/Deceleration time of multi-reference 11 set by simple PLC	0	0 to 3	-
FC-42	Running time of multi-reference 12 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-43	Acceleration/Deceleration time of multi-reference 12 set by simple PLC	0	0 to 3	-
FC-44	Running time of multi-reference 13 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-45	Acceleration/Deceleration time of multi-reference 13 set by simple PLC	0	0 to 3	-
FC-46	Running time of multi-reference 14 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-47	Acceleration/Deceleration time of multi-reference 14 set by simple PLC	0	0 to 3	-
FC-48	Running time of multi-reference 15 set by simple PLC	0.0s (h)	0.0s (h) to 6553.5s (h)	-
FC-49	Acceleration/Deceleration time of multi-reference 15 set by simple PLC	0	0 to 3	-
FC-50	Time unit of simple PLC	0	0: s (second) 1: h (hour)	-

When using the simple PLC to set the main frequency, set FC-16 to select the running mode of the PLC and FC-17 to select whether to retain the running status and frequency of the PLC after power failure or stop. Related parameters are as follows.

Parameter Code	Parameter Name	Default	Value Range	Description
FC-16	Simple PLC operation mode	0	0: Stop after running one cycle	The AC drive stops after running for one cycle, and will start up after receiving a running command again.
			1: Keep final values after running for one cycle	The AC drive automatically retains the final running frequency and direction after running for one cycle. When the drive is started again, it runs from the initial PLC state.
			2: Repeat after running for one cycle	The AC drive automatically starts another cycle after running for one cycle, and will not stop until receiving a stop command.

Parameter Code	Parameter Name	Default	Value Range	Description
FC-17	Simple PLC Retention selection upon power failure	00	Ones: Retention selection upon power failure	
			0: Non-retentive upon power failure	The AC drive restarts the PLC process upon power-on.
			1: Retentive at power failure	The AC drive memorizes the latest running status and frequency of the PLC set before power failure, and continues to run from the memorized moment after its power is restored.
			Tens: Retention selection upon stop	
			0: Non-retentive upon stop	The AC drive restarts the PLC process upon power-on.
			1: Retentive upon stop	The AC drive memorizes the latest running status and frequency of the PLC when it stops, and continues to run from the memorized moment.
FC-50	Simple PLC Running time unit	0	0: s (second) 1: h (hour)	It sets the time unit of PLC running.
FC-51	Multi-reference 0 setting mode	0	0: FC-00 1: AI1 2: AI2 4: Pulse reference 5: PID 6: F0-08 (Preset frequency), which can be modified by UP/DOWN key	-

Simple PLC can be the frequency source or V/f separation voltage source. For details, see F3-13 descriptions in "3.5.1 V/f Curve Settings".

3.2.7 Setting Main Frequency Through PID

Select the PID as the main frequency source by setting F0-03 to 8.

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. The PID-controlled output is used as the running frequency. The PID control is generally used for field process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

- Proportional gain Kp: When there is a deviation between the PID input and output, the PID regulator adjusts the output to reduce the deviation of the controlled variable. The deviation reduction speed depends on the proportionality coefficient Kp. A greater Kp value means faster deviation reduction but causes oscillation, especially in the case of long hysteresis. A smaller Kp value means lower probability of oscillation but leads to slow adjustment. (A proportional gain of 100.0 indicates that when the deviation between PID feedback and PID reference is 100.0%, the PID regulator regulates the out-

put frequency reference at the amplitude of the maximum frequency.)

- Integral time Ti: Ti determines the integral regulation intensity of the PID regulator. The shorter the integral time, the greater the adjustment intensity. (When the deviation between PID feedback and PID reference is 100.0%, the integral regulator performs continuous regulation within the time. The regulation amount reaches the maximum frequency.)

- Differential time Td: Td determines the regulation intensity of the PID regulator on the deviation change. Longer differential time indicates greater adjustment intensity. (Differential time indicates the time within which the feedback change reaches 100.0%. The regulation amount reaches the maximum frequency.)

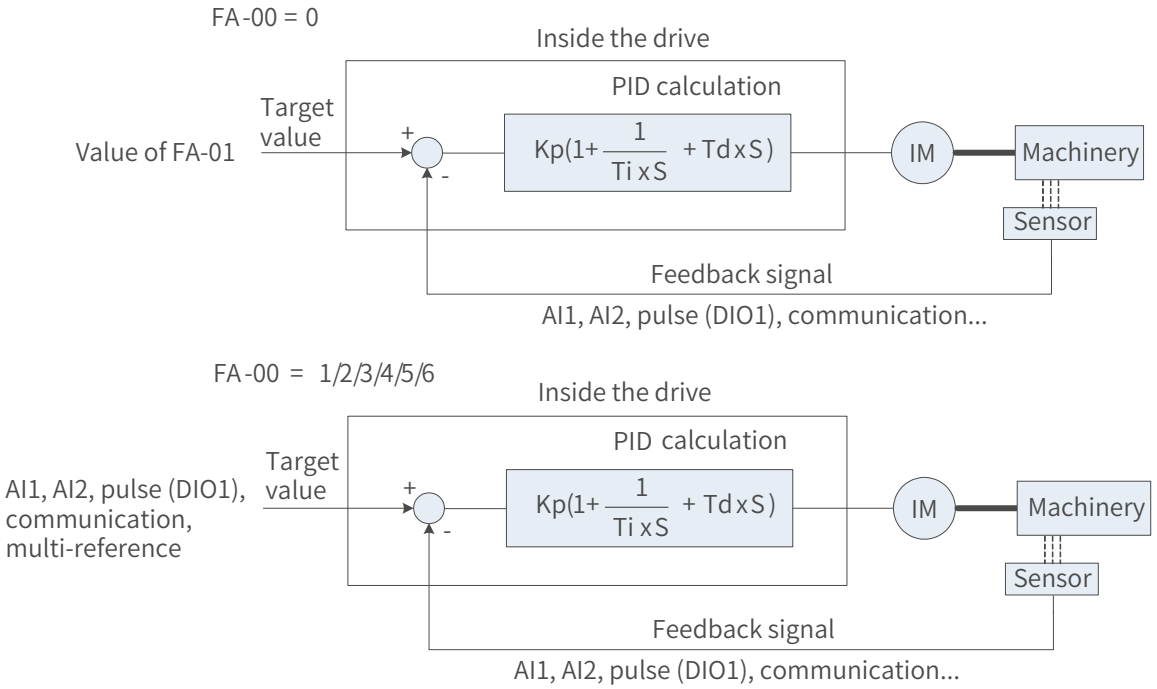


Figure 3-19 Principle of process PID control

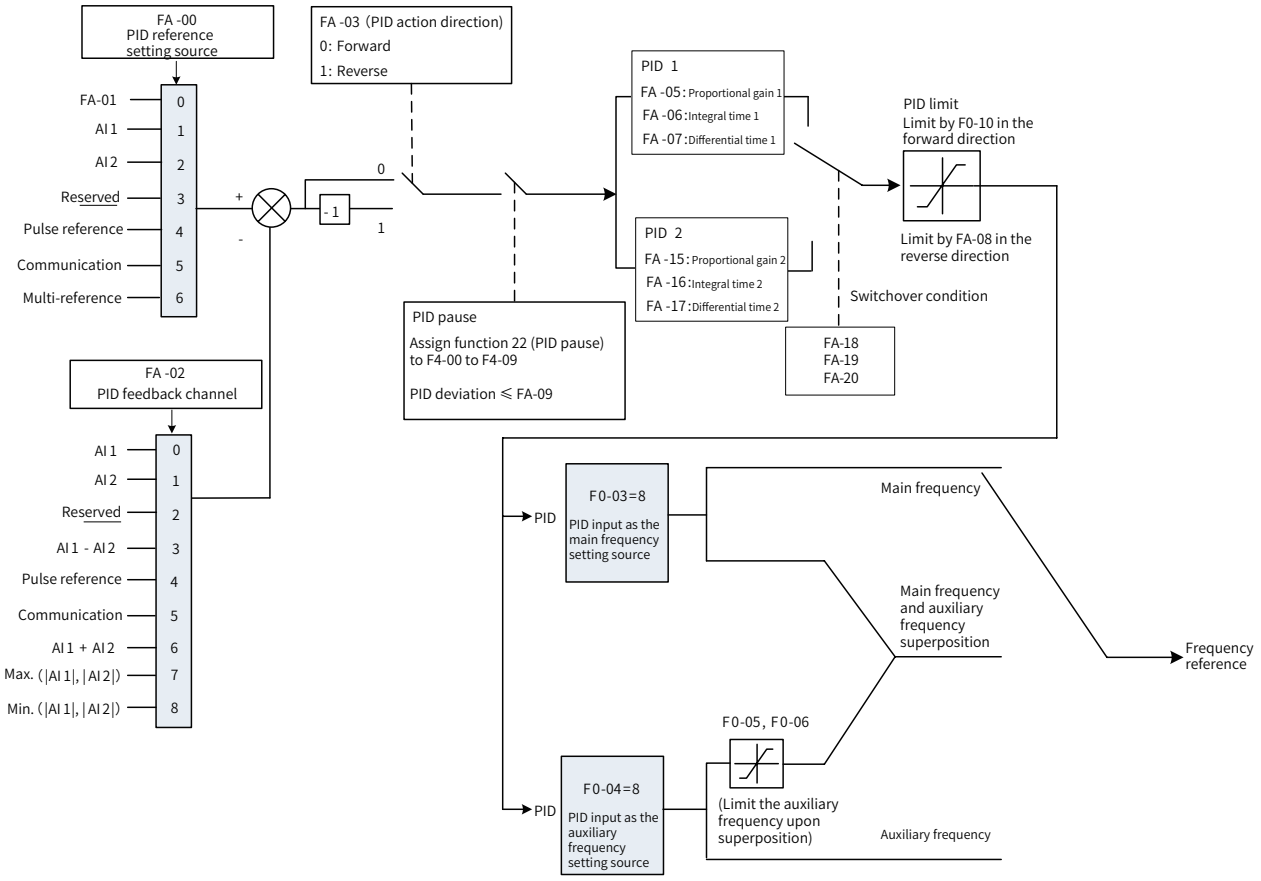


Figure 3-20 Parameter settings for process PID control

Parameter Code	Parameter Name	Default	Value Range	Description
FA-00	PID reference source	0	0: FA-01 1: AI1 2: AI2 3: Reserved 4: Pulse reference (DIO1) 5: Communication (1000H) 6: Multi-reference	This parameter specifies the reference channel of the PID target value. The PID reference is a relative value. The value 100% corresponds to 100% of the feedback signal of the controlled system. Note: When FA-00 is set to 6 (multi-reference), FC-51 (Source of multi-reference 0) cannot be set to 5 (PID reference).
FA-01	PID digital setting	50.0%	0.0% to 100.0%	When FA-00 is set to 0, you need to set this parameter. 100% corresponds to the maximum feedback.
FA-02	PID feedback source	0	0: AI1 1: AI2 2: Reserved 3: AI1 – AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: AI1 + AI2 7: Max. (|AI1|, |AI2|) 8: MIN (|AI1|, |AI2|)	It is used to select the PID feedback channel.

Parameter Code	Parameter Name	Default	Value Range	Description
FA-03	PID action direction	0	0: Forward	If the feedback signal is smaller than the PID reference, the drive output frequency increases.
			1: Reverse	If the feedback signal is smaller than the PID reference, the drive output frequency decreases.
FA-04	PID reference and feedback range	1000	0 to 65535	This parameter is used for display of the PID reference and feedback, which are dimensionless. For example, if the parameter is set to 1000, the PID reference (0% to 100%) corresponds to the feedback value (0 to 1000) linearly.
FA-05	Proportional gain Kp1	20.0	0.0 to 1000.0	PI regulation is suitable for most systems.
FA-06	Integral time Ti1	2.00s	0.01s to 10.00s	
FA-07	Differential time Td1	0.000s	0.000s to 10.000s	
FA-08	PID cut-off frequency in reverse direction	0.00 Hz	0.00 to maximum frequency	When the frequency source is pure PID, the PID cut-off frequency in the reverse direction is the minimum PID output value.
FA-09	PID error limit	0.0%	0.0% to 100.0%	It helps to balance the accuracy and stability of system outputs.
FA-10	PID differential limit	0.10%	0.00% to 100.0%	It is used to set the range of PID differential output. In PID control, the differential operations may easily cause system oscillation. Thus, the PID differential regulation is generally restricted to a small range.
FA-11	PID reference change time	0.00s	0.00s to 650.00s	This parameter defines the time required for the PID reference to change from 0.0% to 100.0%.
FA-12	PID feedback filter time	0.00s	0.00s to 60.00s	This parameter defines the filter time of PID feedback. The filter helps to reduce interference on the feedback but lowers the responsiveness of the process closed-loop system.
FA-13	PID error gain	100.0%	0.0% to 100.0%	-
FA-15	Proportional gain Kp2	20.0	0.0 to 1000.0	These parameter are used for the switchover of two groups of PID parameters. PID parameters can be switched through the DI or automatically based on the PID deviation. Parameters FA-15 to FA-17 are set in the same way as FA-05 to FA-07.
FA-16	Integral time Ti2	2.00s	0.01s to 10.00s	
FA-17	Differential time Td2	0.000s	0.000s to 10.000s	

Parameter Code	Parameter Name	Default	Value Range	Description
FA-18	PID parameter switchover condition	0	0: Not switched	-
			1: Switchover by DI	To enable switchover through the DI, assign the DI with function 43 (PID parameter switchover). If the DI is invalid, group 1 (FA-05 to FA-07) is selected. If the DI is valid, group 2 (FA-15 to FA-17) is selected.
			2: Automatic switchover based on deviation	When the absolute value of the deviation between PID feedback and PID reference is lower than the value of FA-19, group 1 is selected. When the absolute value of the deviation between PID feedback and PID reference is higher than the value of FA-20, group 2 is selected. When the deviation between PID feedback and PID reference is within the value of FA-19 (PID parameter switchover deviation 1) and the value of FA-20 (PID parameter switchover deviation 2), the PID parameters are the linear interpolated value of the two groups of parameter values, as shown in the following figure.
			3: Automatic switchover based on running frequency	In this mode, when the running frequency of the AC drive is between 0 and the maximum frequency, the PID parameters are the linear interpolated value of the two groups of parameter values.
			6: Automatic adjustment based on roll diameter	In this mode, when the current roll diameter changes between the maximum roll diameter (B0-08) and minimum roll diameter (B0-09), the PID parameters are the linear interpolated value of the two groups of parameter values. The minimum roll diameter corresponds to parameter group 1 (FA-05 to FA-07), and the maximum roll diameter corresponds to parameter group 2 (FA-15 to FA-17).
			7: Adjustment based on the maximum roll diameter percentage	In this mode, when the current roll diameter changes between the result of the maximum roll diameter (B0-08) multiplied by FA-20 and the result of the maximum roll diameter (B0-08) multiplied by FA-19, the PID parameters are the linear interpolated value of the two groups of parameter values.

Parameter Code	Parameter Name	Default	Value Range	Description
FA-19	PID parameter switchover deviation 1	20.0%	0.00 to FA-20	100% corresponds to the maximum deviation between PID reference and PID feedback. The two parameters take effect when FA-18 is 2.
FA-20	PID parameter switchover deviation 2	80.0%	FA-19 to 100.0%	
FA-21	PID initial value	0.0%	0.0% to 100.0%	When the AC drive starts up, the PID outputs an initial value (FA-21). After the PID initial value active time (FA-22) is reached, the PID starts closed-loop regulation operations. For PID initial value functions, see "Figure 3-22 PID initial value". PID initial value
FA-22	Active time of PID initial value	0.00s	0.00s to 650.00s	-
FA-25	PID integral	0	Integral pause 0: Inactive 1: Valid	When integral pause is inactive, it remains inactive no matter whether the multi-functional DI is active.
FA-26	Detection level of PID feedback loss	0.0%	0.0%: No detection; 0.1% to 100.0%	-
FA-27	Detection time of PID feedback loss	0.0s	0.0s to 20.0s	It is used to judge whether PID feedback is lost. The AC drive reports Err.31 when the PID feedback remains smaller than the PID feedback loss detection level (FA-26) for a period exceeding the detection time of PID feedback loss (FA-27).

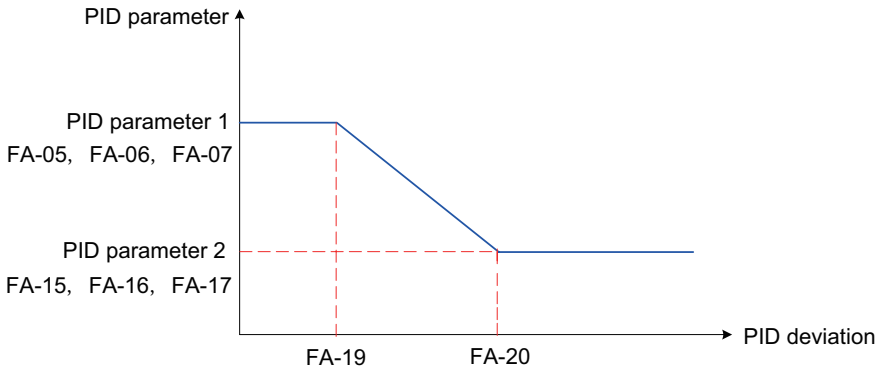


Figure 3-21 PID parameter switchover

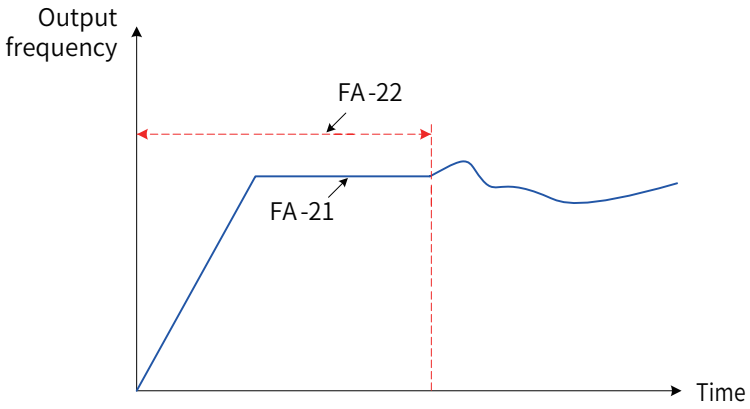


Figure 3-22 PID initial value

NOTE

- The upper and lower limits and range of the frequency output when the PID is used as the main frequency source are described as follows (for example, when the frequency source is only PID or main frequency + PID).

The reverse cut-off frequency is 0 or reverse running is prohibited (any one of the following three situations).

① FA-08 = 0, F8-13 = 0;
② FA-08 = 0, F8-13 = 1;
③ FA-08 ≠ 0, F8-13 = 1

Output upper limit: frequency upper limit

Output lower limit: frequency lower limit

Output range: frequency lower limit to frequency upper limit (F0-14 to F0-12)

The reverse cut-off frequency is not 0 and reverse running is allowed (FA-08 ≠ 0, F8-13 = 0).

Output upper limit: frequency upper limit;
Output lower limit: negative reverse cut-off frequency

Output range: negative reverse cut-off frequency (— FA-08) to frequency upper limit (F0-12)

- For details on PID adjustment methods, see "1.2 External LCD Operating Panel".

3.2.8 Setting Main Frequency Through Communication

The communication address is as follows.

Communication Address	Communication Type	Description
0x1000	CANlink, Modbus, PROFIBUS DP	-100.00% to 100.00% correspond to -10000 to 10000.
0x7310	CANopen, CANlink, Modbus, PROFIBUS DP	Two decimal places. For example, if the decimal value 1000 is written, the frequency reference is 10.00 Hz. Note: Frequency reference and speed reference (0x7317) cannot be used at the same time.

0x7317	CANopen, CANlink, Modbus, PROFIBUS DP	The unit is 1 rpm. Note: Speed reference and frequency reference (0x7310) cannot be used at the same time.

3.2.9 Selecting Input Method for Auxiliary Frequency Reference

Set F0-04 to select the input method for the auxiliary frequency reference. There are ten auxiliary frequency sources in total, including digital setting (non-retentive at power failure), digital setting (retentive at power failure), AI1, AI2, pulse input, multi-reference, simple PLC, PID, communication, and synchronization control. The following figure shows the setting interface.

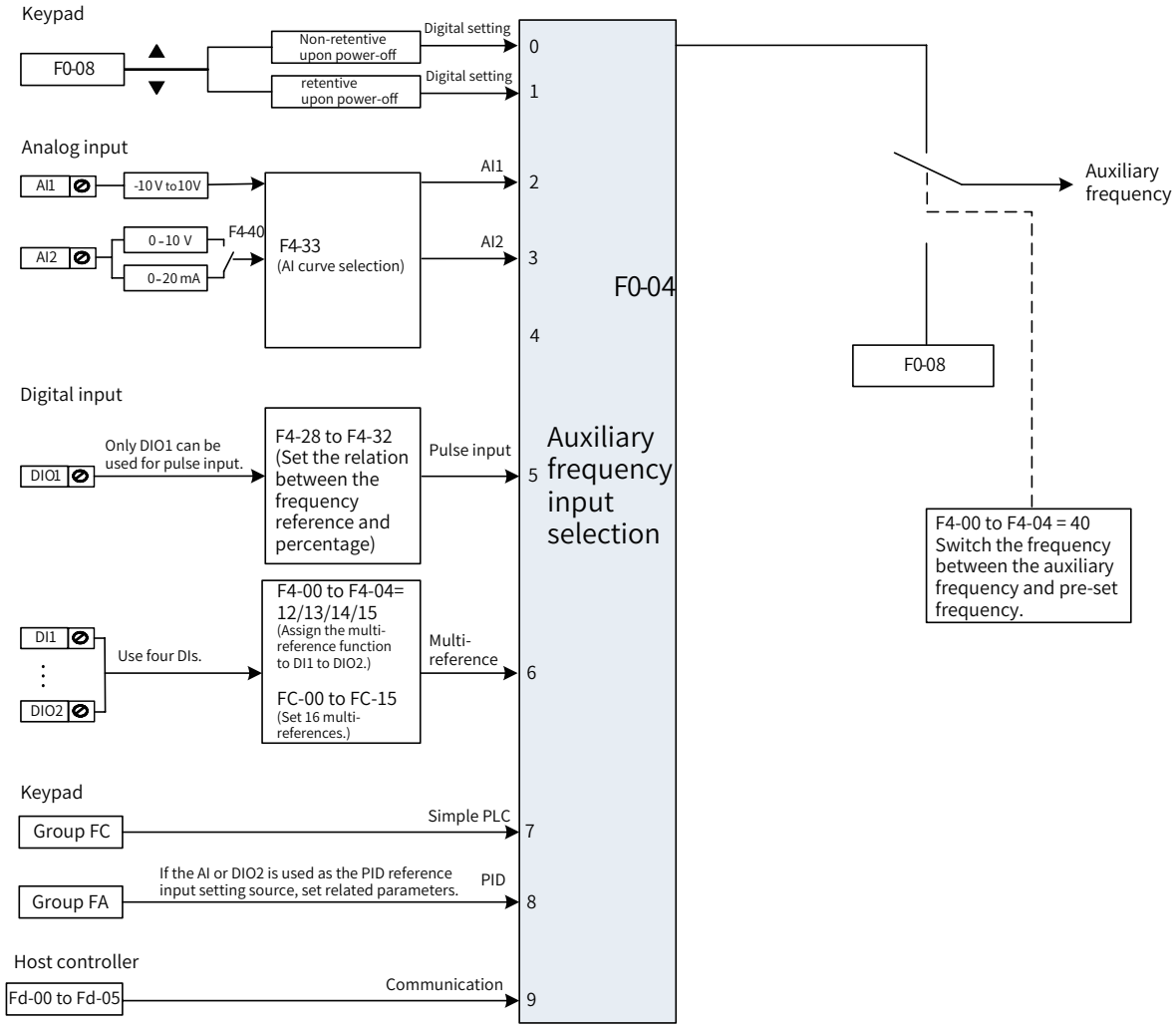


Figure 3-23 Auxiliary frequency reference source selection

Parameter Code	Parameter Name	Default	Value Range	Description
F0-04	Auxiliary frequency reference setting channel selection	0	0	Operating panel (digital setting, non-retentive at power failure)
			1	Operating panel (digital setting, retentive at power failure)
			2	AI1
			3	AI2
			5	Pulse setting (DIO1)
			6	Multi-reference
			7	Simple PLC
			8	PID
			9	Communication

When the auxiliary frequency reference is used as a separate frequency reference source, it is set in the same way as the main frequency reference. When the auxiliary frequency reference is used for superposition (that is, the main and auxiliary frequency references are superposed to set the frequency), it is used following the instructions in "3.2.10 Setting Channel Selection for Main and Auxiliary Frequency Superposition Reference".

3.2.10 Setting Channel Selection for Main and Auxiliary Frequency Superposition Reference

Main and auxiliary frequency superposition is used to set the frequency reference by performing operations on the main frequency and auxiliary frequency. The relationship between the target frequency and the main and auxiliary frequencies is set in F0-07, which is described as follows.

1. Main frequency reference: The main frequency reference is directly used as the target frequency reference.

2. Auxiliary frequency reference: The auxiliary frequency reference is directly used as the target frequency reference.

3. Operations on the main and auxiliary frequency references: There are five types of main and auxiliary operations, including main frequency + auxiliary frequency, main frequency – auxiliary frequency, max. (main frequency, auxiliary frequency), min. (main frequency, auxiliary frequency), and main frequency x auxiliary frequency.

4. Frequency switchover: The DI is used to select the preceding three frequency references or perform switchover among them. In this case, allocate function 18 (frequency reference switchover) to the DI.

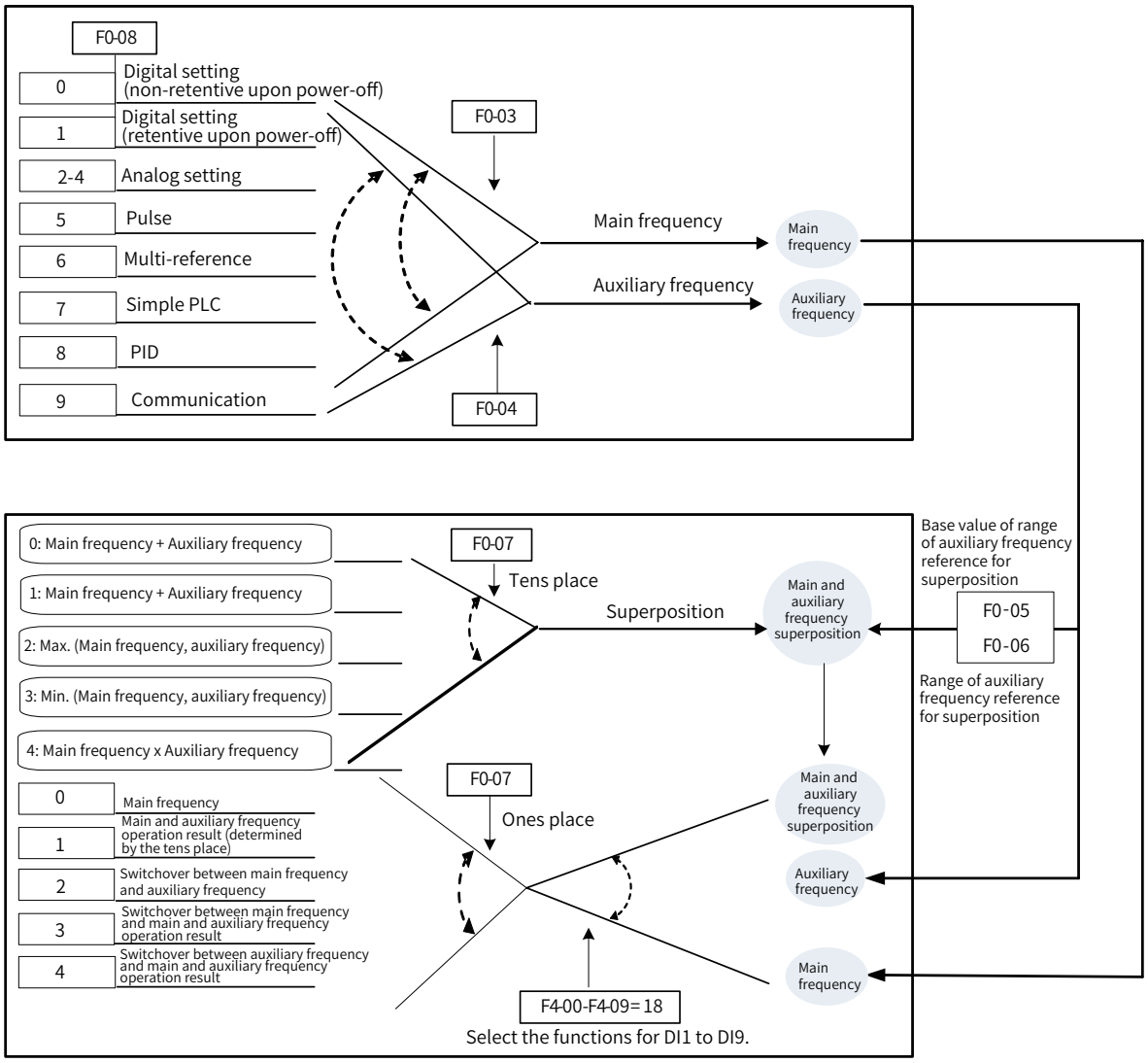


Figure 3-24 Main and auxiliary frequency superposition

Parameter Code	Parameter Name	Default	Value Range
F0-07	Frequency reference superposition selection	00	Ones: Frequency reference selection 0: Main frequency reference 1: Main and auxiliary operation result (based on the tens place) 2: Switchover between main frequency reference and auxiliary frequency reference 3: Switchover between main frequency reference and main and auxiliary frequency operation result 4: Switchover between auxiliary frequency reference and main and auxiliary frequency operation result Tens: Operation on main and auxiliary frequencies 0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x Auxiliary frequency

Main and auxiliary frequency superposition

Operation	Main Frequency Reference Source	Auxiliary Frequency Reference Source	Description
+	Digital setting	AI/Pulse/Multi-reference/ Simple PLC/ Communication	1. Settings by UP/DOWN key are invalid. 2. Output range: F0-08 + Auxiliary frequency reference.
	AI/Pulse/Multi-reference/ Simple PLC/ Communication	Digital setting	1. Settings by UP/DOWN key are invalid. 2. Output range: Main frequency reference + Value set by UP/DOWN key.
	Digital setting	PID	1. Settings by UP/DOWN key are invalid. 2: The set digital value is forced to 0. 3. Output range: Auxiliary frequency reference.
	PID	Digital setting	1. Settings by UP/DOWN key are invalid. 2: The set digital value is forced to 0. Output range: Main frequency reference.
	AI/Pulse/Multi-reference/ Simple PLC/ Communication	PID	1. Settings by UP/DOWN key are invalid. 2. The frequency lower limit is invalid. 3. Output range: Main frequency reference + Auxiliary frequency reference.
	PID	AI/Pulse/Multi-reference/ Simple PLC/ Communication	1. Settings by UP/DOWN key are invalid. 2. Output range: Auxiliary frequency reference.
	Digital setting	Digital setting	1. Settings by UP/DOWN key are invalid. 2. Output range: Main frequency reference + Value set by UP/DOWN key, which is the same as digital setting of the single frequency source.
–/x/Max./ Min.	Any	Any	1. When digital setting is used, the value set by UP/DOWN key is inactive. The digital setting value is defined by F0-08. 2. Either the main frequency or auxiliary frequency can be set through PID. 3. Either the main frequency or auxiliary frequency can be set through the simple PLC. 4. When both the main and auxiliary frequency references are set by digit, the main frequency reference is active, the auxiliary frequency reference is inactive, and the value set by UP/DOWN key is active.

Operation	Main Frequency Reference Source	Auxiliary Frequency Reference Source	Description
Single frequency source	Digital setting	-	1. Settings by UP/DOWN key are valid. 2. Output range: Main frequency reference + Value set by UP/DOWN key. 3. Adjustment range for the UP/DOWN key: (Frequency upper limit – Main frequency) to (Frequency lower limit – Main frequency). 4. The UP/DOWN key cannot reverse the frequency direction.
	PID	-	1. The frequency lower limit is invalid. 2. The PID output range is defined by the PID output frequency upper and lower limits. 3. When reverse rotation is prohibited and the lower limit of PID output is a negative value, the lower limit of PID output is 0.
	Others		/

Parameter Code	Parameter Name	Default	Value Range
F0-05	Base value of range of auxiliary frequency reference for superposition	0	0: Relative to the maximum frequency 1: Relative to main frequency reference
F0-06	Range of auxiliary frequency reference for superposition	100%	0% to 150%

These two parameters are only valid in the main frequency + auxiliary frequency operation to limit the range of the auxiliary frequency.

Parameter Code	Parameter Name	Default	Value Range
F0-27	Main frequency coefficient	10.00%	0.00% to 100.00%
F0-28	Auxiliary frequency coefficient	10.00%	0.00% to 100.00%

These two parameters are only used in the main frequency x auxiliary frequency operation. Assume that the main frequency is Frq1 and the auxiliary frequency is Frq2.

Frq = (Frq1 x F0-27) x (Frq2 x F0-28)

3.2.11 Frequency Reference Limit

Frequency upper limit: Defines the maximum running frequency of the motor.

Frequency lower limit: Defines the minimum running frequency of the motor.

Maximum frequency: Defines the maximum output frequency.

Frequency upper limit source: Defines the source of the frequency upper limit.

Frequency upper limit offset: Defines the offset of the frequency upper limit. This parameter is valid only when the frequency upper limit source is set to the AI.

Parameter Code	Parameter Name	Default	Value Range
F0-10	Maximum frequency	50.00 Hz	5.00 Hz to 600.00 Hz
F0-11	Source of frequency upper limit	0	0: F0-12 1: AI1 2: AI2 3: Reserved 4: Pulse reference (DIO1) 5: Communication
F0-12	Frequency upper limit	50.00 Hz	F0-14 to F0-10
F0-13	Frequency upper limit offset	0.00 Hz	0.00 Hz to F0-10 (maximum frequency)
F0-14	Frequency lower limit	0.00 Hz	0.00 Hz to frequency upper limit

3.2.12 Running Mode When Frequency Reference Is Below Lower Limit

When the running frequency is lower than the frequency lower limit, select the running state of the AC drive by setting F8-14.

Run at zero speed: The drive is running with the output frequency of 0 and the RUN indicator becomes on on the keypad.

Stop: The AC drive stops running, and the RUN indicator on the keypad becomes off.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-14	Running mode when frequency reference is below lower limit	0	0: Run at frequency lower limit	If the running frequency is below the frequency lower limit, the AC drive will run at the frequency lower limit.
			1: Stop	When the running frequency is below the frequency lower limit, the AC drive stops.
			2: Run at zero speed	When the running frequency is lower than the frequency lower limit, the AC drive runs at zero speed.

3.3 Start and Stop Modes

This section mainly describes how to start/stop the AC drive.

3.3.1 Start Modes

The AC drive supports three start modes: direct start, flying start, and pre-excitation start. Set F6-00 to select a start mode of the drive.

Parameter Code	Parameter Name	Default	Value Range	Description

F6-00	Start mode	0	0: Direct start 1: Flying start (asynchronous AC motor) 2: Pre-excitation startup (asynchronous AC motor)	Flying start is recommended if you need to start a motor that is rotating at a high speed. Flying start and pre-excitation start apply only to asynchronous AC motor.
F6-01	Flying start mode	0	0: From frequency at stop 1: From 50 Hz 2: From the maximum frequency	This parameter is valid only in theV/f mode.
F6-02	Flying start speed	20	1 to 100	This parameter is valid only in theV/f mode.
F6-03	Start frequency	0.00 Hz	0.00 Hz to 10.00 Hz	When the frequency reference is smaller than the start frequency, the driveruns at the startup frequency.
F6-04	Start frequency holding time	0.0s	0.0s to 100.0s	During switchover between forward running and reverse running, this parameter is invalid. The start frequency holding time is not included in the acceleration time, but included in the running time of the simple PLC.
F6-05	Start DC braking current/Pre-excitation current	50%	0% to 100%	Larger DC braking current indicates stronger braking force. 100% corresponds to the rated motor current. The current upper limit is 80% of the rated current of the AC drive.
F6-06	Start DC braking time/Pre-excitation time	0.0s	0.0s to 100.0s	This parameter is valid only when the start mode is direct start.

1) Direct start

The direct start mode (F6-00 = 0) applies to most of loads. For the time sequence, see "Figure 3-25 Direct start time sequence". The setting of starting frequency before start applies to lifting loads, such as elevators and cranes. For the time sequence, see "Figure 3-26 Time sequence for start with the starting frequency set". The setting of DC braking before start applies to applications where the motor may rotate at start. For the time sequence, see "Figure 3-27 Time sequence for start with DC braking".

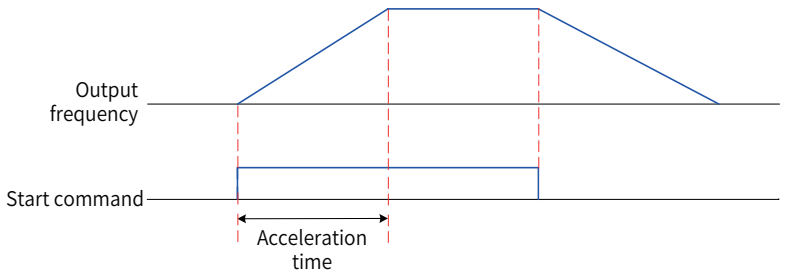


Figure 3-25 Direct start time sequence

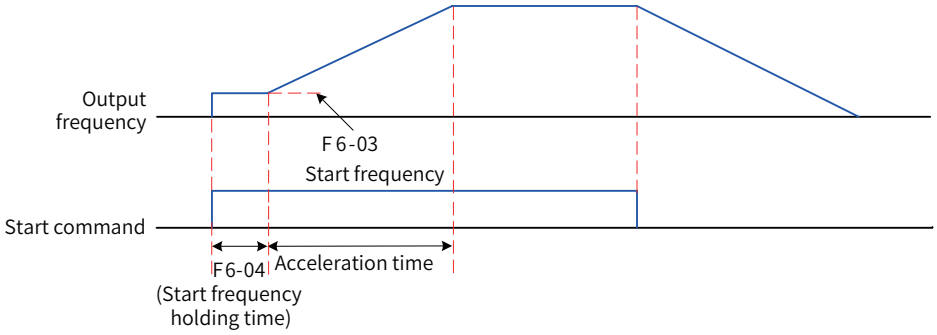


Figure 3-26 Time sequence for start with the starting frequency set

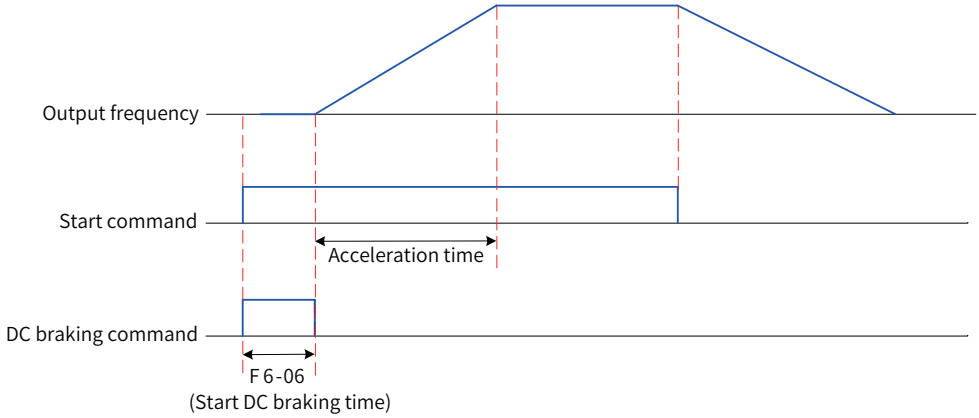


Figure 3-27 Time sequence for start with DC braking

2) Flying start

You can enable flying start by setting F6-00 to 1. The AC drive first judges the speed and direction of the motor and starts to run at the detected motor frequency. It is suitable for drives driving large inertia mechanical loads. If the motor is still rotating due to inertia when the AC drive is started, the use of flying start can avoid startup overcurrent. The following figure shows the startup frequency curve.

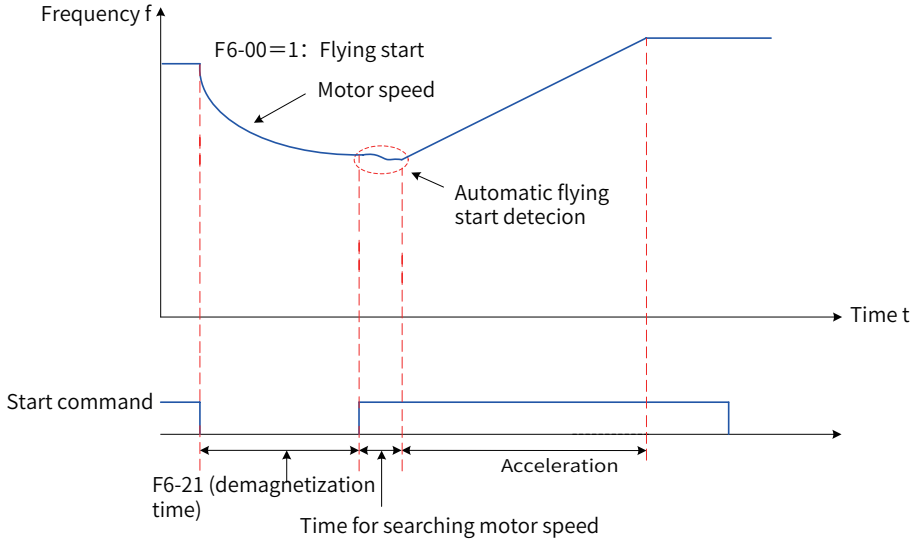


Figure 3-28 Flying start

3) Pre-excitation start

The pre-excitation start (F6-00 = 2) applies only to the asynchronous motors in SVC and FVC modes. In this mode, the motor is pre-excited before start to improve the responsiveness and reduce the starting current. The time sequence diagram is the same as that for start with DC braking. The recommended pre-excitation current is 1.5 x no-load current (F1-10), with the maximum value not larger than the rated current of the motor. If the pre-excitation current is the same as the no-load current (F1-10), the optimal pre-excitation time is 3 x rotor time constant. The rotor time constant equals mutual inductance (F1-09) + leakage inductance (F1-08)/ rotor resistance (F1-07). The unit of mutual inductance and leakage inductance is L and the unit of the resistor is Ω. If the pre-excitation current is higher than the no-load current, reduce the pre-excitation time proportionally. If the pre-excitation current is lower than the no-load current, increase the pre-excitation time proportionally.

3.3.2 Stop Mode

Two stop modes are available to the AC drive: decelerate to stop and coast to stop. Set F6-10 to select the stop mode.

Parameter Code	Parameter Name	Default	Value Range	Description
F6-10	Stop mode	0	0: Decelerate to stop 1: Coast to stop	
F6-11	DC braking/Position lock start frequency for stop	0.00 Hz	0.00 Hz to maximum frequency	During decelerating to stop, when the operating frequency drops below the value of F6-11, the drive starts DC braking or performs position lock. When DC braking for stop is used, the recommended DC braking start frequency for stop is 2% of the motor rated frequency.
F6-12	Waiting time of DC braking for stop	0.0s	0.0s to 100.0s	When the running frequency decreases to the value set by F6-11, the AC drive stops output for a period set by F6-12 and then starts DC braking.
F6-13	DC braking current for stop	50%	0% to 100%	Larger DC braking current indicates stronger braking force. 100% corresponds to the rated motor current. The current upper limit is 80% of the rated current of the AC drive.
F6-14	DC braking time for stop	0.0s	0.0s to 100.0s	If this parameter is set to 0, DC braking is disabled.

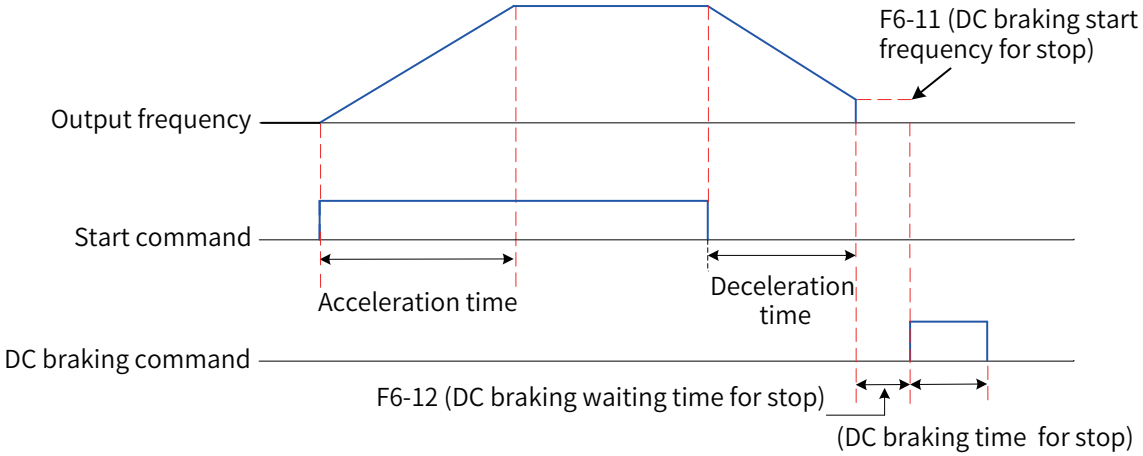


Figure 3-29 Time sequence of DC braking for stop

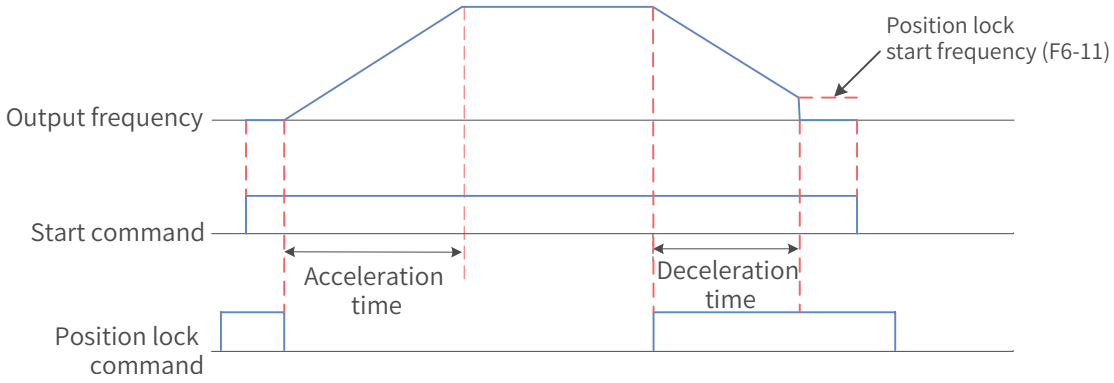


Figure 3-30 Timing diagram of position lock

1) Decelerate to stop

After you set F6-10 to 0, the drive decelerates to stop. Once the stop command becomes valid, the drive decreases the output frequency according to the deceleration time and stops when the frequency decreases to 0.

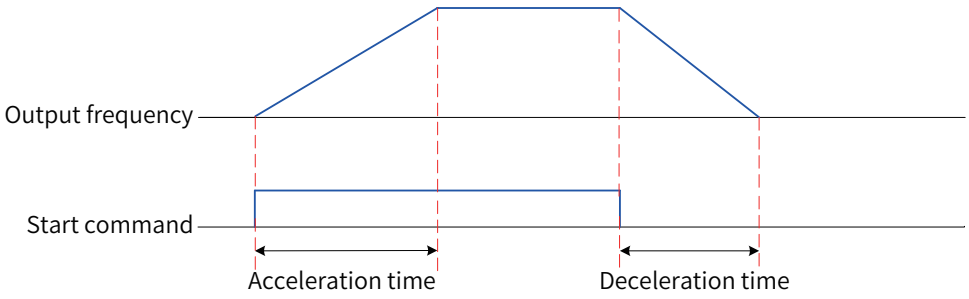


Figure 3-31 Time sequence for deceleration to stop

2) Coast to stop

Set F6-10 to 1 to select the coast-to-stop mode. Once the stop command takes effect, the drive immediately stops output, and the motor coasts to stop according to mechanical inertia.

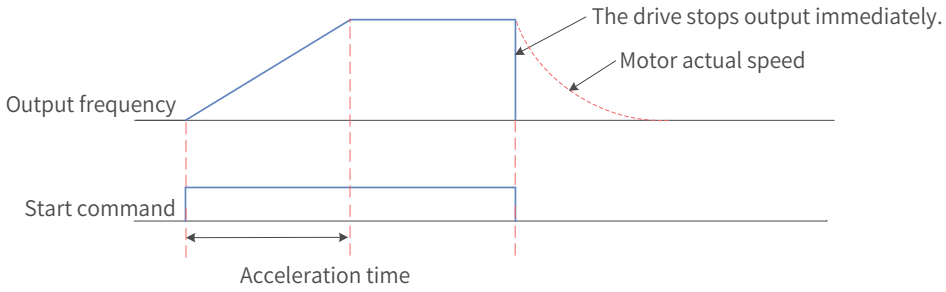


Figure 3-32 Time sequence for coast to stop

3.3.3 Acceleration/Deceleration Time and Curve Setting

Acceleration time refers to the time that the AC drive accelerates from 0 Hz to the acceleration/deceleration time reference frequency (F0-25).
Deceleration time refers to the time that the AC drive decelerates from the acceleration/deceleration time reference frequency (F0-25) to 0 Hz.

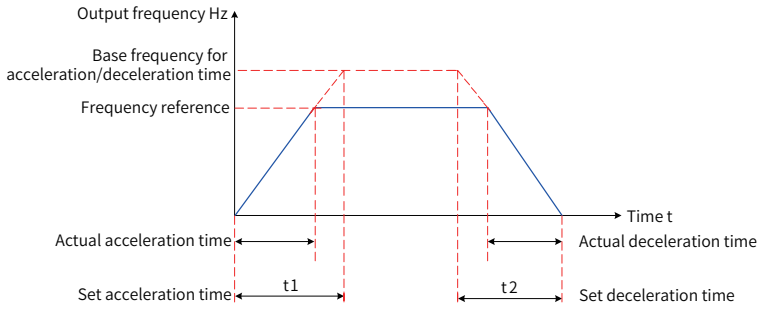


Figure 3-33 Acceleration/Deceleration time

The MD810 provides four groups of acceleration/deceleration time for selection. You can perform switchover via the DI. For example, select DI1 and DI2 for switchover.

Parameter Code	Parameter Name	Value	Description
F4-00	DI1 function selection	16	Acceleration/deceleration time selection terminal 1
F4-01	DI2 function selection	17	Acceleration/deceleration time selection terminal 2

DI1 State	DI2 State	Acceleration/Deceleration Time
OFF	OFF	Group 1: F0-17, F0-18
ON	OFF	Group 2: F8-03, F8-04
OFF	ON	Group 3: F8-05, F8-06
ON	ON	Group 4: F8-07, F8-08

Table 3-2 Selecting the acceleration and deceleration time via the DI

Parameter Code	Parameter Name	Default	Value Range	Description
F0-17	Acceleration time 1	Model dependent	0s to 65000s	F0-19 = 0
			0.0 to 6500.0	F0-19 = 1
			0.00 to 650.00	F0-19 = 2
F0-18	Deceleration time 1	Model dependent	0s to 65000s	F0-19 = 0
			0.0 to 6500.0	F0-19 = 1
			0.00 to 650.00	F0-19 = 2
F8-03	Acceleration time 2	Model dependent	Same as F0-17	-
F8-04	Deceleration time 2	Model dependent	Same as F0-18	-
F8-05	Acceleration time 3	Model dependent	Same as F0-17	-
F8-06	Deceleration time 3	Model dependent	Same as F0-18	-
F8-07	Acceleration time 4	0.0s	Same as F0-17	-
F8-08	Deceleration time 4	0.0s	Same as F0-18	-
F0-19	Acceleration/ Deceleration time unit	1	0: 1s 1: 0.1s 2: 0.01s	If you modify this parameter, the decimal places of the displayed acceleration and deceleration time will change.
F0-25	Base frequency for acceleration/ deceleration time	0	0: Maximum frequency 1: Frequency reference 2: 100 Hz	-
F6-07	Acceleration/ Deceleration mode	0	0: Linear acceleration/ deceleration	This parameter defines the frequency change mode during the AC drive start and stop process. 0: The output frequency increases or decreases linearly. 1: 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 running and quick response in real time.
			1: Dynamic S-curve acceleration/ deceleration	
F6-08	Time proportion of S-curve start segment	30.0%	0.0% to (100.0% - F6-09)	The following condition must be met: F6-08 + F6-09 ⩽ 100.0%
F6-09	Time proportion of S-curve end segment	30.0%	0.0% to (100.0% - F6-08)	-

3.4 Motor Auto-tuning

Motor auto-tuning is the process that the AC drive obtains the parameters of the controlled motor.

The following auto-tuning methods are available for asynchronous motors: static auto-tuning of the asynchronous motor, complete auto-tuning of the asynchronous motor, and with-load complete auto-tuning of the asynchronous motor.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-37	Auto-tuning selection	0	0: No operation	Auto-tuning is not performed.
			1: Static auto-tuning of the asynchronous motor	Only stator resistance, rotor resistance and leakage inductance are obtained through static auto-tuning.
			2: Complete auto-tuning of the asynchronous motor	All motor parameters are obtained through dynamic auto-tuning. If the AC drive is in the FVC mode, you must set encoder parameters (F1-27 to F1-34).
			3: With-load complete auto-tuning of the asynchronous motor	All motor parameters including the encoder direction are obtained through this auto-tuning mode.

The three motor auto-tuning methods are compared as follows.

Auto-tuning Mode	Applicable Occasion	Auto-tuning Effect
1: Static auto-tuning of the asynchronous motor	It applies to scenarios where motors cannot be disconnected from the load and dynamic auto-tuning is not allowed.	Normal
2: Complete auto-tuning of the asynchronous motor	It applies to scenarios where motors can be disconnected from the load.	Best
3: With-load complete auto-tuning of the asynchronous motor	It applies to scenarios where the motor cannot be disconnected from the load and dynamic complete auto-tuning is not allowed.	Good

1) Procedure of partial static auto-tuning of the asynchronous motor

Step	Description
Step 1	After power-on, set F0-02 to 0 to define LED keypad as the command source.
Step 2	Input the motor parameters (F1-00 to F1-05) according to the motor nameplate correctly.
Step 3	Set F1-37 to 1 (static partial auto-tuning of the asynchronous motor), and press **ENTER**. The following information is displayed on the keypad:
Step 4	Press and hold the **ENTER** key on the LED keypad for more than three seconds. The motor does not rotate but gets energized. The RUN indicator lights up. If the preceding display disappears and the keypad returns to the normal parameter display state, it indicates auto-tuning is done. The values of F1-06 to F1-08 will be computed by the AC drive automatically.

2) Procedure of dynamic complete auto-tuning of the asynchronous motor

If the motor features constant output or high accuracy is required, perform dynamic complete auto-tuning after disconnecting the motor from the load for optimal auto-tuning effect.

Step	Description
Step 1	After power-on, set F0-02 to 0 to define the keypad as the command source.

Step	Description
Step 2	Input the motor parameters (F1-00 to F1-05) according to the motor nameplate correctly.
Step 3	If F0-01 is set to 1 (FVC), input encoder parameters (F1-27, F1-28, and F1-30).
Step 4	Set F1-37 to 2 to select dynamic complete auto-tuning of the asynchronous motor. Press **Enter** on the keypad. The following information is displayed on the keypad:
Step 5	Press and hold the **ENTER** key on the LED keypad for more than three seconds. The motor accelerates/decelerates or runs forwardly/reversely as driven by the drive. The RUN indicator keeps ON and the auto-tuning process lasts for a while. If the preceding display disappears and the keypad returns to the normal parameter display state, it indicates auto-tuning is done. The values of F1-06 to F1-10 and F1-30 will be computed by the AC drive automatically.

3) Procedure of static complete auto-tuning of the asynchronous motor

If the motor cannot be disconnected from the load, use the static complete auto-tuning of the asynchronous motor.

Step	Description
Step 1	After power-on, set F0-02 to 0 to define the keypad as the command source.
Step 2	Input the motor parameters (F1-00 to F1-05) according to the motor nameplate correctly.
Step 3	Set F1-37 to 3 (Static complete auto-tuning of the asynchronous motor). Press **Enter** on the keypad. The following information is displayed on the keypad:
Step 4	Press and hold the **ENTER** key on the LED keypad for more than three seconds. The motor does not rotate but gets energized. The RUN indicator lights up. If the preceding display disappears and the keypad returns to the normal parameter display state, it indicates auto-tuning is done. The values of F1-06 to F1-10 will be computed by the AC drive automatically.

NOTE

- In addition to the preceding motor auto-tuning methods, you can also input motor parameters manually.
- You can use the LED keypad as the command source for motor auto-tuning. Besides, you can also use the LCD operating panel (F0-02 = 0), DI (F0-02 = 1), or communication channel (F0-02 = 2) as the command source for motor auto-tuning.
- The PKW areas of the Modbus, PROFIBUS DP, and CANopen support auto-tuning through communication, whereas their PZD areas do not support auto-tuning through communication. To perform auto-tuning through communication, write the value of F1-37 and then write operation commands.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-00	Motor type	0	0	Common asynchronous motor
			1	Variable-frequency asynchronous motor
			2	Synchronous motor

Parameter Code	Parameter Name	Default	Value Range	Description
F1-01	Rated motor power	Model dependent	0.1 kW to 1000.0 kW	F1-00 to F1-05 are parameters on the motor nameplate. To improve the control performance in the FVC, V/f, and SVC mode, perform motor parameter auto-tuning. The accuracy of the auto-tuned values are closed related to the parameters on the motor nameplate.
F1-02	Rated motor voltage	Model dependent	1 V to 2000 V	
F1-03	Rated motor current	Model dependent	0.1 A to 6553.5 A	
F1-04	Rated motor frequency	Model dependent	0.01 Hz to maximum frequency	
F1-05	Rated motor speed	Model dependent	1 rpm to 65535 rpm	
F1-06	Asynchronous/ Synchronous motor stator resistance	Model dependent	0.001 Ω to 65.535 Ω (drive power ≤ 55 kW) 0.0001 Ω to 6.5535 Ω (drive power > 55 kW)	F1-06 to F1-10 are asynchronous motor parameters and can be obtained through motor auto-tuning. Only F1-06 to F1-08 can be obtained through static partial auto-tuning. F1-06 to F1-10 as well as F1-30 (encoder phase sequence) can be obtained through dynamic complete auto-tuning. If motor auto-tuning cannot be performed on site, set these parameters according to data provided by motor manufacturer.
F1-07	Asynchronous motor rotor resistance	Model dependent	0.001 Ω to 65.535 Ω (drive power ≤ 55 kW) 0.0001 Ω to 6.5535 Ω (drive power > 55 kW)	
F1-08	Leakage inductive reactance of asynchronous motor	Model dependent	0.01 mH to 655.35 mH (drive power ≤ 55 kW) 0.001 mH to 65.535 mH (drive power > 55 kW)	
F1-09	Mutual inductive reactance of asynchronous motor	Model dependent	0.1 mH to 6553.5 mH (drive power ≤ 55 kW) 0.01 mH to 655.35 mH (drive power > 55 kW)	
F1-10	No-load current of asynchronous motor	Model dependent	0.1 A to F1-03	
F1-17	Axis D inductance of synchronous motor	Model dependent	0.01 mH to 655.35 mH (drive power ≤ 55 kW) 0.001 mH to 65.535 mH (drive power > 55 kW)	
F1-18	Axis Q inductance of synchronous motor	Model dependent	0.01 mH to 655.35 mH (drive power ≤ 55 kW) 0.001 mH to 65.535 mH (drive power > 55 kW)	
F1-19	Back EMF of synchronous motor	Model dependent	0.1 V to 6553.5 V	

Parameter Code	Parameter Name	Default	Value Range	Description
F1-27	Encoder PPR	1024	1 to 65535	It sets pulses per revolution (PPR) of the encoder. In the FVC mode, the encoder PPR mus be set properly. Otherwise, the motor cannot run normally.
F1-28	Encoder type	0	0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver	
F1-29	PG signal filter	1	0: Non-adaptive filter 1: Adaptive filter 2: Fixed interlock 3: Auto interlock	
F1-30	A/B phase sequence of the ABZ incremental encoder	0	0: Forward 1: Reverse	0: Phase A is advanced of phase B for forward motor rotation. Phase B is advanced of phase A for forward motor rotation. 1: Phase B is advanced of phase A for forward motor rotation. Phase A is advanced of phase B for reverse motor rotation.
F1-31	Encoder zero position angle	0.0°	0.0° to 359.9°	
F1-32	Numerator of motor gear ratio	1	1 to 65535	
F1-33	Denominator of motor gear ratio	1	1 to 65535	
F1-34	Number of resolver pole pairs	1	1 to 32	
F1-35	Frequency-division coefficient of resolver	1	0 to 63	
F1-36	PG disconnection detection	0	0: Enable 1: Disable	

3.5 Control Performance

3.5.1 V/f Curve Settings

1) Settings of linear, multi-point, and square V/f curves

Parameter Code	Parameter Name	Default	Value Range	Description
F3-00	V/f curve setting	0	0: Linear V/f 1: Multi-point V/f 2: Square V/f 3: 1.2-power V/f 4: 1.4-power V/f 6: 1.6-power V/f 8: 1.8-power V/f 9: Reserved 10: V/f complete separation 11: V/f half separation	-
F3-01	Torque boost	Model dependent	0.0% to 30.0%	-
F3-02	Cut-off frequency of torque boost	50.00 Hz	0.00 Hz to maximum frequency	-
F3-03	Frequency 1 on multi-point V/f curve	0.00 Hz	0.00 Hz to F3-05	-
F3-04	Voltage 1 on multi-point V/f curve	0.0%	0.0% to 100.0%	
F3-05	Frequency 2 on multi-point V/f curve	0.00 Hz	F3-03 to F3-07	
F3-06	Voltage 2 on multi-point V/f curve	0.0%	0.0% to 100.0%	
F3-07	Frequency 3 on multi-point V/f curve	0.00 Hz	F3-05 to rated motor frequency (F1-04)	
F3-08	Voltage 3 on multi-point V/f curve	0.0%	0.0% to 100.0%	

- General constant-torque linear V/f curve

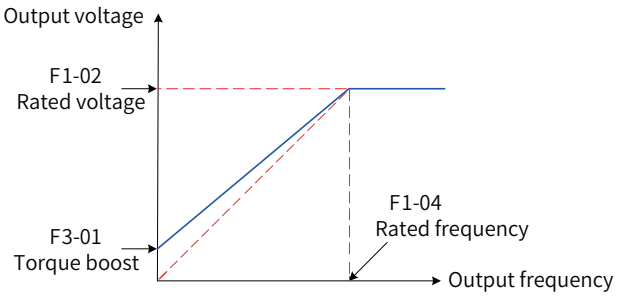


Figure 3-34 General constant-torque linear V/f curve

The output voltage and output frequency change linearly at frequencies lower than the rated frequency. It is applicable to general mechanical transmission applications such as acceleration of high-inertia fans, punch presses, centrifuges, and water pumps.

- User-defined multi-point V/f curve

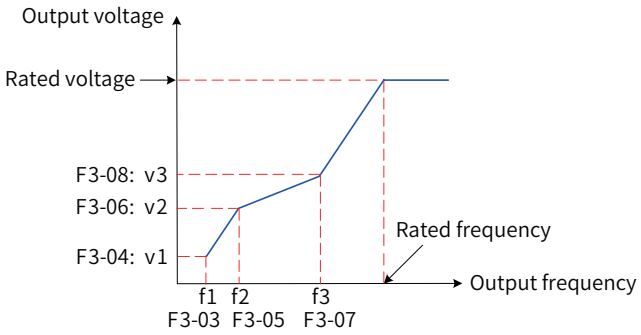


Figure 3-35 User-defined multi-point V/f curve

The multi-point V/f curve is defined by F3-03 to F3-08. The setting range of the frequency is from 0.00 Hz to the rated motor frequency. The setting range of the voltage is from 0.0% to 100%, corresponding to 0 V to the rated motor voltage. You must set the multi-point V/f curve based on motor' s load characteristics. Observe this formula during setting: F3-03 ⩽ F3-05 ⩽ F3-07. To ensure correct settings, the AC drive restricts the upper and lower limits of F3-03, F3-05, and F3-07. Set them in this order: F3-07, F3-05, and F3-03.

- Variable-torque square V/f curve

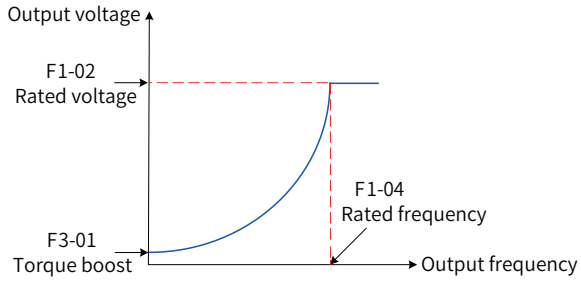


Figure 3-36 Variable-torque square V/f curve

The output voltage and output frequency change according to square curve at frequencies lower than the rated frequency. It is applicable to applications such as fans and water pumps with light load which does not change frequently.

2) Settings of V/f separation curve

Parameter Code	Parameter Name	Default	Value Range	Description
F3-13	Voltage source for V/f separation	0	0: F3-14 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Multi-reference 6: Simple PLC 7: PID 8: Communication Note: The value 100.0% corresponds to the rated motor voltage.	-
F3-14	Voltage digital setting for V/f separation	0 V	0 V to rated motor voltage	In the V/f half-separation mode, the output voltage is twice the value of F3-14.
F3-15	Voltage acceleration time for V/f separation	0.0s	0.0s to 1000.0s Note: This parameter indicates the time that the voltage increases from 0 V to the rated motor voltage.	In the V/f half-separation mode, this parameter is invalid, and the voltage rise time is the same as that set by F0-17.
F3-16	Voltage deceleration time for V/f separation	0.0s	0.0s to 1000.0s Note: This parameter indicates the time that the voltage increases from 0 V to the rated motor voltage.	In the V/f half-separation mode, this parameter is invalid, and the voltage fall time is the same as that set by F0-18.
F3-17	Stop mode for V/f separation	0	0: The frequency and the voltage decline to 0 separately. 1: Te frequency declines to 0 after the voltage declines to 0.	-

The voltage rise time indicates the time that the output voltage increases from 0 to the rated motor voltage. See t1 in the figure.

The voltage fall time indicates the time that the output voltage declines from the rated motor voltage to 0. See t2 in the figure.

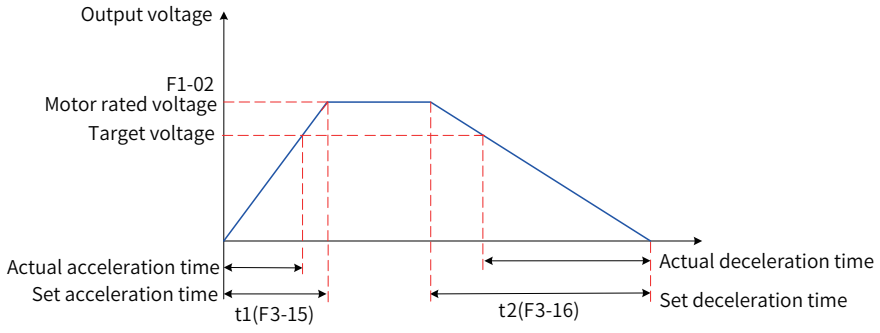


Figure 3-37 V/f separation

3.5.2 Output Current (Torque) Limit

During acceleration, operation at constant speed, or deceleration, if the current exceeds the overcurrent stall action current (default: 150%, indicating 1.5 times the rated AC drive current), the overcurrent stall prevention function is activated. In this case, the output frequency decreases until the current drops below the overcurrent stall action current. Then, the output frequency increases to the target frequency. Therefore, the acceleration time is prolonged. If the actual acceleration time cannot meet your requirement, increase the value of overcurrent stall action current (F3-18) accordingly.

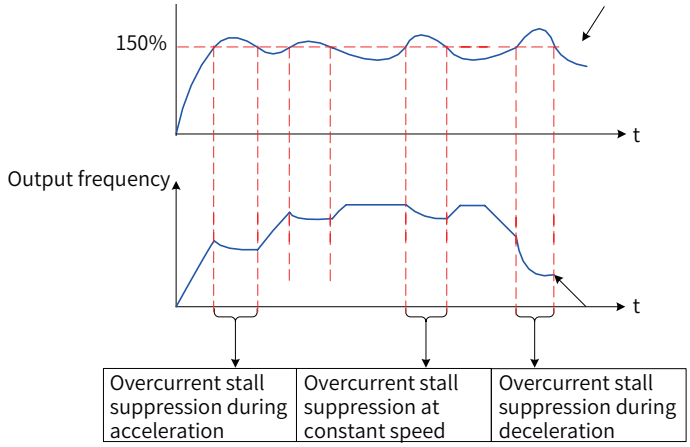


Figure 3-38 Overcurrent stall action

Parameter Code	Parameter Name	Default	Value Range	Description
F3-18	Overcurrent stall action current	150%	50% to 200%	It indicates the current that the overcurrent stall prevention function is enabled.
F3-19	Overcurrent stall suppression	1	0, 1	0: Inactive 1: Valid
F3-20	Overcurrent stall suppression gain	20	0 to 100	The larger the value, the better the overcurrent suppression effect. However, if the value is too large, current oscillation will occur. If pulse-by-pulse current limit occurs on the site after overcurrent suppression is enabled, increase the value appropriately.
F3-21	Current compensation coefficient for overcurrent stall action at multiplied rated frequency	50%	50% to 200%	This parameter reduces the overcurrent stall action current at high speed. It is invalid when set to 50%. The recommended value for F3-18 in the field weakening area is 100%.

In the high frequency area, the motor drive current is small. At the same stall current, the motor speed drops faster when the motor runs below the rated frequency than when the motor runs above the rated frequency. To improve motor running characteristic, you can lower down the stall action current when the motor runs above the rated frequency. The method improves acceleration performance and prevents the motor from stall in the application where high running frequency and several times the field weakening are required and load inertia is large, such as centrifuges.

Overcurrent stall action current when the frequency is above the rated frequency = (fs/fn) x k x LimitCur

fs: running frequency; fn: rated motor frequency; k: Current compensation coefficient for over-current stall action at multiplied rated frequency (F3-21); LimitCur: overcurrent stall action current (F3-18)

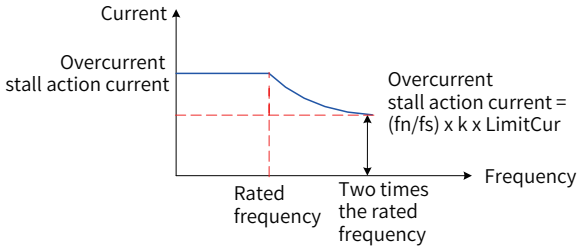


Figure 3-39 Overcurrent stall action at multiplied rated frequency

NOTE

- For high-power motors with carrier frequency below 2 kHz, the overcurrent stall action current must be reduced. This is because the increase in ripple current will cause the start of pulse-by-pulse current limit before the overcurrent stall suppression function, resulting in insufficient torque.

3.5.3 Overvoltage Stall Suppression

When the bus voltage rises above the value of F3-22 (overvoltage stall action voltage), the motor enters the generating state (motor speed > output frequency). In this case, the overvoltage stall function is activated, which adjusts the output frequency and extends the deceleration time to prevent trip. If the actual deceleration time cannot satisfy the requirement, increase the over-excitation gain.

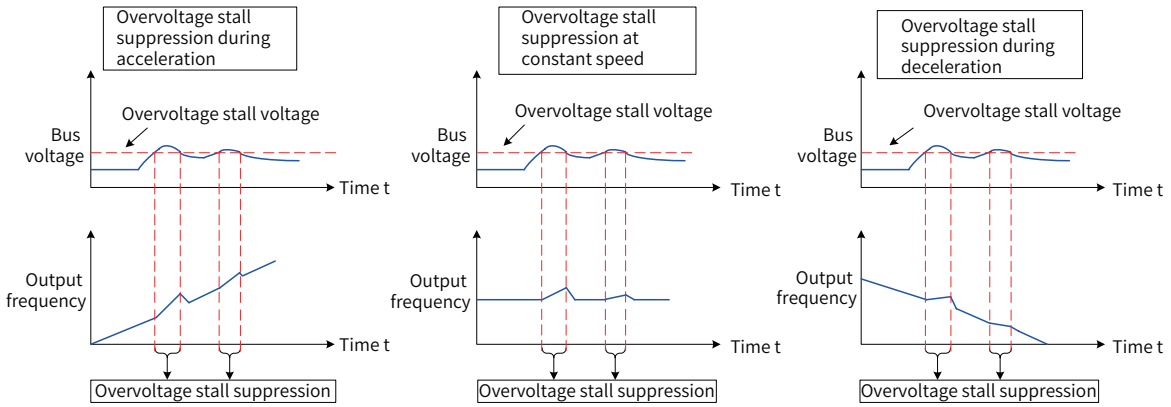
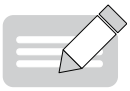


Figure 3-40 Overvoltage stall suppression action

Parameter Code	Parameter Name	Default	Value Range	Description
F3-22	Action voltage for overvoltage stall suppression	770.0 V	650.0 V to 800.0 V	-
F3-23	Overvoltage stall suppression	1	0, 1	0: Disable 1: Enable (default)
F3-24	Frequency gain for overvoltage stall suppression	30	0 to 100	Increasing F3-24 will improve the control effect of the bus voltage, but the output frequency will fluctuate. If the output frequency has great fluctuation, reduce F3-24 properly. Increasing F3-25 can reduce the overshoot of the bus voltage.
F3-25	Voltage gain for overvoltage stall suppression	30	0 to 100	
F3-26	Frequency rise threshold for overvoltage stall suppression	5 Hz	0-50 Hz	It indicates the maximum rise frequency for overvoltage stall suppression.
F3-10	V/f over-excitation gain	64	0 to 200	Over-excitation gain can suppress rise of the bus voltage, preventing the overvoltage fault. The larger the over-excitation gain, the better the suppression performance.
F3-11	V/f oscillation suppression gain	40	0 to 100	-



NOTE

Observe the following notice when using a braking resistor, braking unit, or energy feedback unit:

- Set F3-10 (V/f over-excitation gain) to 0. Otherwise, overcurrent may occur during drive running.
- Set F3-23 (Overvoltage stall suppression) to 0. Otherwise, the deceleration time may be extended.

3.5.4 Improving V/f Operation Performance

1) How to shorten the actual acceleration time in the V/f control mode?

Symptom	Solution
During acceleration, the actual acceleration time of the motor is far longer than the set acceleration time.	If the target frequency is below twice the rated frequency and the actual acceleration time cannot meet the requirements during acceleration, increase F3-18 (Overcurrent stall suppression action current) properly with the step value of 10% each time. When F3-18 exceeds 170%, drive overload (Err10) or fast current limit fault (Err40) may occur.
	If the target frequency is above three or four times the rated frequency, during rapid acceleration, motor stall is very likely to occur. The output frequency of the drive has reached the target frequency, but the actual motor speed stays at a certain speed within the medium speed range and at a low frequency, or the acceleration time is overlong. In this case, you can adjust F3-21 (Compensation coefficient for overcurrent stall action current at multiplied rated frequency) to 100%.

2) How to shorten the actual deceleration time under V/f control?

Symptom	Solution
During deceleration, the actual acceleration time of the motor is far longer than the set deceleration time.	If no braking resistor or feedback unit is installed, increase F3-10 (V/f over-excitation gain) properly with the step value of ±20 each time. If increasing the value of F3-10 causes the motor oscillation or overvoltage, reduce the overvoltage stall suppression voltage gain.
	If the AC drive is installed with a braking resistor or feedback unit, and the input voltage of the drive is from 360 V to 420 V, set F9-08 (Braking unit action start voltage) of the power supply unit and F1-02 (Braking unit action start voltage) of the drive unit to 690 V and set F3-10 (V/f over-excitation gain) to 0.
	Apply DC braking for stop. Set F6-11 (DC braking start frequency for stop) to 0.5 Hz, F6-13 (DC braking current for stop) to 50%, and F6-14 (DC braking time for stop) to 1s.

3) How to limit the output current under V/f control, and how to prevent overcurrent in extreme impact load situations?

Symptom	Solution
For better protection on the motor and control of the upper motor current limit, take the measures in the right part to adjust the upper limit of the drive output current.	Adjust the upper limit of the drive output current by setting F3-18 (Overcurrent stall suppression action current). Upper limit of the drive output current = Rated drive current x F3-18 (default: 150%). It is suggested that the upper limit of the drive output current should not be smaller than the rated motor current. The recommended value is 1.5 times the rated motor current.
	Overcurrent or fast current limit fault (Err40) may be caused by rapid acceleration/deceleration or impact loads. In this case, adjust F3-20 (Overcurrent stall suppression gain) with the step value of ±10 each time. Too much adjustment may cause current oscillation.

4) How to limit the bus voltage under V/f control to prevent overvoltage?

Symptom	Solution

During running, overvoltage is easily caused by some constant-speed generating loads (such as typical oilfield pumping units) and impact loads that are suddenly added and removed (such as typical high-power punch presses). If overvoltage still occurs in case of factory parameters, take the measures in the right part to avoid overvoltage.	For constant-speed intermittent generating loads, decrease F3-22 (Overvoltage stall suppression action voltage, default: 770 V). In the event that there is no certain restriction on the upper limit of bus voltage, adjust F3-22 to 720 V. If overvoltage still occurs, adjust F3-24 (Maximum rise frequency during overvoltage stall suppression) to 10 Hz or 20 Hz (such as oilfield pumping units which have periodical long-time power generation).
	For impact loads that are suddenly added and removed, decrease F3-22 (Overvoltage stall suppression action voltage) to about 720 V.
	For large inertia rapid deceleration loads, if the AC drive is installed with a braking resistor, and the input voltage of the drive is from 360 V to 420 V, set F9-08 (Braking unit action start voltage) of the power supply unit and F1-02 (Braking unit action start voltage) of the drive unit to 690 V and set F3-10 (V/f over-excitation gain) to 0. If overvoltage still occurs, decrease F3-22 (Overvoltage stall suppression action voltage) to about 740 V.

3.5.5 Speed Loop

Parameter Code	Parameter Name	Default	Value Range	Description
F2-00	Low-speed speed loop Kp	30	1 to 100	-
F2-01	Low-speed speed loop Ti	0.500s	0.001s to 10.000s	-
F2-02	Switchover frequency 1	5.00 Hz	0.00 to F2-05	-
F2-03	High-speed speed loop Kp	20	1 to 100	-
F2-04	High-speed speed loop Ti	1.00s	0.01s to 10.00s	-
F2-05	Switchover frequency 2	10.00 Hz	F2-02 to maximum frequency	-
F2-07	Speed feedback filter time	0.004s	0.000s to 0.100s	-

Speed loop PI parameters are divided into low-speed parameters and high-speed parameters. If the running frequency is lower than F2-02 (Switchover frequency 1), PI parameters are F2-00 and F2-01. If the running frequency is higher than F2-05 (Switchover frequency 2), the speed loop PI parameters are F2-03 and F2-04. If the running frequency is between F2-02 and F2-05, PI parameters are switched over linearly between two groups of PI parameters, as shown below.

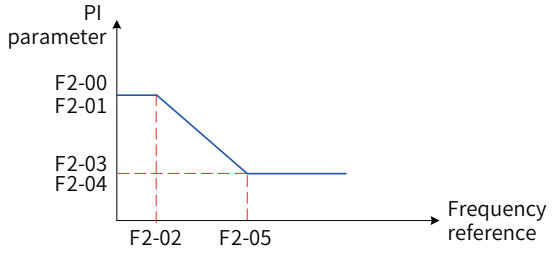
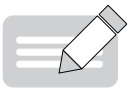


Figure 3-41 Speed loop PI parameters

By setting the proportional gain and integral time of the speed regulator, you can adjust the dynamic response to speed changes in the vector control mode.

Increasing the proportional gain or reducing the integral time can speed up dynamic response of the speed loop. However, too large proportional gain or too short integral time may cause system oscillation.

If the default setting cannot meet the requirements, make proper adjustment. Increase the proportional gain first to ensure that the system does not oscillate, and then reduce the integral time to ensure that the system has quick response and small overshoot.



NOTE

- Improper PI parameter settings may lead to a high speed overshoot. In addition, overvoltage may occur when overshoot drops.

Increasing F2-07 improves motor stability but weakens dynamic responsiveness. Decreasing F2-07 weakens motor stability but improves dynamic responsiveness. Note that setting F2-07 to an excessively low value may cause motor oscillation. The default value of F2-07 applies to most of applications.

3.5.6 Slip Adjustment in Vector Control Mode

Parameter Code	Parameter Name	Default	Value Range	Description
F2-06	Vector control slip gain	100%	50% to 200%	This function improves control performance.

In the vector control mode (F0-01 is set to 0 or 1), this parameter can be used to adjust the speed stability accuracy of the motor. For example, increase this parameter when the running frequency of the motor is lower than the output frequency of the AC drive.

In the FVC mode (F0-01 = 1), this parameter can adjust output current of the AC drive under the same load. Decrease this parameter gradually when an AC drive with a large power controls a lightly loaded motor. Adjustment of this parameter is not required normally.

3.5.7 Overexcitation in Vector Control Mode

Parameter Code	Parameter Name	Default	Value Range	Description
F2-08	Vector control overexcitation gain	64	0 to 200	64

For high-inertia loads, overexcitation gain in the vector control mode can speed up the motor deceleration. A larger over-excitation gain means better effect. However, overexcitation gain increases the output current of the AC drive and leads to motor wear and tear.

3.5.8 Torque Limit

The torque upper limit is set as follows in vector control (FVC or SVC).

Parameter Code	Parameter Name	Default	Value Range	Description

F2-09	Torque upper limit source in speed control mode	0	0: F2-10 1: AI1 2: AI2 3: Reserved 4: Pulse setting 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) The full range of options 1-7 corresponds toF2-10.	-
F2-10	Digital setting of torque upper limit in speed control	150.0%	0.0% to 200.0%	When the rated current of the motor is lower than 25% of the rated current of the AC drive, the rated current of the AC drive is used as the base value; otherwise, the rated current of the motor is used as the base value.
F2-11	Torque limit source in speed control (generating)	0	0: F2-10(in generating and motoring state) 1: AI1 2: AI2 3: Reserved 4: Pulse setting 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) 8: F2-12 The full range of options 1-7 corresponds to F2-12.	-
F2-12	Digital setting of torque upper limit in speed control (generating)	150.0%	0.0% to 200.0%	The torque upper limit in the generating state takes the rated current of the AC drive as the base.

- In the speed control mode, there are eight modes to set the torque upper limit. In the motoring state, the torque upper limit source is defined by F2-09; in the generating state, the torque upper limit source is defined by F2-11.
- In the speed control mode, if F2-11 is set to a value ranging from 1 to 8, the torque upper limit differs in the motoring state and in the generating state. In the motoring state, the full range of the torque upper limit is defined by F2-10. In the generating state, the full range of the torque upper limit is defined by F2-12, as shown in the following figure.

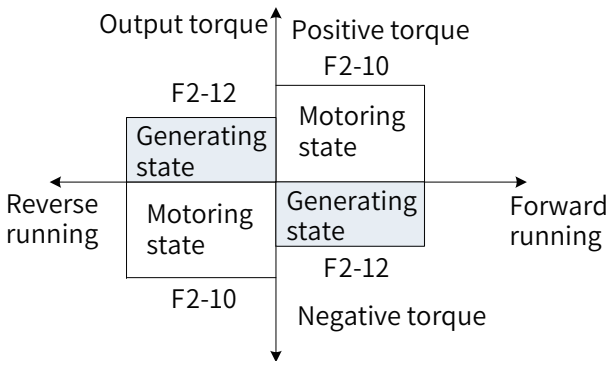


Figure 3-42 Torque upper limit in the speed control mode

Parameter Code	Parameter Name	Default	Value Range	Description
F2-53	Generating power limit	0	0: Enable 1: Disable	-
F2-54	Generating power upper limit	Model dependent	0.0% to 200.0%	-

- In scenarios where braking resistors are not used for cam load, quick acceleration/deceleration, and sudden unloading, enabling generating power limit can effectively reduce bus voltage overshoot during motor braking, so as to prevent overvoltage. F2-54 is a percentage of the generating power to the rated motor power. If overvoltage still occurs after you set F2-53 to 1 (Enable), decrease the value of F2-54.

3.5.9 Torque Control

Parameter Code	Parameter Name	Default	Value Range	Description
A0-00	Speed/Torque control mode selection	0	0: Speed control; 1: Torque control	-
A0-01	Torque reference source in torque control mode Torque reference source	0	0: A0-03 1: AI1 2: AI2 3: Reserved 4: Pulse (DIO1) 5: Communication (1000H) 6: Min. (AI1,AI2) 7: Max. (AI1,AI2) The full range of options 1-7 corresponds to the value of A0-03.	-
A0-03	Torque digital setting in torque control	150.0%	-200.0% to 200.0%	The actual torque is the percentage (value of A0-03) of the rated motor torque.
A0-04	Torque filter time	0.000s	0.000s to 5.000s	-
A0-05	Digital setting of speed limit	0.00%	-120.0% to 120.0%	The actual frequency is the percentage (value of A0-05) of the maximum frequency (F0-10).
A0-07	Torque acceleration time	1.00s	0.00s to 650.00s	-
A0-08	Torque deceleration time	1.00s	0.00s to 650.00s	-
A0-09	Speed limit reference source	0	0: A0-05 1: Frequency reference	
A0-10	Speed limit offset	5.00 Hz	0 to F0-10 (Maximum frequency)	

Parameter Code	Parameter Name	Default	Value Range	Description
A0-11	Active mode of speed limit offset	1	0: Bi-directional offset 1: Uni-directional offset	
A0-12	Frequency acceleration time	1.0s	0.0s to 6500.0s	
A0-13	Frequency deceleration time	1.0s	0.0s to 6500.0s	
A0-14	Torque mode switchover	1	0: Not switched 1: Switch to speed control mode at stop 2: The target torque is 0 at stop.	

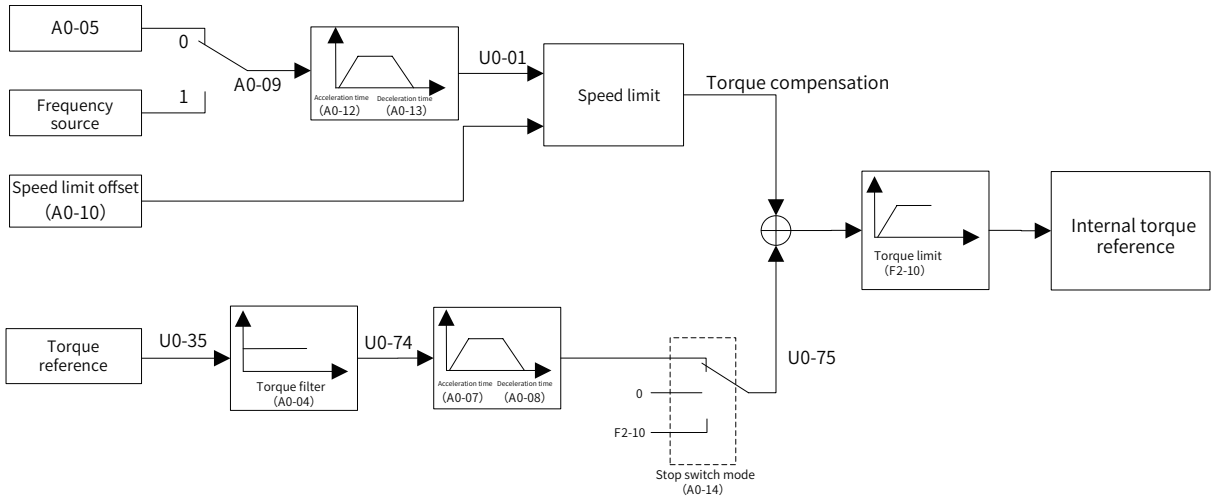


Figure 3-43 Torque control system

◆ Select the speed/torque control mode (A0-00).

The speed/torque control mode is set by A0-00.

The multi-function DI of the MD810 supports two functions related to torque control: function 29 (Torque control prohibited) and function 46 (Speed control/Torque control switchover). The two DI functions need to be used together with A0-00 to implement speed control/torque control switchover.

If the speed control/torque control switchover function (function 46) is invalid, the control mode is determined by A0-00. If the function 46 is valid, the control mode is reverse to the value of A0-00.

When function 29 (Torque control prohibited) is enabled, the AC drive always runs in the speed control mode.

◆ Set the torque reference in the torque control mode (A0-01, A0-03).

A0-01 is used to set the torque reference. There are a total of eight torque reference sources.

The torque reference is a relative value. The value 100.0% corresponds to the rated motor torque. View the motor output torque through U0-06, and the value 100% corresponds to the rated motor torque. The value ranges from -200.0% to 200.0%, indicating that the maximum

torque of the drive is two times the rated torque of the motor.

◆ Set the frequency upper limit in the torque control mode (A0-05, A0-09, A0-10, A0-11).

In the torque control mode, the frequency upper limit can be defined by A0-05 or the frequency source, depending on the setting of A0-09.

The acceleration/deceleration time of the frequency upper limit is set by A0-12 (acceleration) or A0-13 (deceleration).

In the torque control mode, if the load torque is lower than the output torque of the motor, the motor speed keeps increasing. Therefore, the maximum motor speed (that is, the frequency upper limit) must be restricted to prevent accidents such as runaway.

◆ Sett the torque acceleration/deceleration time in the torque control mode (A0-07, A0-08).

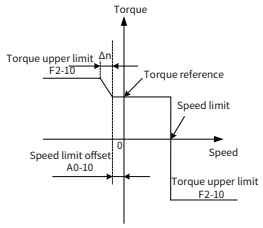
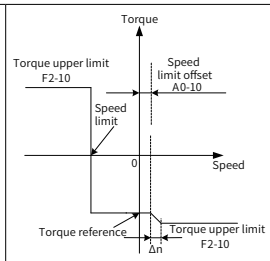
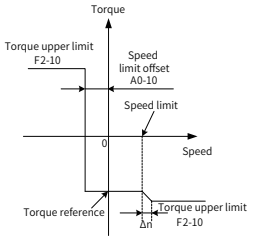
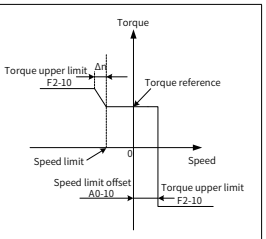
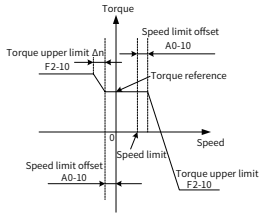
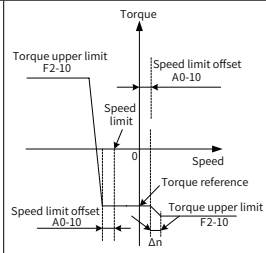
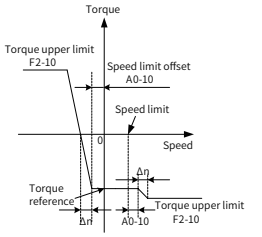
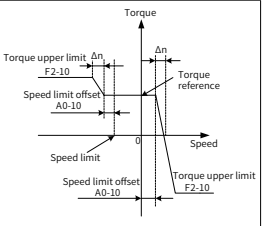
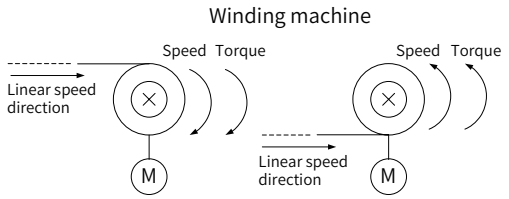
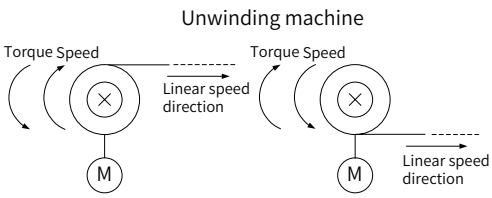
In the torque control mode, the difference between the motor output torque and the load torque determines the speed change rate of the motor and load. Therefore, the motor speed may change quickly, resulting in loud noise or high mechanical stress. Proper acceleration/deceleration time in the torque control mode helps smooth changes in the motor speed. The acceleration/deceleration time represents the time needed for the torque to increase from 0 to A0-03.

In the torque control mode, the acceleration/deceleration time is not required for start with small torque. For applications requiring quick torque response, set the acceleration/deceleration time to 0.00s.

For example, two AC drives are connected to drive the same load. To balance the load distribution, set one AC drive as the master and select the speed control mode. Set the other one as the slave and select the torque control mode. The slave receives the output torque of the master as the torque command and follows the master rapidly. In this case, the acceleration/deceleration time of the slave in the torque control mode is set to 0.00s.

◆ Speed limit/speed limit offset

	Operation Condition			
Operation Command	Forward running	Forward running	Forward running	Forward running
Torque Reference Direction	+	-	-	+
Speed Limit Direction	+	-	+	-
Normal Running Direction	Forward running	Reverse running	Forward running	Reverse running

Uni-directional Speed Limit Offset (A0-11 = 1)				
Bi-directional Speed Limit Offset (A0-11 = 0)				
Application Example				

3.5.10 Descriptions of Current Loop Parameters

Parameter Code	Parameter Name	Default	Value Range	Description
F2-13	Proportional gain of current loop low-speed	1.0	0.1 to 10.0	The values are obtained automatically through motor auto-tuning.
F2-14	Integral gain of current loop low-speed	1.0	0.1 to 10.0	
F2-15	Proportional gain of current loop high-speed	1.0	0.1 to 10.0	
F2-16	Integral gain of current loop high-speed	1.0	0.1 to 10.0	

Current loop PI parameters for vector control are divided into low-speed and high-speed groups. These parameters can be automatically obtained through complete auto-tuning of the asynchronous motor and generally do not need to be modified.

The current loop integral regulator does not use the integral time as the dimension. Instead, set the integral gain directly. Note that too large current loop PI gain may lead to oscillation of the entire control loop. Therefore, when current oscillation or torque fluctuation is great, manually decrease the proportional gain or integral gain.

3.5.11 Improving Field Weakening Area Performance

Parameter Code	Parameter Name	Default	Value Range	Description
F2-21	Maximum output voltage coefficient	105%	100% to 110%	This parameter indicates the boost capacity of the maximum output voltage of the AC drive. Increasing the value of this parameter will improve the maximum loading capacity in the motor field weakening area. Be aware that this may lead to an increase in motor current ripple and an increase in motor heating. Decreasing the value of this parameter will reduce the motor current ripple and motor heating. Be aware that this will lower the maximum loading capacity in the motor field weakening area. The default value applies to most of application.

3.5.12 Operation and Performance Improvement in FVC Mode

1) Procedure for vector control mode with speed sensor

◆ Speed control settings

Table 3-3 Procedure for speed control mode with speed sensor

Procedure	Parameter	Description
Check that the drive is wired correctly.	-	If the drive reports E19.00 during auto-tuning, check whether the drive is wired correctly and whether motor parameters are set correctly.
Set the motor parameters.	F1-01, F1-02, F1-03, F1-04, F1-05	
Set the encoder type and pulses per revolution.	F1-27 to F1-28	If the drive reports E20.00, check whether the encoder and PG card work properly.
Select a control mode.	F0-01	-
Motor auto-tuning	F1-37	Dynamic complete auto-tuning of the asynchronous motor may take a while. Wait until auto-tuning is done before proceeding to the next step. Dynamic complete auto-tuning of the asynchronous motor is recommended (F1-37 = 2). When using this auto-tuning mode, disconnect the load from the motor so that the motor can reach a high speed. If the load cannot be disconnected from the motor (such as crane applications), use the static complete auto-tuning mode (set F1-37 = 3).
Set the command source and frequency reference source accordingly.	F0-02, F0-03	-
Trial run	A0-00 = 0	-

◆ Torque control settings

Table 3-4 Procedure for torque control mode with speed sensor

Procedure	Parameter	Description
Check that the drive is wired correctly.	-	If the drive reports E19.00 during auto-tuning, check whether the drive is wired correctly and whether motor parameters are set correctly.
Set the motor parameters.	F1-01, F1-02, F1-03, F1-04, F1-05	
Set the encoder type and pulses per revolution.	F1-27 to F1-28	If the drive reports E20.00, check whether the encoder and PG card work properly.
Select a control mode.	F0-01	-
Motor auto-tuning	F1-37	Dynamic complete auto-tuning of the asynchronous motor may take a while. Wait until auto-tuning is done before proceeding to the next step. Dynamic complete auto-tuning of the asynchronous motor is recommended (F1-37 = 2). When using this auto-tuning mode, disconnect the load from the motor so that the motor can reach a high speed. If the load cannot be disconnected from the motor (such as crane applications), use the static complete auto-tuning mode (set F1-37 = 3).
Set the command source.	F0-02	-
Set torque control parameters.	A0-00, A0-01, A0-03, A0-05	-
Trial run	-	-

2) Loop settings in the FVC mode

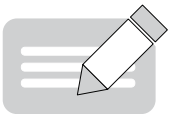
◆ Speed loop settings

· If the value of the speed loop gain are set too high, the motor may vibrate or produce unusual noise when operating at the frequency lower than the rated frequency. In this case, decrease the values of F2-00 and F2-03, and increase the values of F2-01 and F2-04.

· If the system speed overshoot is high during rapid acceleration, increase the speed loop Kp (increase the values of F2-00 and F2-03) and reduce the speed loop Ki (increase the values of F2-01 and F2-04).

· In winding/unwinding applications, the roll diameter changes in inverse proportion to the motor speed. Therefore, when the roll diameter is large, increase the value of the speed loop gain to ensure dynamic response of the system (increase the value of F2-00 and reduce the value of F2-01).

· For a device running at an extremely low speed (for example, a milling machine running at 0.01 Hz), increase the value of the speed loop gain (especially the speed loop integral gain) to ensure smooth operation. That is, increase the value of F2-00 and decrease the value of F2-01.



NOTE

- In scenarios with poor encoder feedback signals, the speed loop gains cannot be too high. Otherwise, the dynamic response speed of the system is affected. In this case, first take measures to improve the quality of encoder feedback signals (for example, separate power cables of the motor from signal cables of the encoder, and ensure good grounding of the system). Otherwise, directly reducing the speed loop gains will slow down dynamic response of the system, degrading the system operation performance.

◆ Current loop settings

Current loop parameters are auto-tuned during complete auto-tuning of the asynchronous motor. The auto-tuned values apply to most of applications. However, you can fine tune these parameters in the following conditions.

· If a motor running in the FVC mode oscillates or generates usual noise, and the oscillation or noise cannot be completely removed by reducing the speed loop gain, moderately reduce the current loop gain (reduce the values of F2-13, F2-14, F2-15, and F2-16).

· If the system requires a low overshoot, the speed loop gain cannot be too low. In this case, if the motor oscillates or generates abnormal noise when running in the FVC mode, moderately reduce the current loop gain (reduce the values of F2-13, F2-14, F2-15, and F2-16).

◆ Solutions to errors during high-speed operation in the FVC mode

Vibrations or operation errors may occur when the drive runs at a high frequency (for example, above 200 Hz) in the FVC mode. In this case, operate the drive with the same frequency in the V/f mode and check whether the feedback frequency (U0-29) is the same as the frequency reference. If there is a large difference (greater than 4 Hz) between these two frequency values, the encoder signal may be distorted (non-orthogonal or abnormal duty cycle) and the PG card filtering operation lead to the difference. In this case, take the following measures.

· Replace the encoder. Check whether the encoder is normal or installed properly and whether the encoder model supports the pulse frequency.

· If measures have been taken to prevent encoder signal distortion during high-speed operation, high filter capacitance of the PG card may cause a failure in receiving signals. In this case, set F1-29 properly for PG signal filtering.

◆ Shortening acceleration/deceleration time in the FVC control mode

During rapid acceleration/deceleration, the actual acceleration/deceleration time is longer than the preset value. To shorten the acceleration/deceleration time, take the following measures.

· To shorten the motor acceleration time, increase the torque upper limit in the FVC control mode (increase the value of F2-10 properly, but in no case greater than 180%). Increasing the torque upper limit shortens the motor acceleration time but also leads to an increase in the motor current, which may easily cause faults such as overload.

· Use an appropriate braking resistor to shorten the deceleration time.

◆ Limiting the bus voltage to prevent overvoltage in the FVC control mode

In high inertia or rapid deceleration applications, overvoltage may occur during deceleration. The optimization measures are the same as those used in the V/f control mode. The same parameters are used in the two modes.

3.5.13 Auxiliary Control Parameters

Parameter Code	Parameter Name	Default	Value Range	Description
A5-00	Frequency upper limit for DPWM switchover	12.00 Hz	0.00 Hz to 15.00 Hz	Increasing A5-00 to the maximum frequency will reduce the motor noise.
A5-01	PWM modulation mode	0	0: Asynchronous modulation 1: Synchronous modulation	When the value that the carrier frequency divided by the running frequency is smaller than 10, the output current oscillation or large current harmonics will be caused. In this case, adjust PWM modulation mode to the synchronous modulation to reduce current harmonics.
A5-03	Random PWM depth	0	0: Random PWM inactive 1 to 10: Random PWM carrier frequency depth	The value 0 indicates that the random PWM is invalid. If the motor has large noise, increase A5-03 with the step value of one to lower down the noise.

3.5.14 Encoder Signal Processing

The PG card of the AC drive supports programmable filtering of encoder signals.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-29	PG signal filter	1	0 to 3	This parameter is used to set the filter mode.

0 (Non-adaptive filtering): The filter coefficient of the PG card is fixed and small. It is applicable to the environment with no or weak interference or high speed applications.

1 (Adaptive filtering): The filter coefficient of the PG card is automatically adjusted. Therefore, the PG card features strong anti-interference abilities, especially when the feedback speed of the encoder is lower than 100 kHz. This mode applies to scenarios with strong interference. This mode is enabled by default.

2 (Fixed interlock): When the PG card is set to this mode, it has all functions when set to adaptive filtering. In addition, in this mode, the PG card also features edge jitter elimination of the encoder feedback signal. This mode applies to scenarios where edge jitter exists in the encoder feedback signal.

3 (Automatic interlock): When the PG card is set to this mode, it has all functions when set to fixed interlock. In addition, the PG card can switch between the adaptive filtering mode and the fixed interlock mode. This can meet requirements of zero-speed running and non-zero-speed running, and prevent useful signals from being cleared as edge jitter during zero speed

running in the fixed interlock mode.

◆ Encoder disconnection detection

Parameter Code	Parameter Name	Default	Value Range	Description
F1-36	PG disconnection detection	0	0: Disable 1: Enable	-

The PG card of the MD810 supports encoder disconnection detection by hardware. This function is valid only for encoders with differential interfaces, and can be used to detect signals of phase A, phase B, and phase Z. If the PG card is connected only to phase A and phase B, the AC drive reports E20.00. In this case, disable encoder disconnection detection. Otherwise, the AC drive keeps reporting this error.

3.6 Protection Functions

3.6.1 Startup Protection

The AC drive is equipped with startup protection for safety. If F8-18 is set to 1, startup protection will be performed in the following two situations.

Situation 1: If the run command is valid (for example, the terminal is in the closed state before power-on) upon power-on the AC drive, the drive does not respond to the command. The AC drive responds to the command only after the run command is canceled and becomes valid again.

Situation 2: If the run command is active when the AC drive fault is reset, the drive does not respond to the run command. The run command must be canceled first to disable running protection.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-18	Startup protection	0	0: Disable 1: Enable	If this parameter is set to 1, the motor can be prevented from responding to the run command upon power-on or fault reset in unexpected conditions.

3.6.2 Motor Overload Protection

Parameter Code	Parameter Name	Default	Value Range	Description

F9-00	AC drive overload suppression	0	0: Disable 1: Enable	This parameter indicates the troubleshooting when the AC drive overloads. When this parameter is set to 0, the AC drive will report a fault upon overload and the output will be blocked. When this parameter is set to 1, in case that the drive is about to be overloaded, the AC drive automatically lowers down the output current to about the rated current. This can avoid overload; however, the running speed may be reduced or block may occur. For lifting loads, set this parameter to 0.
F9-01	Motor overload protection gain	1.00	0.20 to 10.00	Set F9-01 if you need to adjust the motor overload current and time.
F9-02	Motor overload warning coefficient	80%	50% to 100%	This parameter is used to determine the degree of warning before the motor overload protection. The higher the value is, the later the warning signal is sent.

To protect different load motors, set the motor overload protection gain based on the overload capacity of the motor. The motor overload protection curve is an inverse time lag curve, as shown in the following figure.

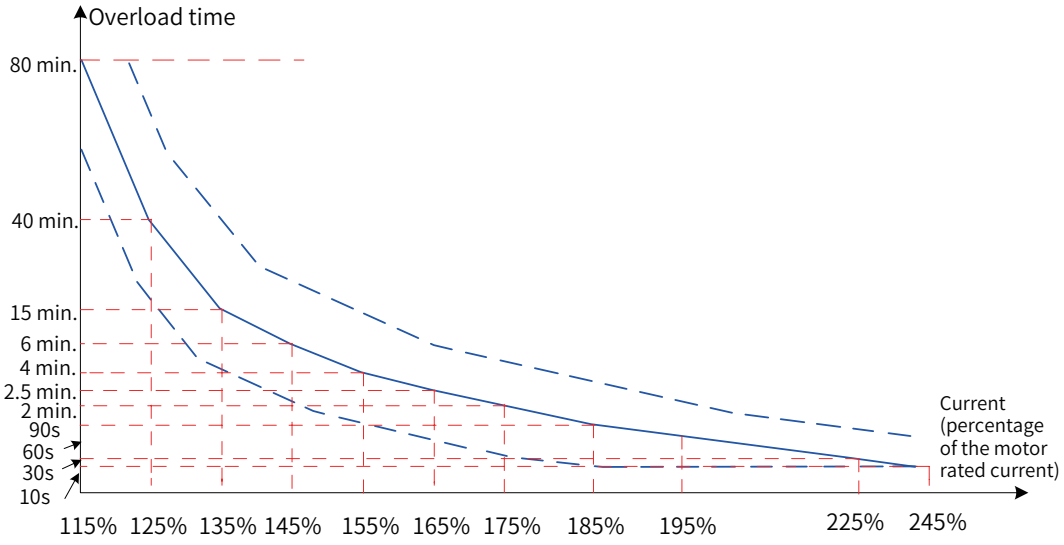


Figure 3-44 Inverse time lag curve of motor overload protection

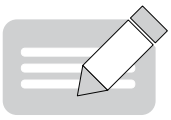
When the running current reaches 175% of the rated motor current and the motor runs at this level for 2 minutes, or when the running current reaches 115% of the rated motor current and the motor runs at this level for 80 minutes, the AC drive reports a motor overload alarm (E11.00).

Example:

Assume that the rated motor current is 100 A and F9-01 is set to 1.00. If the running current reaches 125 A (125% of 100 A) and the motor runs at this level for 40 minutes, the AC drive reports a motor overload alarm (E11.00).

Assume that the rated motor current is 100 A and F9-01 is set to 1.20. If the running current reaches 125 A (125% of 100 A) and the motor runs at this level for 48 minutes (40 x 1.2), the AC

drive reports a motor overload alarm (E11.00).



NOTE

- The maximum overload time is 80 minutes and the minimum overload time is 10 seconds.

Example of motor overload protection adjustment: The AC drive reports an overload fault after the motor runs at 150% of the rated motor current for 2 minutes.

As shown by the overload curve, 150% (I) of the rated motor current is between 145% (I1) and 155% (I2) of the rated motor current. The overload error reporting time for 145% of the rated motor current is 6 minutes (T1), and that for 155% of the rated motor current is 4 minutes (T2). Therefore, the overload error reporting time for 150% of the rated motor current in default settings can be calculated. The calculation formula is as follows:

T = T1 + (T2 – T1) x (I – I1)/(I2 – I1) = 6 + (4 – 6) x (150% – 145%)/(155% – 145%) = 5 (minute)

Therefore, if the overload fault needs to be reported when the motor runs at 150% of the rated motor current for 2 minutes, set the motor overload protection gain F9-01 to 0.4 (F9-01 = 2/5).

- Set F9-01 (Motor overload protection gain) properly based on the actual overload capacity. If the value of F9-01 is set too high, the motor may be damaged because the motor overheats but the AC drive does not report the alarm timely.

- When the motor overload detection level reaches the value of F9-02 (Motor overload warning coefficient), the DO or fault relay outputs the motor overload warning signal. The value of F9-02 is the percentage of the time duration during which the motor runs continuously at a certain overload point without reporting the overload fault.

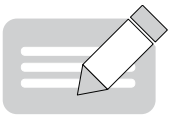
  On the condition that the motor overload protection gain is set to 1.00 and motor overload warning coefficient is set to 80%, when the motor running current reaches 145% of the rated motor current and the motor runs at this level for 4.8 min (80% x 6 min), the DO or fault relay outputs the motor overload warning signal.

- The motor overload warning function is used to send a warning signal to the control system via the DO before the motor overload protection applies. The motor overload warning coefficient is used to determine how early the alarm signal is sent before the motor overload protection applies. The higher the value is, the later the warning signal is sent. When the cumulative output current of the AC drive exceeds the product of multiplying the overload time (Y value of motor overload protection inverse time lag curve) and F9-02 (motor overload warning coefficient), the DO outputs an active motor overload warning signal. When F9-02 is set to 100% and the warning advance value is 0, the motor overload warning and the motor overload protection are triggered simultaneously.

3.6.3 Phase Loss Protection

Parameter Code	Parameter Name	Default	Value Range	Description
F9-06	Output phase loss detection before startup	0	0: Disable 1: Enable	It takes about several seconds to detect output phase loss during operation. In low-frequency operations or applications where risks exist in start with phase loss, this function can be used to detect phase loss fault upon start. However, in applications where short start time is required, do not use this function.
F9-48	Fault protection action selection 1	10050	-	The hundreds place of F9-48 is used to set the stop mode when the output phase loss is detected. 0: Coast to stop. 1: Decelerate to stop. If you need to disable the output phase loss detection, set the hundreds place of F9-48 to 5.

6.6.4 Fault Reset



NOTE

- Undervoltage (E09.00) is reset automatically when the bus voltage recovers to the normal value. It is not included in the number of automatic reset times upon fault.
- Short circuit to ground (E23.00) cannot be reset automatically or manually. It can be reset only after power-off and then power-on.
- The fault protection action selection is performed after the number of automatic reset times upon fault is reached.

Parameter Code	Parameter Name	Default	Value Range	Description
F9-09	Number of automatic reset times upon fault	0	0 to 20	It is used to set the number of automatic reset times upon fault of the AC drive when automatic reset is selected for the AC drive. If the number of automatic reset times exceeds the value of this parameter, the AC drive will remain in the faulty state.
F9-10	DO action during automatic reset upon fault	1	0: The DO does not act. 1: The DO acts.	It is used to decide whether the DO (with function 2 assigned) acts during automatic reset upon fault if the automatic reset function is used.
F9-11	Waiting time for automatic reset upon fault	1.0s	0.1s to 100.0s	It is used to set the duration from the time when the drive reports an alarm to the time when automatic reset upon fault is performed.

3.6.5 Fault Protection Action Selection

Faults are divided into four levels, corresponding to four protective actions depending on severity from high to low: coast to stop, decelerate to stop, alarm, and fault cancellation.

When "alarm" is selected as the protective action against fault, the operating panel displays Axx.xx, such as .

When "fault cancellation" is selected as the protective action against fault, no prompt will be displayed when a fault occurs. Select this option only when necessary.

Parameter Code	Parameter Name	Default	Value Range	Description
F9-48	Fault protection action selection 1	10050	Ones: Motor overload (E11.00) 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Fault cancellation Tens: Reserved Hundreds: Output phase loss (E13.00), same as the ones place Thousands: Reserved Ten thousands: External fault (E15.00), same as the ones place	For output phase loss, "Decelerate to stop" and "Alarm" options are effective only in the V/f control mode.
F9-49	Fault protection action selection 2	00050	Ones: Communication fault (E16.xx) 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Fault cancellation Tens: Reserved Hundreds: Reserved Thousands: Motor auto-tuning fault (E19.xx) 0: Coast to stop 4: Alarm 5: Fault cancellation Ten thousands: Encoder fault (E20.xx) 0: Coast to stop 4: Alarm 5: Fault cancellation	Encoder fault: The encoder needs to be disconnected in some cases. In this case, after the ten thousands place is set to 4 (alarm) and disconnection is detected, the FVC mode is automatically switched to the SVC mode.

Parameter Code	Parameter Name	Default	Value Range	Description
F9-50	Fault protection action selection 3	25000	Ones: Reserved Tens: Abnormal motor auto-tuning result (E22.00) 0: Coast to stop 5: Fault cancellation Hundreds: Motor short-circuited to the ground (E23.00) 0: Coast to stop 5: Fault cancellation Thousands: Inter-phase short circuit (E24.00) 0: Coast to stop 5: Fault cancellation Ten thousands: Reserved	
F9-51	Fault protection action selection 4	51111	Ones: Cumulative running time reached (E26.00) 0: Coast to stop 1: Stop according to the stop mode 2: Continue operation 5: Fault cancellation Tens: User-defined fault 1 (E27.00), same as the ones place Tens: User-defined fault 2 (E28.00), same as the ones place Hundreds: Power-on time reached (E29.00), same as the ones place Ten thousands: E30.00, same as the ones place	-
F9-52	Fault protection action selection 5	00101	Ones: PID feedback loss during running (E31.00) 0: Coast to stop 1: Stop according to the stop mode 2: Continue operation 5: Fault cancellation Tens: Reserved Hundreds: Reserved Thousands: Excessive speed deviation (E42.00), same as the ones place Tens: Motor overspeed (E43.00), same as the ones place	

Parameter Code	Parameter Name	Default	Value Range	Description
F9-53	Fault protection action selection 6	05500	Ones: Motor overheat (E45.00) 0: Coast to stop 1: Stop according to the stop mode 2: Continue operation 5: Fault cancellation Tens: Reserved Hundreds: Reserved Thousands: Reserved Ten thousands: Fan fault (E80.00) 0: Coast to stop 1: Stop according to the stop mode 5: Fault cancellation	
F9-54	Frequency for continuing to run upon fault	0	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency	If a fault occurs during the running of the AC drive and the fault protection action is set to "Continue operation", the AC drive displays A** and continues to run at the frequency set by F9-54.
F9-55	Backup frequency upon fault	100.0%	0.0% to 100.0%. 100.0% corresponds to the maximum frequency F0-10.	

3.6.6 Motor Overheat Protection

Parameter Code	Parameter Name	Default	Value Range	Description
F9-56	Motor temperature sensor type	0	0: No temperature sensor (AI used for analog input) 1: PT100 2: PT1000	A motor temperature sensor must be connected to AI and GND terminals. The drive supports temperature sensors PT100 and PT1000. Set the sensor type correctly for normal use. You can view the motor temperature in U0-34.

F9-57	Motor overtemperature protection threshold	110°C	0° C to 200° C	When the motor temperature exceeds the motor overtemperature protection threshold (F9-57), the AC drive reports E45.00 and acts according to the fault protection action set by F9-53.
F9-58	Motor overtemperature warning threshold	90° C	0° C to 200° C	When the motor temperature exceeds the motor overtemperature warning threshold (F9-58), the DO allocated with function 39 (Motor overtemperature warning) outputs a valid signal.

3.6.7 Power Dip Ride-through

The power dip ride-through function ensures continuous system running upon an instantaneous power failure. When an instantaneous power failure occurs, the AC drive keeps the motor in the power generation state to keep the bus voltage at a value around the threshold for enabling power dip ride-through. This prevents the AC drive from stopping due to undervoltage, as shown in the following figure. See the following figure.

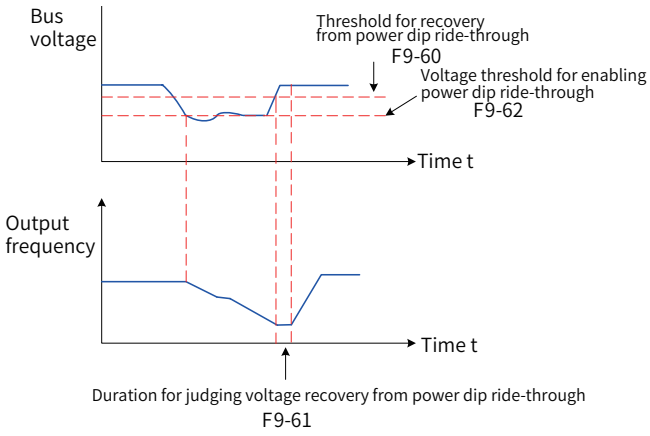
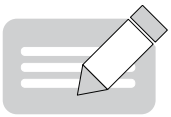


Figure 3-45 Power dip ride-through process

Parameter Code	Parameter Name	Default	Value Range	Description
F9-59	Power dip ride-through	0	0: Disable 1: Keep bus voltage constant 2: Decelerate to stop	"Keep bus voltage constant" is recommended for large-inertia applications such as fans, water pumps, and centrifuges, and "Decelerate to stop" is recommended for the textile industry.
F9-60	Threshold for recovery from power dip ride-through	85%	80% to 100%	100% corresponds to 540 V.
F9-61	Duration for judging voltage recovery from power dip ride-through	0.5s	0.0s to 100.0s	This parameter is valid only when F9-59 is set to 1 (Keep bus voltage constant).
F9-62	Voltage threshold for enabling power dip ride-through	80%	60% to 100%	100% corresponds to 540 V.
F9-71	Power dip ride-through gain Kp	0 to 100	40	This parameter is valid only when F9-59 is set to 1 (Keep bus voltage constant). If undervoltage occurs frequently in the process of power dip ride-through, increase Kp and Ki.
F9-72	Power dip ride-through integral coefficient Ki	0 to 100	30	
F9-73	Deceleration time of power dip ride-through	0s to 300.0s	20.0s	This parameter is valid only when F9-59 is set to 2 (Decelerate to stop).



NOTE

- When F9-59 is set to 1 (Keep bus voltage constant) and the power grid resumes, the drive output frequency rises to the target frequency according to the acceleration time.
- When F9-59 is set to 2 (Decelerate to stop) and the power grid resumes, the drive continues to decrease the output frequency to 0 Hz and stops. The drive will not start until it receives the run command again.

3.6.8 Load Loss Protection

Parameter Code	Parameter Name	Default	Value Range	Description
F9-51	Fault protection action 4	51111	-	Ten thousands place of F9-51 is used to to enable load loss detection. When the output current of the AC drive falls below F9-64 (Load loss detection level) for longer than the value of F9-65 (Load loss detection time), the AC drive performs load loss protection action. Once the load recovers during protection, the AC drive automatically runs at the frequency reference.
F9-64	Load loss detection level	10.0%	0.0% to 100.0%	
F9-65	Load loss detection time	1.0s	0.1s to 60.0s	

3.6.9 Overspeed Protection

This function is effective only for vector control with speed sensor (F0-01=1).

Parameter Code	Parameter Name	Default	Value Range	Description
F9-67	Overspeed detection level	20.0%	0.0% to 50.0% (maximum frequency)	When the detected motor speed exceeds F0-10 (Maximum frequency) for a percentage higher than F9-67 (Overspeed detection level) and for longer than the time set by F9-68 (Overspeed detection time), the AC drive reports E43.00 and acts as selected by F9-52 (Fault protection action selection). When F9-68 (Overspeed detection time) is set to 0.0s, the overspeed detection function is disabled.
F9-68	Overspeed detection time	1.0s	0.0s to 60.0s	

3.6.10 Protection Against Excessive Speed Deviation

This function is effective only for vector control.

Parameter Code	Parameter Name	Default	Value Range	Description
F9-69	Detection level for excessive speed deviation	20.0%	0.0% to 50.0% (maximum frequency)	When detected motor speed is different from frequency reference and the difference is larger than the value of F9-69 for longer than the time set by F9-70 (Detection time for excessive speed deviation), the AC drive reports E42.00 and acts as selected by F9-52 (Fault protection action selection). When F9-70 (Detection time for excessive speed deviation) is set to 0.0s, the excessive speed deviation detection function is disabled.
F9-70	Detection time for excessive speed deviation	5.0s	0.0s to 60.0s	

3.6.11 Undervoltage and Overvoltage Threshold and Fast Current Limit Protection

Parameter Code	Parameter Name	Default	Value Range	Description
A5-06	Undervoltage threshold	350 V	210 V to 420 V	When the bus voltage is lower than the value of A5-06 or higher than the value of A5-09, the AC drive reports Err09 or Err05 to Err07.
A5-09	Overvoltage threshold	820 V	650 V to 820 V	
A5-04	Fast current limit	1	0: Enable 1: Disable	This parameter is 0 for the SVC mode by default and is 1 for other control modes. It is recommended to disable this function in hoisting applications, such as cranes.

3.6.12 Short Circuit to Ground Detection

Parameter Code	Parameter Name	Default	Value Range	Description
F9-07	Detection of short circuit to ground	1	0: No detection 1: Detection upon power-on 2: Detection before running 3: Detection upon power-on and before running	-

3.7 Monitoring

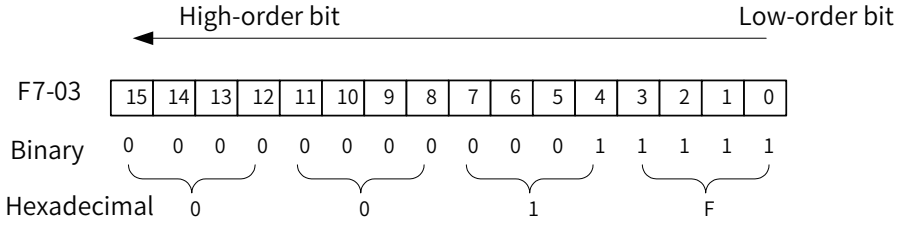
The monitoring function enables you to view the drive state on the LED keypad. You can view monitoring parameters in the following two ways.

1) In the stop or operation state, you can use the key ▼ to switch every bit of F7-03, F7-04, and F7-05 to view multiple status parameters.

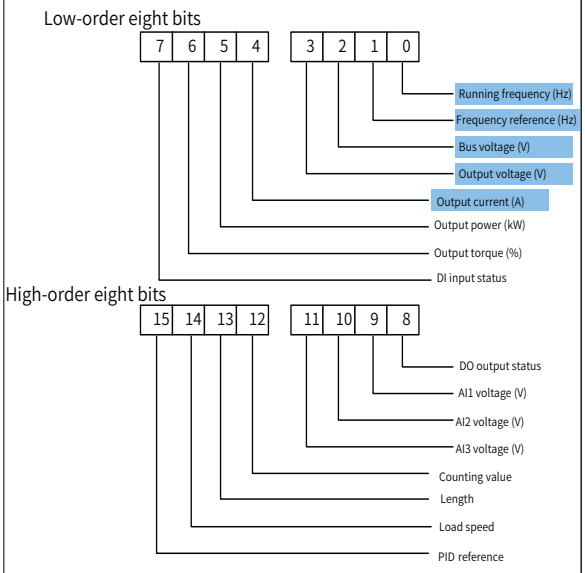
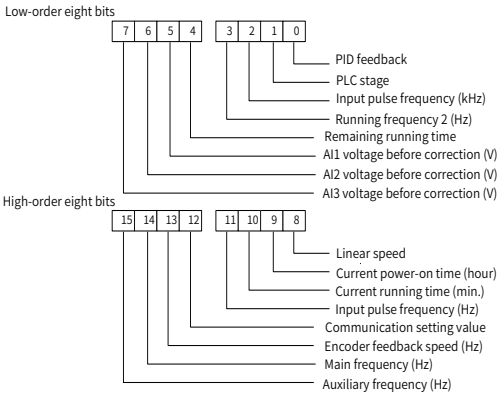
In the operation state, 32 operating status parameters are available. Each binary bit of F7-03 (Parameter 1 displayed during operation) and F7-04 (Parameter 2 displayed during operation) determine whether the corresponding parameter is displayed. In the stop state, 13 stop status parameters are available. Each binary bit of F7-05 (Parameter displayed at stop) determines whether the corresponding parameter is displayed.

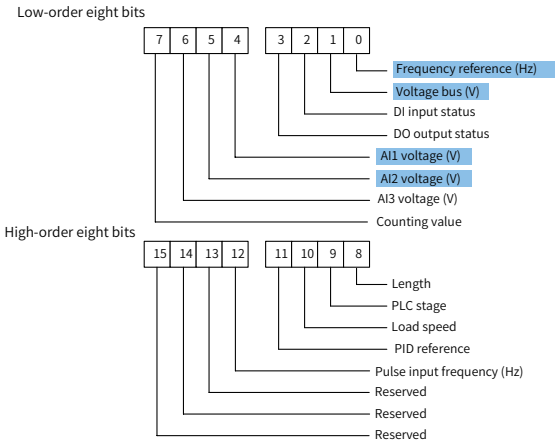
For example, to view the operating parameters on the keypad, such as the running frequency, bus voltage, output voltage, output current, output power, and PID reference, perform the following operations.

- Each bit of F7-03 (Parameter 1 displayed during operation) corresponds to one parameter. Set the corresponding bit to 1.
- Convert the binary value to a hexadecimal value and set F7-03 to this hexadecimal value. (The following figure tells you how to convert a binary number to the hexadecimal equivalent.)
- You can use the key ▼ to switch every bit of F7-03 to view related parameters. The following figure shows the setting.



Other monitoring parameters are viewed in the same way as F7-03. The corresponding relationship between the monitoring parameters and every bit of F7-03, F7-04, and F7-05 is as follows.

Parameter Code	Parameter Name	Default	Value Range	Description
F7-03	Parameter 1 displayed during operation	1F	0000 to FFFF	If a parameter needs to be displayed during running, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-03 to the hexadecimal number.  Note: The shaded parameters are displayed by default.
F7-04	Parameter 2 displayed during operation	0	0000 to FFFF	If a parameter needs to be displayed during running, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-04 to the hexadecimal number. 

Parameter Code	Parameter Name	Default	Value Range	Description
F7-05	Stop display parameter	33	0000 to FFFF	If a parameter needs to be displayed when the AC drive stops, set its corresponding bit to 1. After converting the binary number to a hexadecimal number, set F7-05 to the hexadecimal number.  Note: The shaded parameters are displayed by default.

NOTE

- Upon power-on after power-off, the parameter display mode restores to that set before power-off.
- The monitoring parameters corresponding to each bit of F7-03, F7-04, and F7-05 do not completely correspond to all the monitoring parameters in group U0. If the parameter to be monitored cannot be found by F7-03, F7-04, and F7-05, search it in group U0 through the key by using method 2.

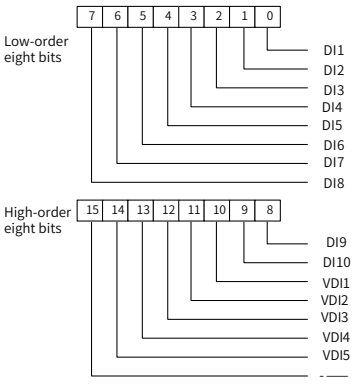
To convert a binary number into a hexadecimal equivalent, do as follows:

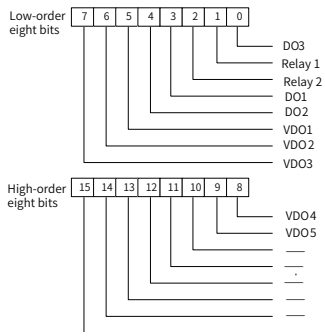
· From right to left, every four binary digits correspond to one hexadecimal digit. If there are less than four binary digits left, fill in with 0 to make the number of left binary digits to be four. Then, convert every four binary digits into a decimal number. 0000 to 1111 in the binary format correspond to 0 to 15 in the decimal format and 0 to F in the hexadecimal format. Convert the decimal number into a hexadecimal equivalent according to the corresponding relationship between decimal and hexadecimal numbers. See the following table for details.

For example, the binary number is 011 1101 1111 1001. After adding 0 to the highest place, the binary number changes to 0011 1101 1111 1001. According to the preceding table, the hexadecimal equivalent is 3DF9.

Binary	1111	1110	1101	1100	1011	1010	1001	1000	0111	0110	0101	0100	0011	0010	0001	0000
Decimal	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Hex.	F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0

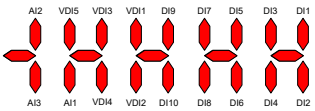
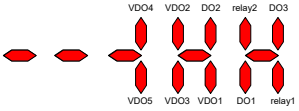
2) Use the keypad to enter group U0 and view the monitoring parameters. For details on how to operate the keypad, see Chapter 4 Commissioning Tools. The monitoring parameters listed in the following table are read-only.

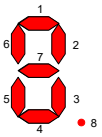
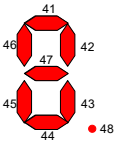
Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-00	Running frequency (Hz)	0.01 Hz	0.00-500.00 Hz	It displays the absolute value of the AC drive operating frequency.
U0-01	Frequency reference (Hz)	0.01 Hz		It displays the absolute value of the AC drive frequency reference.
U0-02	Bus voltage (V)	0.1 V	0.0 V to 3000.0 V	It displays the bus voltage of the AC drive.
U0-03	Output voltage (V)	1 V	0 V to 1140 V	It displays the output voltage of the drive during operation.
U0-04	Output Current (A)	0.01 A	0.00 A to 655.35 A (drive power ⩽ 55 kW) 0.0 A to 6553.5 A (drive power > 55 kW)	It displays the output current of the drive during operation.
U0-05	Output power (kW)	0.1 kW	0 to 32767	It displays the output power of the drive during operation.
U0-06	Output torque (%)	0.1%	-200.0% to 200.0%	It displays the output torque of the drive during operation. This percentage takes the rated motor torque as the basis.
U0-07	DI input state	1	0x0000 to 0x7FFF	It displays the state value of the DI. After the value is converted to a binary number, each bit of the binary number corresponds to one DI signal. The value 1 indicates that the input is high level. The value 0 indicates that the input is low level. The corresponding relationship between bits and DIs is as follows. 

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-08	DO output state	1	0x0000 to 0x03FF	It displays the state value of the DO. After the value is converted to a binary number, every bit of the binary number corresponds to one DO signal. The value 1 indicates that the output is high level, and the value 0 indicates that the output is low level. The relationship between bits and DOs is as follows. 
U0-09	AI1 voltage (V)	0.01 V	0.00 V to 10.57 V	
U0-10	AI2 voltage (V)/ current (mA)	0.01 V /0.01 mA	0.00 V to 10.57 V 0.00 mA to 20.00 mA	You can set F4-40 to select voltage input or current input.
U0-11	Motor speed	1 rpm	0 rpm to 65535 rpm	-
U0-12	Counting value	1	1 to 65535	It displays the value in the counting function.
U0-13	Length value	1	1 to 65535	It displays the value in the fixed length function.
U0-14	Load speed	It is determined by the ones place of F7-12.	0 to Rated motor speed	It displays the load speed.
U0-15	PID reference	1	0 to 65535	PID reference = PID reference (percentage) x FA-04 (PID reference feedback range)
U0-16	PID feedback	1	0 to 65535	PID feedback = PID feedback (percentage) x FA-04 (PID reference feedback range)
U0-17	PLC stage	1	0 to 15	A total of 16 multi-references are available.
U0-18	Pulse input reference (Hz)	0.01 kHz	0.00 kHz to 100.00 kHz	It displays DI5 high-speed pulse sampling frequency.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-19	Feedback speed (Hz)	0.01 Hz	-500.0 Hz to 500.0 Hz (Tens place of F7-12 is 1.)	When the tens place of F7-12 (number of decimal places for load speed display) is set to 1, the number of decimal places of U0-19 is 1 and the display range is -500.0 Hz to +500.0 Hz.
			-320.00 Hz to 320.00 Hz (Tens place of F7-12 is 2.)	When the tens place of F7-12 is set to 2, the number of decimal places of U0-19 is 2 and the display range is -320.00 Hz to +320.00 Hz.
U0-20	Remaining running time	0.1 min	0.0min to 6500.0 min	It displays the remaining running time when the timing operation is performed.
U0-21	AI1 voltage before correction	0.001 V	0.000 V to 10.570 V	It displays the actual sampled voltage/current through the AI. The actual voltage/current used has been corrected linearly to reduce the deviation between the sampled voltage/current and the actual input voltage/current. For voltage/current that has been corrected linearly, see U0-09 and U0-10.
U0-22	AI2 voltage (V)/ current (mA) before correction	0.001 V /0.01 mA	0.000 V to 10.570 V 0.000 mA to 20.000 mA	
U0-25	Current power-on time	1 min	0–65000 min	-
U0-26	Current operating time	0.1 min	0.0 min to 6500.0 min	-
U0-27	Input pulse frequency	1 Hz	0-65535 Hz	It displays DI5 high-speed pulse sampling frequency. It is the same as U0-18 but in different units.
U0-28	Communication setpoint	0.01%	-100.00% to 100.00%	It displays data written through the communication address 0x1000. The setpoint of address 0x1000 determines the base of this percentage.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-29	Encoder feedback speed	0.01 Hz	-320.00 Hz to 320.00 Hz (Tens place of F7-12 is 2.)	It displays the motor operating frequency measured by the encoder. When the tens place of F7-12 (number of decimal places for load speed display) is set to 2, the number of decimal places of U0-29 is 2 and the display range is -320.00 Hz to 320.00 Hz.
			-500.0 Hz to 500.0 Hz (Tens place of F7-12 is 1.)	When the tens place of F7-12 (number of decimal places for load speed display) is set to 1, the number of decimal places of U0-29 is 1 and the display range is -500.0 Hz to 500.0 Hz.
U0-30	Main frequency display	0.01 Hz	0.00 Hz to 500.00 Hz	It displays the main frequency reference.
U0-31	Auxiliary frequency display	0.01 Hz	0.00 Hz to 500.00 Hz	It displays the auxiliary frequency reference.
U0-34	Motor temperature	1° C	0° C to 200° C	It indicates the motor temperature sampled through AI3. For motor temperature detection, see F9-56 (Type of motor temperature sensor).
U0-35	Target torque (%)	0.1%	-200.0% to 200.0%	It displays the current torque upper limit reference, which is a percentage of the rated motor torque.
U0-37	Power factor angle	0.1°	—	It displays the current power factor angle.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-38	ABZ position	1	0 to 65535	It displays the number of phase-A and phase-B pulses of the ABZ encoder. This value is four times the number of pulses that the encoder runs. For example, if 4000 is displayed, the actual number of pulses that the encoder runs is 4000/4 = 1000. The value increases when the encoder rotates in the forward direction and decreases when the encoder rotates in the reverse direction. After increasing to 65535, the value will be set to 0 and increase from 0 again. After decreasing to 0, the value be set to 65535 and decrease from 65535 again. You can check whether installation of the encoder is normal by viewing U0-38.
U0-39	Target voltage for V/f separation	1 V	0 V to rated motor voltage	It displays the target output voltage in the V/f separation status.
U0-40	Output voltage for V/f separation	1 V	0 V to rated motor voltage	It displays the current actual output voltage in the V/f separation status.
U0-41	DI input state display	1	—	DI state indication: "ON" represents high level and "OFF" represents low level. 
U0-42	DO output state display	1	—	DO state indication: "ON" represents high level and "OFF" represents low level. 

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-43	DI function status display 1 (functions 01 to 40)	1	—	It displays whether DI functions 1 to 40 are active. The keypad has five LEDs, which represent functions 1 to 8, 9 to 16, 17 to 24, 25 to 32, and 33 to 40 respectively from the right to the left. Each LED corresponds to eight functions, as shown in the following figure. DI state indication: "ON" represents high level and "OFF" represents low level. 
U0-44	DI function status display 2 (functions 41 to 80)	1	—	It displays whether DI functions 41 to 59 are active. The keypad has five LEDs, which represent functions 41 to 48, 49 to 56, and 57 to 59 respectively from the right to the left. Each LED corresponds to eight functions, as shown in the following figure. DI state indication: "ON" represents high level and "OFF" represents low level. 
U0-45	Fault subcode	1	0 to 51	It displays the fault subcode.
U0-58	Z signal counter	1	0 to 65535	It displays the number of phase Z pulses of the ABZ or UVW encoder. The parameter value increases or decreases by 1 every time the encoder rotates one revolution forward or reversely. You can check whether the encoder is installed properly through U0-58.
U0-59	Frequency reference (%)	0.01%	-100.00% to 100.00%	It displays the frequency reference. The parameter value takes the maximum frequency of the drive (F0-10) as the base.
U0-60	Operating frequency (%)	0.01%	-100.00% to 100.00%	It displays the current operating frequency. The parameter value takes the maximum frequency of the drive (F0-10) as the base.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-61	Drive status	1	—	1: Forward running; 2: Reverse running; 3: Stopped; 4: Auto-tuning; 5: Faulty
U0-68	AC drive state read through PROFIBUS DP card	1	Bit 0	It indicates running status. 0: Stopped; 1: Running
			Bit 1	It indicates the running direction. 0: Forward; 1: Reverse
			Bit 2	It indicates the faulty status. 0: No fault; 1: Faulty
			Bit 3	It indicates whether the output frequency reaches the pre-set value. 0: Yes; 1: No
			Bit 4	It indicates that communication is normal (fixed to 1 under normal conditions).
			Bit 5	It indicates whether the control variables of the drive are controlled through communication. 0: No; 1: Yes
			Bit 6	It indicates whether the control commands of the drive are controlled through communication. 0: No; 1: Yes
			Bit 7	It indicates whether a warning occurs. 0: No; 1: Yes
			Bit 8 to Bit 15	It indicates the fault code (main code). For details, see specific fault descriptions.
U0-69	Frequency read through PROFIBUS DP card	0.01 Hz	-320.00 Hz to 320.00 Hz	FVC: Test run speed feedback Other control modes: Synchronous speed feedback
U0-74	Target torque in torque control mode (after filter time A0-04)	0.1%	-200.0% to 200.0%	The actual torque upper limit equals the rated motor torque x value of U0-77.
U0-75	Real-time target torque in torque control mode (after acceleration/ deceleration time A0-07/A0-08)	0.1%	-200.0% to 200.0%	The actual torque upper limit equals the rated motor torque x value of U0-77.
U0-76	Torque upper limit in motoring state	0.1%	0.0% to 200.0%	The actual torque upper limit equals the rated motor torque x value of U0-77.
U0-77	Torque upper limit in generating state	0.1%	0.0% to 200.2%	The actual torque upper limit equals the rated motor torque x value of U0-77.

3.8 Input/Output Terminals

This section describes functions of the DI, DO, virtual DI, virtual DO, AI and AO.

3.8.1 DI Functions

The drive provides multiple multi-functional DI terminals (DIO1 can be used as the high-speed pulse input terminal). Each DI can be assigned with a specific function.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-00	DI1 function selection	1	0 to 62	For details, refer to the following table.
F4-01	DI2 function selection	4		
F4-03	DIO1 function selection	12		
F4-04	DIO2 function selection	13		
F4-35	DI1 delay time	0.0s	0.0s to 3600.0s	This parameter defines the delay time of the drive when the DI status changes. F4-35 is available only for DI1 and DI2.
F4-36	DI2 delay time	0.0s	0.0s to 3600.0s	
F4-38	DI active mode selection 1	00000	Ones: DI1 active status setting 0: Active high 1: Active low Tens: DI2 active status setting (0 to 1, same as the ones place) Hundreds: Reserved Thousands: DIO1 active status setting (0 to 1, same as above) Ten thousands: DIO2 active status setting (0 to 1, same the ones place)	When active high is selected, the DI is active when connected to the COM terminal and inactive when disconnected from the COM terminal. When active low is selected, the DI is inactive when connected to the COM terminal and active when disconnected from the COM terminal.

Descriptions of DI functions

Value Range	Function	Description
0	No function	Set 0 for reserved terminals to avoid malfunction.
1	Forward running (FWD) or operation command	In two-wire mode 1 (F4-11 = 0) and three-wire mode 1 (F4-11 = 2), the terminal is used to set the forward direction.
		In two-wire mode 2 (F4-11 = 1) and three-wire mode 2 (F4-11 = 3), the terminal is used to set the operation command.
2	Reverse running (REV) or running direction	In two-wire mode 1 (F4-11 = 0) and three-wire mode 1 (F4-11 = 2), the terminal is used to set the reverse direction.
		In two-wire mode 2 (F4-11 = 1) and three-wire mode 2 (F4-11 = 3), the terminal is used to set the running direction (forward/reverse).

Value Range	Function	Description
3	Three-wire control	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.
4	Forward jog (FJOG)	The terminal is used to set the AC drive to jog forwardly. The jog frequency, acceleration time, and deceleration time are described in F8-00, F8-01 and F8-02 respectively in section 6.11.1.
5	Reverse jog (RJOG)	The terminal is used to set the AC drive to jog reversely. The jog frequency, acceleration time, and deceleration time are described in F8-00, F8-01 and F8-02 respectively in section 6.11.1.
6	Function as the UP key	The terminal is used to increase the frequency when the frequency is set through the terminal. When this terminal is active, it works as if is kept pressed down. When this terminal is inactive, it works as if is released.
7	6: Function as the DOWN key	The terminal is used to decrease the frequency when the frequency is set through the terminal. When this terminal is active, it works as if is kept pressed down. When this terminal is inactive, it works as if is released.
8	Coast to stop	The drive stops and the motor stops according to the inertia.
9	Fault reset (RESET)	Reset the drive faults. Remote fault reset can be implemented through this terminal.
10	Running pause	When the terminal is active, the AC drive decelerates to stop with all running parameters memorized (such as the PLC, wobble, and PID parameters). When the terminal is inactive, the AC drive resumes its status before stop.
11	External fault NO input	When an external signal is delivered to the drive, the drive reports fault E15.00.
12	Multi-reference terminal 1	The setting of 16 multi-references or 16 other references can be implemented through combinations of 16 states of these four terminals. For details, see the table of multi-reference function descriptions.
13	Multi-reference terminal 2	
14	Multi-reference terminal 3	
15	Multi-reference terminal 4	
16	Acceleration/ deceleration time selection terminal 1	Totally four groups of acceleration/deceleration time can be selected through combinations of two states of these two terminals. For details, see “Table 3-2 Selecting the acceleration and deceleration time via the DI”.
17	Acceleration/ deceleration time selection terminal 2	
18	Frequency source switchover	The terminal is used to switch between two frequency reference sources according to F0-07 (frequency reference superposition).

Value Range	Function	Description
19	Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key	When the main frequency is set through the keypad and this function is selected, the frequency set by ▲ or ▼ key on the keypad or by terminal functioning as the UP/DOWN key (6 or 7) can be cleared, and the frequency reference will be reset to the value of F0-08.
20	Control command switchover terminal 1	When the operation command is set through the terminal (F0-02 = 1), this function can implement switchover between terminal control and keypad control. When the operation command is set through communication (F0-02 = 2), this function can implement switchover between communication control and keypad control.
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 invalid	The PID is invalid temporarily. The drive maintains the current output frequency without PID adjustment of the frequency source.
23	Simple PLC status 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 this terminal is active, the wobble function is paused and the AC drive outputs at the center frequency.
25	Counter input	In the count process, the number of pulses is counted when the terminal is active.
26	Counter reset	In the count process, the counter status is cleared when the terminal is active.
27	Length counting input	In the fixed length process, the length count is input when the terminal is active.
28	Length reset	In the fixed length process, the length is cleared when the terminal is active.
29	Torque control prohibited	In torque control mode, the drive switches to speed control when this terminal is active. The drive switches back to the torque control mode when the terminal becomes inactive.
31	Reserved	Reserved
32	Immediate DC braking	The terminal is used to switch the drive to the DC braking state.
33	External fault NC input	When an external signal is delivered to the drive, the drive reports fault E15.01.
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 PID action direction	The terminal is used to reverse the PID action direction defined by FA-03 (PID action direction).
37	Control command switchover terminal 2	The terminal is used for switchover between terminal control and communication control. If terminal control is used, the system switches to communication control when the terminal is active. If communication control is used, the system switches to terminal control when the terminal is active.
38	PID integral pause	After this function is active, the integral adjustment function pauses. However, the proportional and derivative adjustment functions are still valid.

Value Range	Function	Description
39	Switchover between main frequency and preset frequency	The terminal is used to switch the main frequency to the preset frequency (F0-08).
40	Switchover between auxiliary frequency and preset frequency	The terminal is used to switch the auxiliary frequency to the preset frequency (F0-08).
42	Position lock enable	When the terminal is active, the drive decelerates to 0 Hz and enters the position lock state.
43	PID parameter switchover	If PID parameters are switched by using the DI (FA-18 = 1), the PID parameters FA-05 to FA-07 are used when the terminal is inactive, and the PID parameters FA-15 to FA-17 are used when the terminal is active.
44	User-defined fault 1	When E27.00 is reported, the AC drive will take measures according to the value of F9-51 (fault protection action).
45	User-defined fault 2	When E28.01 is reported, the AC drive will take measures according to the value of F9-51 (fault protection action).
46	Speed control/Torque control switchover	The terminal is used to enable the drive to switch between the speed control mode and the torque control mode. When 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 terminal is used to make the drive decelerate to stop in any control mode (keypad, terminal, or communication). In this case, the deceleration time is fixed to the value of F8-08 (deceleration time 4).
49	Decelerate to DC braking	The terminal is used to make the AC drive decelerate to the start frequency of DC braking for stop (F6-11) and then enter the DC braking state.
50	Clear current running time	The terminal is used to clear the current running time of the drive. If the current running time is shorter than the set value (greater than 0) of F8-53 (Current running time threshold) and the terminal is active, the current running timing is cleared. If the current running time is longer than the set value (greater than 0) of F8-53 (Current running time threshold) and the terminal is active, the current running timing is not cleared.

Value Range	Function	Description
51	Two-wire/Three-wire mode switchover	The terminal is used to switch the drive between the two-wire control mode and the three-wire control mode. If F4-11 is set to 0 (two-wire mode 1), the AC drive switches to three-wire mode 1 when the terminal is active. If F4-11 is set to 1 (two-wire mode 2), the AC drive switches to three-wire mode 2 when the terminal is active. If F4-11 is set to 2 (three-wire mode 1), the AC drive switches to two-wire mode 1 when the terminal is active. If F4-11 is set to 3 (three-wire mode 2), the AC drive switches to two-wire mode 2 when the terminal is active.
52	Reverse running inhibition	When the terminal is active, even if the reverse frequency is set, the actual frequency of the AC drive is limited to 0. This function is the same as F8-13 (Reverse frequency inhibited).
54	Roll diameter reset	When the roll is replaced in the tension mode, the initial roll diameter must be reset.
55	Initial roll diameter 1	When B0-10 is set to 0, the terminal is used to switch the initial roll diameter among B0-11 to B0-13.
56	Initial roll diameter 2	
57	Pre-charge	This function applies when automatic roll change is needed and linear speeds of axes with rolls to be changed need to be synchronized in the tension mode.
58	Winding/unwinding switchover	This function is used to switch between winding and unwinding when the tension mode is used.
59	Roll diameter calculation stopped	In the tension mode, if automatic roll replacement and pre-drive are required, winding diameter calculation can be disabled to avoid influence on the winding diameter calculation.
60	Exiting from tension mode	This function is used to exit the tension control mode.

3.8.2 DO Functions

The MD810 series drive is equipped with multi-function DIOs as standard that can be configured as the DO.

Parameter Code	Parameter Name	Default	Value Range	Description
F5-00	DIO2 output mode	0	0: Pulse output (FMP) 1: Digital output (FMR)	The FM terminal is a programmable multi-functional terminal, which can be used as the high-speed pulse output terminal (FMP) or open collector digital output terminal (FMR). When the FM terminal is used as the high-speed pulse output terminal (FMP), the maximum frequency of the output pulse is 100 kHz. For details, see the description of F5-06.
F5-01	FMR function (open collector output terminal)	0	0 to 41	These five parameters are used to select the functions of the five digital output terminals. T/A-T/B-T/C and P/A-P/B-P/C are the relays on the control board and the expansion card respectively.
F5-02	Function selection of relay (T/A-T/B-T/C) on control board	2		
F5-04	DIO1 output function selection	1		
F5-17	FMR output delay	0.0s	0.0s to 3600.0s	-
F5-18	RELAY1 output delay	0.0s	0.0s to 3600.0s	-
F5-20	DIO1 output delay	0.0s	0.0s to 3600.0s	-
F5-21	DIO2 output delay	0.0s	0.0s to 3600.0s	-
F5-22	DO valid status selection	00000	Ones: FMR (DIO2) valid status selection 0: Positive logic 1: Negative logic Tens: RELAY1 valid status selection (0 to 1, same as above) Hundreds: Reserved Thousands: DIO1 valid status selection (0 to 1, same as above) Ten thousands: Reserved	0: Positive logic (equivalent to a NO contact) Valid status: The DO is internally connected to the COM terminal. Invalid status: The DO is disconnected from the COM terminal. 1: Negative logic (equivalent to a NC contact) Valid status: The DO is disconnected from the COM terminal. Invalid status: The DO is internally connected to the COM terminal.

Descriptions of output terminal function selection:

Value Range	Function	Description
0	No output	The output terminal has no function.
1	Drive running	When the drive is operating and frequency (can be zero) is output, the terminal outputs an active signal.
2	Fault (coast to stop)	The terminal outputs an active signal when the drive stops upon a fault.
3	Frequency detection value 1	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 value (F8-19 x F8-20), the terminal stops outputting the active signal. Refer to "Appendix C Parameter List of the Power Supply Unit" for the detailed descriptions of F8-19 and F8-20.
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	Operating at zero speed (no output at stop)	When the drive is operating and the output frequency is 0, the terminal outputs an active signal. When the drive is in the stop state, the signal is inactive.
6	Motor overload pre-alarm	The drive determines whether the motor load exceeds the overload pre-alarm threshold according to the overload pre-alarm coefficient (F9-02) before triggering protection. When the overload pre-alarm threshold is exceeded, the terminal outputs an active signal. For the calculation of the alarm threshold, see descriptions of the protection functions.
7	Drive overload pre-alarm	The terminal outputs an active signal 10s before overload protection for the drive applies.
8	Counting value reference reached	The terminal outputs an active signal when the counting value reaches the setpoint of FB-08.
9	Designated counting value reached	The terminal outputs an active signal when the counting value reaches the setpoint of FB-09. The terminal outputs an active signal when the counting value reaches the setpoint of FB-09. Function Description
10	Length reached	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 reached	If the cumulative running time of the drive exceeds the time specified by F8-17, the terminal outputs an active signal.
13	Frequency limit reached	The terminal outputs an active signal when the set frequency exceeds the frequency upper limit or lower limit and the drive output frequency reaches the frequency upper limit or lower limit.
14	Torque limited	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 for running	When the drive is powered on and operates in the normal state, the terminal outputs an active signal.
16	AI1 > AI2	The terminal outputs an active signal when the AI1 input is higher than the AI2 input.
17	Frequency upper limit reached	The terminal outputs an active signal when the operating frequency reaches the frequency upper limit (F0-12).

Value Range	Function	Description
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 status	The terminal outputs an active signal when the drive is in the undervoltage state.
20	Communication control	The active or inactive state of the terminal is controlled by the setpoint of communication address 0x2001.
21	Reserved	Reserved
22	Reserved	Reserved
23	Operating at zero speed 2 (output available at stop)	When the drive is operating and the output frequency is 0, the terminal outputs an active signal. The signal remains active when the drive is in the stop state.
24	Cumulative power-on time reached	The terminal outputs an active signal when the cumulative power-on time of the AC drive (F7-13) exceeds the time defined by F8-16.
25	Frequency detection value 2	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 value (F8-28 x F8-29). Refer to "Appendix C Parameter List of the Power Supply Unit" for the detailed descriptions of F8-28 and F8-29.
26	Frequency 1 reached	The terminal outputs an active signal when the running frequency of the AC drive is within the frequency detection range specified by 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 reached	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 reached	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 reached	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 operation reached	When the timing function set by F8-42 is enabled and the operating time reaches the set timing duration, the terminal outputs an active signal. 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 the drive is in the load loss state.
33	Reverse running	The terminal outputs an active signal when the drive is operating in the reverse direction.

Value Range	Function	Description
34	Zero current state	When the output current of the drive is within the zero current range for a duration longer than that defined by 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 reached	The terminal outputs an active signal when F7-07 (drive unit heatsink temperature) reaches the value of F8-47 (module temperature threshold).
36	Output current overlimit	When the output current of the AC drive is higher than F8-36 (output current overlimit 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 reached (output available at stop)	The terminal outputs an active signal when the operating frequency reaches the lower limit (F0-14). The terminal still outputs the active signal when the drive is in the stop state.
38	Alarm	The terminal outputs an active signal when a fault occurs and the drive continues operating. 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 operating time reached	When the current operating time of the drive exceeds the time defined by F8-53, the terminal outputs an active signal.
41	Fault output (coast to stop and no output at undervoltage)	The terminal outputs an active signal when a fault (other than the undervoltage fault) occurs on the AC drive.
43	Position lock succeeded	When the number of position lock deviation pulses is smaller than the value of F6-25, the terminal outputs an active signal.

3.8.3 Virtual DI Functions

The virtual digital input terminals (VDIs), which can be used for multi-functional digital inputs, have the similar functions as the DIs on the control board.

There are three VDI setting sources:

- A1-06: The VDI is set by writing values to A1-06. This mode applies to communication scenarios, where physical DIs are not used. The relationship between A1-06 and VDIs are as follows: The ones to ten thousands places of A1-06 correspond to VDI1 to VDI5, respectively.
- DO state: The MD810 has two DOs. DIO1 corresponds to VDI1, and DIO2 corresponds to VDI2.
- DI state: DI1 and DI2 correspond to VDI1 and VDI2, respectively. DIO1 and DIO2 correspond to VDI4 and VDI5.

The following examples show how to use VDIs.

Example 1: To implement the function that the AC drive reports an alarm and stops when the AI1 input exceeds the limit, set as follows:

Step	Setting

1	Set the VDI1 function to "User-defined fault 1" (A1-00 = 44).
2	Set the DIO1 function to "AI input limit exceeded" (F5-04 = 31).
3	Set the VDI1 state to be determined by the DO (A1-05 = 00001).

After the preceding steps, when the AI1 input exceeds the upper or lower limit, DIO1 outputs an ON signal. In this case, VDI1 becomes active and the AC drive receives user-defined fault 1 through VDI1. Then the AC drive reports E27.00 and stops.

Example 2: In a communication scenario, implement emergency stop through the VDI without using the physical DI.

Step	Setting
1	Set the VDI1 function to "Emergency stop" (A1-00 = 47).
2	Set the VDI1 state to be determined by parameters (A1-05 = 00000).
3	Modify the ones place of A1-06 through communication.

After the preceding steps, set the ones place of A1-06 to 1 to implement the emergency stop function.

Parameter Code	Parameter Name	Default	Value Range	Description
A1-00	VDI1 function selection	0	0 to 60	VDI1 to VDI5 can be used as multi-functional DIs. The assignment of functions 0 to 52 to VDIs is the same as that to common Dis. Functions 53 to 59 are reserved. For details, see descriptions of F4-00 to F4-04.
A1-01	VDI2 function selection	0	0 to 60	
A1-02	VDI3 function selection	0	0 to 60	
A1-03	VDI4 function selection	0	0 to 60	
A1-04	VDI5 function selection	0	0 to 60	
A1-05	VDI active state setting mode	00000	Ones: VDI1 0: A1-06 1: DO state 2: DI state Tens: VDI2 (0 to 2, same as the ones place) Hundreds: VDI3 (0 to 2, same as the ones place) Thousands: VDI4 (0 to 2, same as the ones place) Ten thousands: VDI5 (0 to 2, same as the ones place)	The VDI state can be set in three modes, which is specified by A1-05. 0: The VDI state is determined by the binary bit of A1-06. 1: The VDI state is determined by the state (active or inactive) of the corresponding DO. VDI1 to VDI5 are bound to DO1 to DO5, respectively. 2: The VDI state is determined by the state (active or inactive) of the corresponding DI. VDI1 to VDI5 are bound to DI1 to DI5, respectively.

Parameter Code	Parameter Name	Default	Value Range	Description
A1-06	VDI state setting	00000	Ones: VDI1 0: Invalid 1: Valid Tens: VDI2 (0 to 1, same as the ones place) Hundreds: VDI3 (0 to 1, same as the ones place) Thousands: VDI4 (0 to 1, same as the ones place) Ten thousands: VDI5 (0 to 1, same as the ones place)	-

3.8.4 AIs

The drive provides two analog multi-functional input terminals. The following parameters are used to use the AI as the DI. For more functions of the AI, see 3.2.3 Setting Main Frequency Through AI. When an AI is used as an DI, the AI state is high level if the input voltage of the AI is higher than 7 V and is low level if the input voltage of the AI is lower than 3 V. The AI is in the hysteresis state if the input voltage ranges from 3 V and 7 V. The following figure shows the relationship between AI input voltages and DI states.

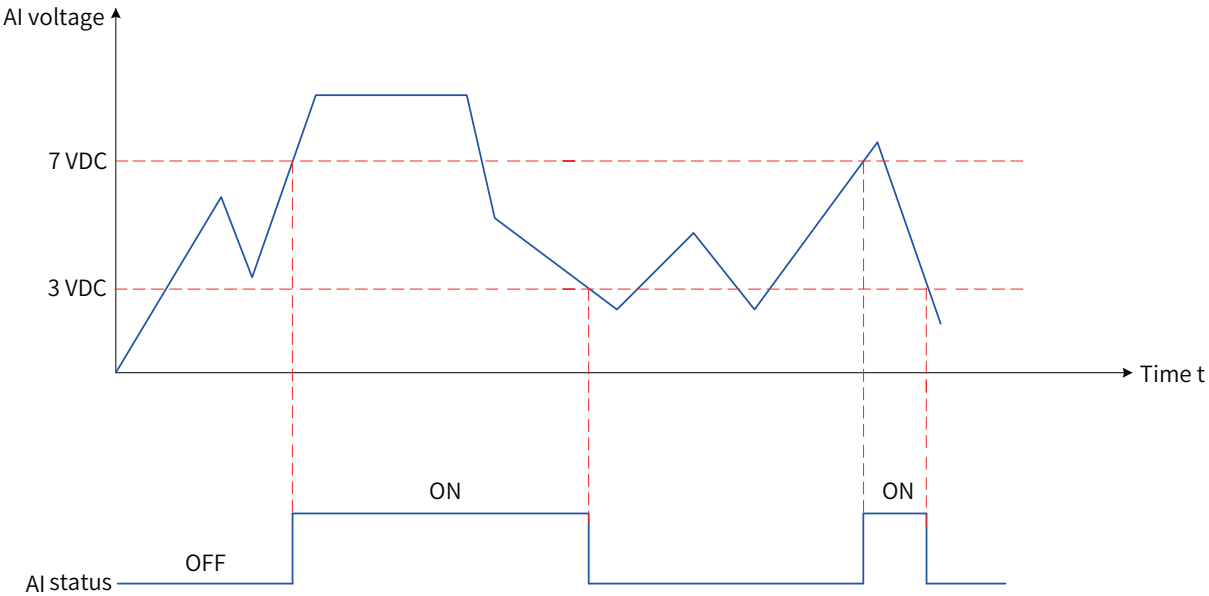


Figure 3-46 Relationship between AI input voltages and DI states

Parameter Code	Parameter Name	Default	Value Range	Description
A1-07	Function selection for AI1 used as DI	0	0 to 60	When the AI is used as the DI, assignment of functions 0 to 52 to the AI is the same as that to the common DI. Functions 53 to 60 are reserved. For details, see descriptions of DI settings in F4 group parameters.
A1-08	Function selection for AI2 used as DI	0	0 to 60	

A1-10	Active mode selection for AI used as DI	00	Ones: AI1 0: Active high 1: Active low Tens: AI2 (0 or 1, the options are the same as that of the ones position)	When the AI is active high, the AI is active if the corresponding bit of A1-10 is set to 0, and inactive if the corresponding bit of A1-10 is set to 1. When the AI is active low, the AI is inactive if the corresponding bit of A1-10 is set to 0, and active if the corresponding bit of A1-10 is set to 1.

3.8.5 AOs and Pulse Output Terminals

The drive provides one AO. The following parameters are used to correct the offset of the analog output zero drift and the output amplitude. They can also be used to define the required AO curve.

Parameter Code	Parameter Name	Default	Value Range	Description
F5-00	DIO2 output mode	0	0: Pulse output (FMP) 1: Digital output (FMR)	DIO2 is a programmable multi-functional terminal, which can be used as the high-speed pulse output terminal (FMP) or open collector digital output terminal (FMR). When DIO2 is used as the high-speed pulse output terminal (FMP), the maximum frequency of the output pulse is 100 kHz. For details on the FMP functions, see the description of F5-06.
F5-06	FMP output function selection (pulse output terminal)	0	0 to 19	For details, see "Table 3-5 Relationship between pulse output/analog output functions and ranges".
F5-07	AO output function selection	0	0 to 19	
F5-09	Maximum frequency of FMP output	50.00 kHz	0.01 kHz to 100.00 kHz	This parameter sets the maximum frequency of pulse output when DIO2 is used for pulse output.
F5-10	AO zero offset coefficient	0.0%	-100.0% to +100.0%	100% of the AO zero deviation coefficient corresponds to 10 V or 20 mA. Zero offset = Zero offset coefficient x 10 V (or 20 mA)
F5-11	AO gain	1.00	-10.00 to +10.00	-
F5-23	AO mode	0	0: Voltage output 1: Current output	-

The voltage 0 V to 10 V of the AO corresponds to 0% to 100%. When the AO function is set to 1 (frequency reference), and the drive frequency is set to 50% of the maximum frequency, the output voltage of the AO is 5 V (50% x 10 V).

The voltage 0 kHz to 100 kHz of the FM (pulse output) terminal corresponds to 0% to 100%. When the FM terminal output function is set to 1 (frequency reference), the drive frequency is set to 50% of the maximum frequency, and F5-09 is set to 100 kHz, the output frequency of the

FM terminal is 50 kHz (50% x 100 kHz).

Table 3-5 Relationship between pulse output/analog output functions and ranges

Value	Function	Range
0	Operating frequency	0 to maximum output frequency
1	Frequency reference	0 to maximum output frequency
2	Output current	0 to 2 times the rated motor current
3	Motor output torque (absolute value, proportion to motor rated torque)	0 to 2 times the rated motor torque
4	Output power	0 to 2 times the rated motor power
5	Output voltage	0 to 1.2 times the rated AC drive voltage
6	Pulse input (100.0% corresponds to 100.00 kHz)	0.01 kHz to 100.00 kHz
7	AI1	0 V to 10 V
8	AI2	0 V to 10 V or 0 mA to 20 mA
9	AI3	0 V to 10 V
10	Length	0 to maximum set length
11	Count value	0 to maximum count value
12	Communication control	0.0% to 100.0%
13	Motor speed	0 to rotational speed corresponding to maximum output frequency
14	Output current	0.0 A to 1000.0 A
15	Bus voltage	0.0 V to 1000.0 V
16	Motor output torque (actual value, proportion to the rated motor torque)	-2 times the rated motor torque to 2 times the rated motor torque

The following is an example of how to calculate AO zero offset coefficient (F5-10) and AO gain (F5-11).

Assume that the AO outputs the operating frequency. The rectified output needs to be 8 V (Y1) when the frequency is 0 Hz (X1) and 4 V (Y2) when the frequency is 40 Hz (X2).

Formula for calculating the gain:

$$K = \frac{(Y1-Y2) \times Xmax}{(X1-X2) \times Ymax}$$

Formula for calculating zero offset coefficient:

$$b = \frac{(X1 \times Y2) - (X2 \times Y1)}{(X1 - X2) \times Ymax} \times 100\%$$

Xmax is the maximum output frequency 50 Hz (assume that the maximum frequency F0-10 is 50 Hz). Ymax is the voltage and the value is 10 V.

The value of F5-11 (AO gain) is -0.5 and the value of F5-10 (AO zero offset coefficient) is 80%.

Table 3-6 Relationship between analog output signal types and corresponding maximum values (Ymax)

Analog Output Signal Type	Corresponding Max. Value (Ymax)
Voltage	10 V

Analog Output Signal Type	Corresponding Max. Value (Ymax)
Current	20 mA

Table 3-7 Relationship between analog output content and corresponding maximum values (Xmax)

Analog Output Content	Corresponding Max. Value (Xmax)
Operating frequency	Maximum output frequency
Frequency reference	Maximum output frequency
Output current	2 x Rated motor current
Output torque (absolute value)	2 x Rated motor torque
Output power	2 x Rated power
Output voltage	1.2 times the rated AC drive voltage
Pulse input	100.00 kHz
AI1	10 V
AI2	10 V or 20 mA
AI3	10 V
Length	Maximum set length
Count value	Maximum counting value
Communication control	100.0%
Motor speed	Speed at the maximum output frequency
Output current	1000.0 A
Output voltage	1000.0 V
Actual value of output torque	2 x Rated motor torque

3.9 Auxiliary Functions

3.9.1 Jog

In some applications, the AC drive needs to run at a low speed temporarily to facilitate equipment testing. In this case, jogging applies. If jogging is adopted, F6-00 must be set to 0 (direct start) and F6-10 must be set to 0 (decelerate to stop).

Parameter Code	Parameter Name	Default	Value Range	Description
F0-25	Base frequency for acceleration/ deceleration time	0	0: F0-10 (Maximum frequency) 1: Frequency reference 2: 100 Hz	-
F8-00	Jog frequency	2.00 Hz	0.00 Hz to maximum frequency	-
F8-01	Acceleration time of jogging	20.0s	0.0s to 6500.0s	Jog acceleration time indicates the time required by the drive to accelerate from 0 Hz to F0-25 (Base frequency of acceleration/deceleration time).
F8-02	Deceleration time of jogging	20.0s	0.0s to 6500.0s	Jog deceleration time indicates the time required by the drive to decelerate from F0-25 (Base frequency of acceleration/ deceleration time) to 0 Hz.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-27	Jog through terminal with priority	0	0: Disable; 1: Enable	This parameter defines whether to set the highest priority to the terminal to enable jogging. If F8-27 is set to 1, and any of F4-00 to F4-09 is set to 4 (forward jog) or 5 (reverse jog) during operation, the AC drive enters jog running status immediately.
F8-56	Jog enabling on the LED keypad	0	-	The LED keypad provided with the product does not have a running key. If jogging is required, you need to set F8-56 to enable jogging.

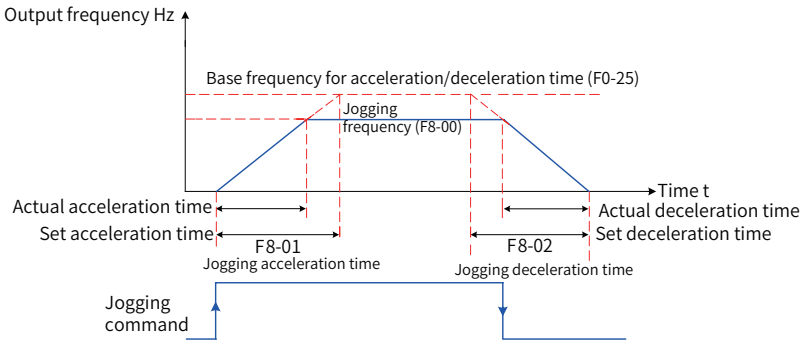


Figure 3-47 Jogging

Table 3-8 Parameter settings for jogging through the keypad

Step	Forward Jogging	Reverse Jogging
1	Set F0-02 to 0 to select the keypad as the command source.	Set F0-02 to 0 to select the keypad as the command source. Set F8-13 to 0 to allow reverse running.
2	Set F8-00 (jog frequency), F8-01 (jog acceleration time), and F8-02 (jog deceleration time) properly.	Set F8-00 (jog frequency), F8-01 (jog acceleration time), and F8-02 (jog deceleration time) properly.
3	Access F8-56, which displays the current jog frequency. If you need to modify the jog frequency, press the UP or DOWN key.	Access F8-56, which displays the current jog frequency. If you need to modify the jog frequency, press the UP or DOWN key.
4	Press ENTER to display JOG. The drive enters the jog state. When you press and hold the UP key, the drive starts jogging forwardly. When you release the UP key, the drive decelerates to stop.	Press ENTER to display JOG. The drive enters the jog state. When you press and hold the DOWN key, the drive starts jogging forwardly. When you release the DOWN key, the drive decelerates to stop.

3.9.2 Jump Frequency, Dead-Zone Time of Forward/Reverse Run Switchover, and Reverse Run Prohibition

◆ Jump frequency

The jump frequency enables the AC drive to avoid mechanical resonance points of the load. The drive can be set with two jump frequencies. If both the two frequencies are set to 0, the jump frequency function is disabled.

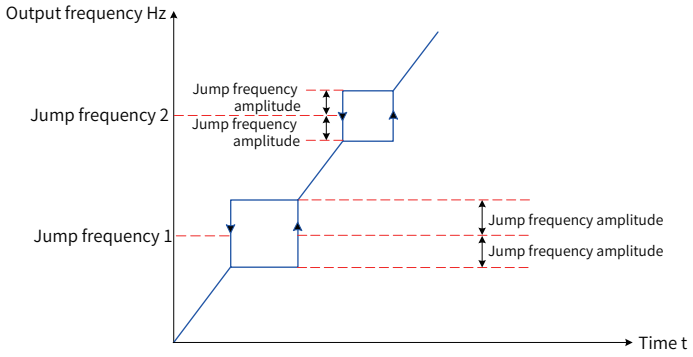


Figure 3-48 Jump frequency

As shown in the preceding figure, when the running frequency approaches the jump frequency during acceleration, the AC drive skips over the jump frequency. The jump range is twice the value of F8-11 (jump frequency amplitude).

When the running frequency approaches the jump frequency during deceleration, the AC drive skips over the jump frequency. The jump range is twice the value of F8-11 (jump frequency amplitude).

Parameter Code	Parameter Name	Default	Value Range	Description
F8-09	Jump frequency 1	0.00 Hz	0.00 Hz to maximum frequency	-
F8-10	Jump frequency 2	0.00 Hz	0.00 Hz to maximum frequency	-
F8-11	Jump frequency amplitude	0.00 Hz	0.00 Hz to maximum frequency	-
F8-22	Jump frequency valid status during acceleration/ deceleration	0	0: Disable 1: Valid	This parameter is used to enable or disable the jump frequency function during acceleration/deceleration. When it is enabled, the AC drive skips over the jump frequency when the running frequency is near the jump frequency during acceleration and deceleration. The jump range is twice the value of F8-11 (jump frequency amplitude). When it is disabled, the AC drive continues to run at the running frequency when the running frequency is near the jump frequency during acceleration and deceleration.

- Dead-zone time of forward/reverse run switchover

Parameter Code	Parameter Name	Default	Value Range	Description
F8-12	Dead zone time of forward/reverse run switchover	0.0s	0.0s to 3000.0s	This parameter defines the transition time at 0 Hz output during switchover between forward running and reverse running.

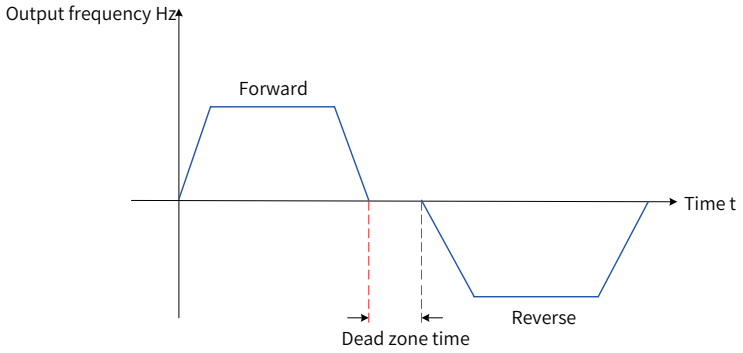


Figure 3-49 Dead zone time of forward/reverse run switchover

◆ Reverse running prohibition

Parameter Code	Parameter Name	Default	Value Range	Description
F8-13	Reverse running prohibition	0	0: Disable; 1: Enable	-

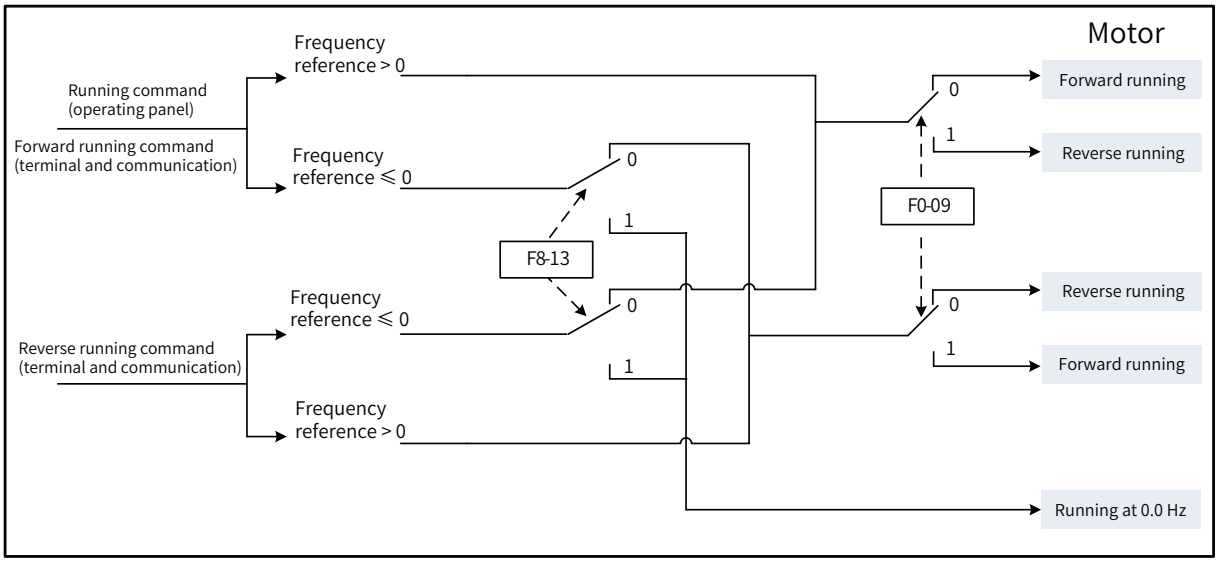


Figure 3-50 Reverse running prohibition

Parameter Code	Parameter Name	Default	Value Range	Description
F0-09	Running direction selection	0	0: Default direction 1: Direction opposite to the default direction	-

You can change the rotation direction of the motor just by modifying this parameter without changing the motor wiring. Modifying this parameter is equivalent to exchanging any two of U,

V, W cables of the motor.

Note

- The motor will resume rotating in the original direction after parameter initialization. Do not use this function in applications where changing the motor direction is prohibited after system commissioning is completed.

3.9.3 User-defined Parameters

FE-00 to FE-29 are user-defined parameters. You can select the required parameters from the parameter list and add them to group FE, which facilitates view and modification.

You can add at most 30 parameters to the FE group. If F0-00 is displayed, the corresponding user-defined parameter is empty. In the user-defined parameter mode, the displayed parameters are defined by FE-00 to FE-31, and the sequence is consistent with that in group FE. The parameter is skipped if F0-00 is displayed.

3.9.4 Frequency Detection (FDT)

This function sets the detection value of the output frequency as well as the hysteresis value upon output cancellation. The hysteresis value is valid only during deceleration. Hysteresis does not occur in detection during acceleration. The following figure describes the frequency detection function.

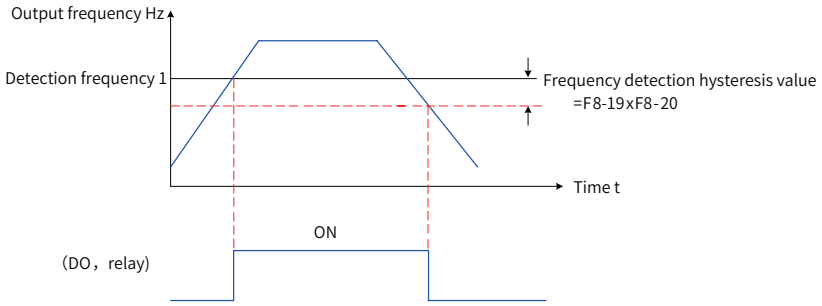


Figure 3-51 Frequency detection

Parameter Code	Parameter Name	Default	Value Range	Description
F8-19	Frequency detection value 1	50.00 Hz	0.00 Hz to maximum frequency (F0-04)	When the running frequency of the AC drive is higher than the frequency detection value, the DO outputs an active signal. When the running frequency of the AC drive is lower than the result of frequency detection value minus frequency detection hysteresis value (F8-19 x F8-20), the DO outputs an inactive signal.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-20	Frequency detection hysteresis rate 1	5.0%	0.0% to 100.0% (FDT1 level)	The frequency detection hysteresis value equals F8-20 x F8-19.
F8-28	Frequency detection value 2	50.00 Hz	0.00 Hz to maximum frequency	-
F8-29	Frequency detection hysteresis rate 2	5.0%	0.0% to 100.0% (FDT2 level)	-

3.9.5 Detection Frequency Amplitude

This function sets the detection frequency range.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-21	Detection frequency amplitude	0.00%	0.0% to 100% (maximum frequency)	The detection frequency amplitude value is F8-21 x maximum frequency. When the running frequency of the AC drive ranges from frequency reference - maximum frequency x F8-21 to frequency reference + maximum frequency x F8-21, the DO outputs an active signal.

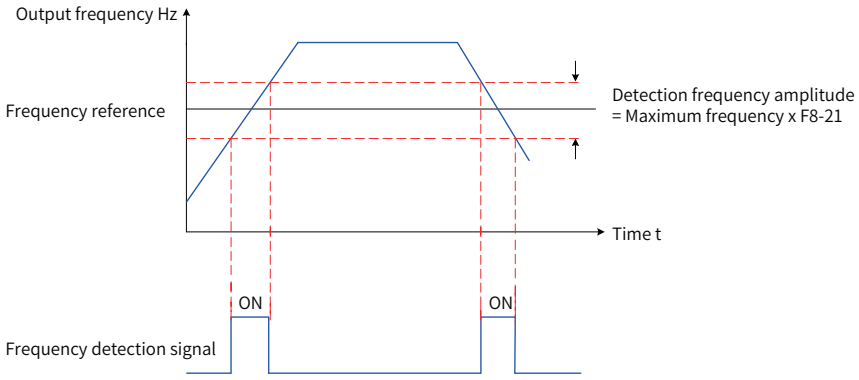


Figure 3-52 Time sequence of the frequency detection amplitude

3.9.6 Frequency for Acceleration/Deceleration Time Switchover

This function is used to switch the acceleration/deceleration time based on the running frequency range when the AC drive is running. This function is valid when the DI is not allocated with function 16 (acceleration/deceleration time selection terminal 1) or 17 (acceleration/deceleration time selection terminal 2).

Parameter Code	Parameter Name	Default	Value Range	Description

F8-25	Frequency for acceleration time 1 and acceleration time 2 switchover	0.00 Hz	0.00 Hz to maximum frequency	-
F8-26	Frequency for deceleration time 1 and deceleration time 2 switchover	0.00 Hz	0.00 Hz to maximum frequency	-

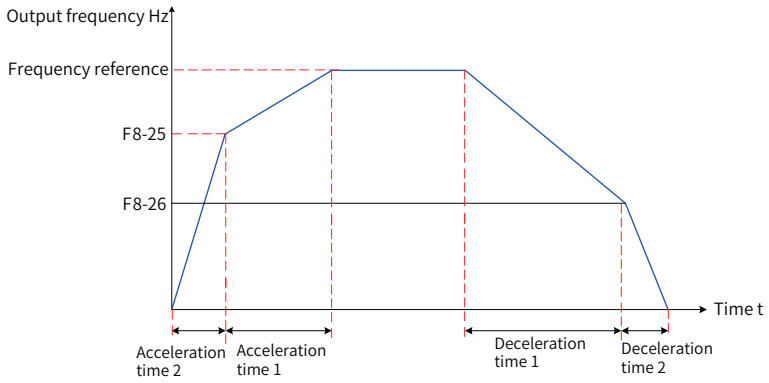


Figure 3-53 Frequency for acceleration/deceleration time switchover

During acceleration, if the running frequency is lower than the value of F8-25, acceleration time 2 is selected. If the running frequency is higher than the value of F8-25, acceleration time 1 is selected. During deceleration, if the running frequency is higher than the value of F8-26, deceleration time 1 is selected. If the running frequency is lower than the value of F8-26, deceleration time 2 is selected.

3.9.7 Detection Frequency

Parameter Code	Parameter Name	Default	Value Range	Description
F8-30	Detection frequency 1	50.00 Hz	0.00 Hz to maximum frequency	When the running frequency of the AC drive is within the frequency detection range (F8-30 - F8-31 x F0-10 to F8-30 + F8-31 x F0-10), the DO outputs an active signal. F0-10 indicates the maximum frequency.
F8-31	Detection frequency amplitude 1	0.0%	0.0% to 100.0% (maximum frequency)	
F8-32	Detection frequency 2	50.00 Hz	0.00 Hz to the maximum frequency	When the running frequency of the AC drive is within the frequency detection range (F8-32 - F8-33 x F0-10 to F8-32 + F8-33 x F0-10), the DO outputs an active signal. F0-10 indicates the maximum frequency.
F8-33	Detection frequency amplitude 2	0.0%	0.0% to 100.0% (maximum frequency)	

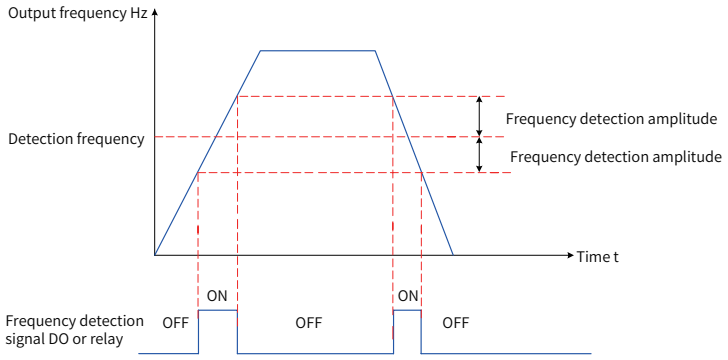


Figure 3-54 Detection frequency

3.9.8 Zero Current Detection

Parameter Code	Parameter Name	Default	Value Range	Description
F8-34	Zero current detection level	5.0%	0.0% to 300.0% (rated motor current)	The DO outputs an active signal when the output current of the AC drive remains at or below the zero current detection value (F8-34 x rated motor current) for a period longer than the value of F8-35 (zero current detection delay time).
F8-35	Zero current detection delay	0.10s	0.00s to 600.00s	

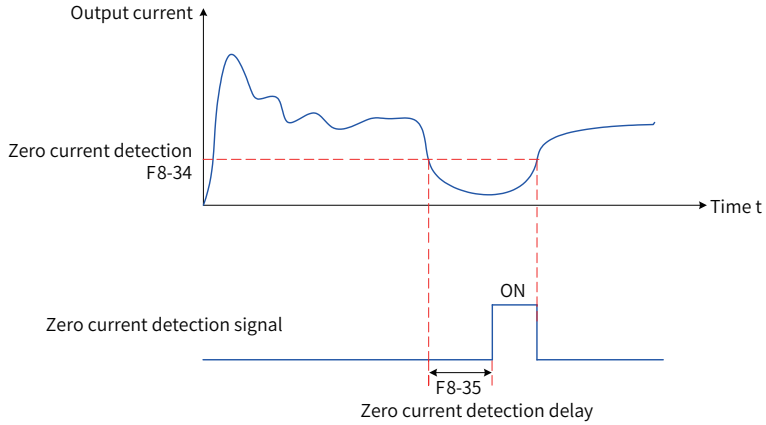


Figure 3-55 Zero current detection

3.9.9 Output Current Overlimit

Parameter Code	Parameter Name	Default	Value Range	Description
F8-36	Output current overlimit threshold	200.0%	0.0% (no detection) 0.1% to 300.0% (rated motor current)	When the output current of the AC drive remains above the result of F8-36 x rated motor current for a period longer than the value of F8-37 (output current overlimit detection delay), the DO outputs an active signal.

F8-37	Output current overlimit detection delay	0.00s	0.00s to 600.00s	-

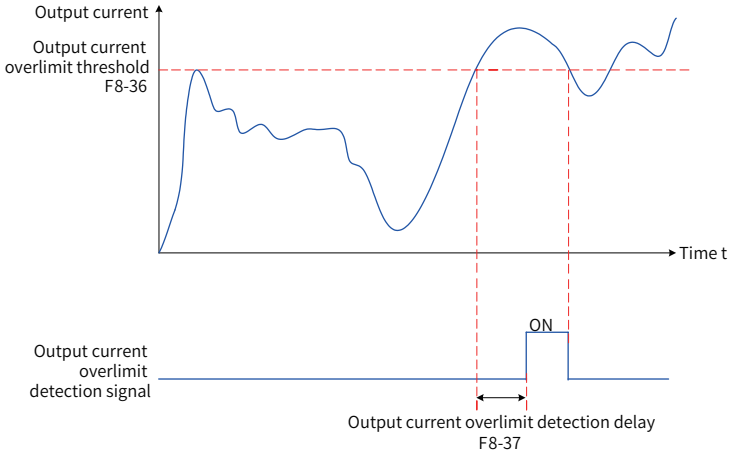


Figure 3-56 Output current overlimit threshold

3.9.10 Detection Current

Parameter Code	Parameter Name	Default	Value Range	Description
F8-38	Detection current 1	100.0%	0.0% to 300.0% (rated motor current)	The DO outputs an active signal when the output current of the AC drive is within the range of (Detection current threshold 1 ± Detection current amplitude 1) x Rated motor current.
F8-39	Detection current amplitude 1	0.0%	0.0% to 300.0% (rated motor current)	
F8-40	Detection current 2	100.0%	0.0% to 300.0% (rated motor current)	The DO outputs an active signal when the output current of the AC drive is within the range of (Detection current threshold 2 ± Detection current amplitude 2) x Rated motor current.
F8-41	Detection current amplitude 2	0.0%	0.0% to 300.0% (rated motor current)	

The MD810 provides two groups of detection current threshold and detection current amplitude parameters, as shown in the following figure.

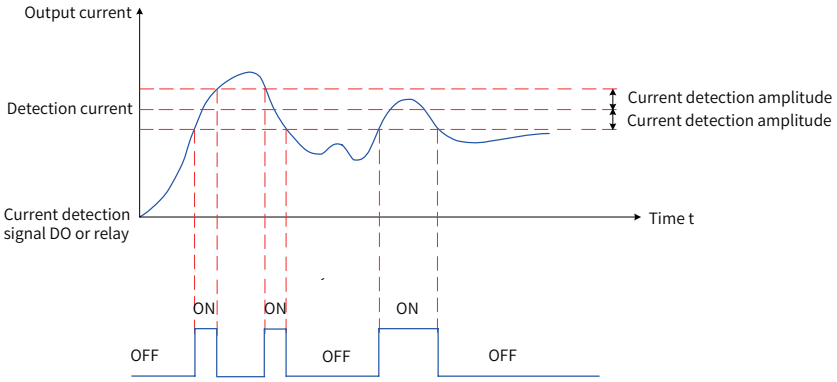


Figure 3-57 Detection current time sequence

3.9.11 Timing Function

The drive supports the timing function. The drive starts timing from 0 each time it starts and

the remaining running duration can be viewed in U0-20.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-42	Timing function	0	0: Disable 1: Valid	If F8-42 is set to 1, the AC drive starts the timing function at startup. When the set timing duration (F8-44) is reached, the AC drive stops automatically and the DO outputs an active signal.
F8-43	Timing operation time setting source	0	0: F8-44 1: AI1 2: AI2	When this parameter is set 1, the timing operation time is equal to the result of AI1 voltage/10 V x F8-44. 100% of the analog input range corresponds to the value of F8-44.
F8-44	Timing operation duration	0.0 min	0.0 min to 6500.0 min	The timing operation time is set by F8-43 and F8-44.

Power-on time threshold

Parameter Code	Parameter Name	Default	Value Range	Description
F8-16	Cumulative power-on time threshold	0 h	0 h to 65000 h	The DO outputs an active signal when the cumulative power-on time (F7-13) of the AC drive reaches the cumulative power-on time threshold (F8-16).

Cumulative running time threshold

Parameter Code	Parameter Name	Default	Value Range	Description
F8-17	Cumulative running time threshold	0 h	0 h to 65000 h	The DO outputs an active signal when the cumulative running time (F7-09) of the AC drive exceeds the cumulative running time threshold (F8-17).

3.9.12 AI1 Input Voltage Upper/Lower Limit

Parameter Code	Parameter Name	Default	Value Range	Description
F8-45	Lower limit of AI1 input voltage protection value	3.10 V	0.00 V to F8-46	When the AI1 input voltage is higher than the value of F8-46 or lower than the value of F8-45, the DO outputs an active signal indicating "AI1 input limit exceeded".
F8-46	Upper limit of AI1 input voltage protection value	6.80 V	F8-45 to 10.00 V	

3.9.13 Module Temperature

Parameter Code	Parameter Name	Default	Value Range	Description
F8-47	Module temperature reach	75° C	0° C to 100° C	When the temperature of the drive unit heatsink reaches the value of F8-47, the DO outputs an active signal.

3.9.14 Cooling Fan

Parameter Code	Parameter Name	Default	Value Range	Description
F8-48	Cooling fan control	0	0: The cooling fan works when the drive is running.	The fan works during drive running. When the drive stops, the fan works if the heatsink temperature is above 40 ° C and stops if the heatsink temperature is below 40° C.
			1: The cooling fan works always.	The fan keeps working after power-on.

3.9.15 Hibernation and Wakeup

The hibernation and wakeup function is used in water supply applications. Generally, set the wakeup frequency (F8-49) equal to or higher than the hibernation frequency (F8-51). The hibernation and wakeup function is disabled if both the wakeup frequency and hibernation frequency are set to 0.00 Hz.

Parameter Code	Parameter Name	Default	Value Range	Description
F8-49	Wakeup frequency	0.00 Hz	F8-51 (hibernation frequency) to F0-10 (maximum frequency)	In the hibernation state, when the frequency reference keeps equal to or larger than the wakeup frequency (F8-49) for the time set by F8-50 and the current running command is valid, the AC drive starts directly.
F8-50	Wakeup delay	0.0s	0.0s to 6500.0s	
F8-51	Hibernation frequency	0.00 Hz	0.00 Hz to wakeup frequency (F8-49)	During the AC drive running, when the frequency reference keeps lower than or equal to the hibernation frequency (F8-51) for the time set by F8-52, the AC drive enters the hibernation state and coasts to stop.
F8-52	Hibernation delay	0.0s	0.0s to 6500.0s	

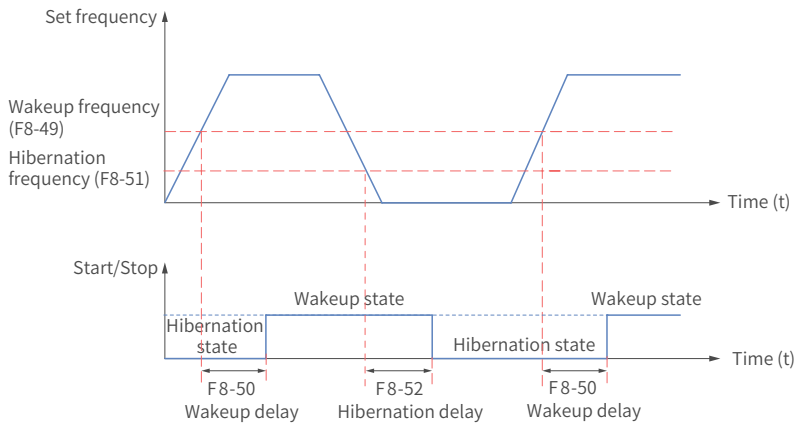


Figure 3-58 Hibernation and wakeup settings

3.9.16 Current Running Time Reach

Parameter Code	Parameter Name	Default	Value Range	Description

F8-53	Current running time threshold	0.0 min	0.0 min to 6500.0 min	When the current running time reaches the value of F8-53, the DO outputs an active signal. This parameter is valid only for the present AC drive running time. The previous running time is not accumulated.

3.9.17 Emergency Stop Deceleration Time

Parameter Code	Parameter Name	Default	Value Range	Description
F8-55	Emergency stop deceleration time	Model dependent	0 to 6553.5	This parameter defines the emergency stop deceleration time. The AC drive decelerates according to the set deceleration time when the emergency stop function is triggered through the terminal. When the deceleration time is 0s in the V/f mode, the AC drive decelerates according to the minimum unit time.

3.10 Positioning control

Positioning control modes are as follows:

R: Incremental positioning

A: Absolute positioning

I: Degree positioning

RI: Fixed length degree positioning

ALL: All position modes

3.10.1 Group B3: Pulse Synchronization Function Parameters

The pulse synchronization function is applicable only to EtherCAT version.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-00	Pulse synchronization mode	0: Speed synchronization 1: Position synchronization 2: Pulse positioning	0	★	-

1) B3-00 is used to set the pulse synchronization mode.

When the frequency source is pulse synchronization, you need to select the pulse synchronization mode. This parameter must be used together with function 87 (Pulse synchronization mode) of the DI.

When function 87 (Pulse synchronization mode) of the DI is inactive, the pulse synchronization mode is determined by the value of B3-00.

When function 87 (Pulse synchronization mode) of the DI is active, the pulse synchronization mode is inverted to the value of B3-00.

When function 88 (Pulse position synchronization control switchover with forward running command) of the DI is active and the command source is terminal control, the drive switches to the pulse position synchronization mode and runs regardless of the state selected by the drive.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-01	Pulse mode	0: Pulse + Direction 1: Two channels of orthogonal pulse	1	★	
B3-02	Phase A/B sequence of orthogonal pulse	0: Forward direction 1: Reverse direction	0	★	-

2) B3-00 and B3-01 are used to set the pulse mode sent by the host controller and the phase sequence of orthogonal pulses.

0: Pulse + direction. This mode supports only differential signal input. Connect differential direction signal cables to A+/A- and pulse signal cables to B+/B- of the positioning expansion card. Handle the jumper of the positioning expansion card. The signal frequency is multiplied by two times.

1: Two channels of orthogonal pulse. This mode supports only differential signal input. Connect differential direction signal cables to A+/A- and B+/B- of the positioning expansion card. Handle the jumper of the positioning expansion card. The signal frequency is multiplied by four times.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-03	Acceleration time (position synchronization)	0.0s to 6500.0s	0	☆	
B3-04	Deceleration time (position synchronization)	0.0s to 6500.0s	0	☆	

3) B3-03 and B3-04 are used to set the acceleration/deceleration time of pulse synchronization.

When the pulse synchronization mode is pulse speed synchronization, the drive standard acceleration/deceleration time (acceleration/deceleration time1/2/3/4) is used.

When the pulse synchronization mode is pulse position synchronization, B3-03 and B3-04 are used as the acceleration/deceleration time.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-05	Feedforward gain (position synchronization)	0.00-600.00	1.00	☆	B3-05

4) B3-05 is used to set the position loop feedforward gain of pulse synchronization

Modify this parameter if necessary. Decrease this parameter when overshoot is too large.

Parame-ter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-06	Proportional gain 1 (position synchronization)	0: Forward direction 1: Reverse direction	0	☆	-
B3-11	Proportional gain switchover (position synchronization)	0: No switching 1: Switched automatically based on deviation	0	★	
B3-12	Proportional gain 2 (position synchronization)	0.00-100.00	1500	☆	
B3-13	Position deviation level 1 of proportional gain switchover (position synchronization)	0 to 30000	0.010s	☆	
B3-14	Position deviation level 2 of proportional gain switchover (position synchronization)	0 to 30000	0	☆	

5) B3-06,B3-11, B3-12,B3-13, and B3-14 are used to set the position loop proportional gain during pulse position synchronization

Adjust this parameter as large as possible if the system is free of oscillation.

Set B3-11 to 0: The synchronous position loop proportional gain of the pulse position is the value of B3-06 when no switchover is performed.

B3-11 is set to 1: When switchover is automatically performed based on the deviation, the synchronous position loop proportional gain of the pulse position is a linear interpolation value between B3-06 and B3-12.

Observe U2-00 during actual running. Increase the value of B3-12 (proportional gain 2) if the pulse synchronization deviation increases.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-07	Electronic gear ratio (numerator)	1 to 30000	1	☆	
B3-08	Electronic gear ratio (denominator)	1 to 30000	1	☆	

6) B3-07 and B3-08 are used to set the electronic gear ratio during pulse synchronization.

When pulse speed synchronization is required, the actual target frequency of the drive = sampling frequency x B3-07/B3-08.

When pulse position synchronization is required, the actual target pulses of the drive = number of sampled pulses x B3-07/B3-08.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-09	Pulse frequency filter time	0 to 1000	0.2	☆	

7) B3-09 is used to set the pulse sampling filter time.

In the pulse position synchronization mode, set the value of B3-09 as small as possible. The recommended value is 0. In the pulse speed synchronization mode, set B3-09 according to actual conditions.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-15	Acceleration compensation gain	0.00-10.00	0.00	☆	

8) B3-15 is used to set the acceleration compensation gain.

When the external frequency signal is in the acceleration/deceleration phase, the proportional gain may not be adjusted to the correct position. In this case, the acceleration/deceleration compensation gain can be set to make the deviation during acceleration/deceleration smaller.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-16	Maximum pulse deviation	1–10000	5.00 Hz	☆	

9) B3-16 is used to set the maximum pulse deviation, that is, the maximum deviation during position loop adjustment when the pulse position is synchronized.

When the deviation exceeds B3-16, use B3-16 as the deviation calculation value in the position loop. This prevents too large position loop adjustment caused by excessive deviation.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-18	Minimum pulse deviation	0 to 1000	2	☆	

10) B3-18 is used to set the minimum pulse deviation, that is, the minimum deviation during position loop adjustment when the pulse position is synchronized.

When the deviation is smaller than B3-18, use 0 as the deviation calculation value of the position loop. In this case, the position loop stops adjusting to prevent motor jitter.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode

B3-19	Minimum frequency reference of pulse synchronization	0.0010-5.0000 Hz	2	☆	

11) B3-19 is used to set the minimum frequency of pulse synchronization. That is, it is used to set the minimum frequency of the external pulse reference, which is the target running frequency of the drive.

When the external operating frequency of the drive is very low, set B3-19 to a value smaller than the minimum operating frequency of the drive.

When the external operating frequency change rate of the drive is very large, set B3-19 to a large value to speed up the response of the drive synchronization.

Parameter Code	Parameter Name	Value Range	Default	Change Mode	Effective Mode
B3-21	Detection value for excessive pulse deviation	0 to 20000	0	☆	
B3-22	Detection time for excessive pulse deviation	0.00-10.00	1.00	☆	

12) B3-21 and B3-22 are used to set the detection value and detection time of the excessive pulse deviation during pulse position synchronization.

When the pulse position is synchronized, the pulse deviation exceeds the value of B3-20 for the duration longer than the time set by B3-21, the drive reports Err55: Excessive pulse deviation.

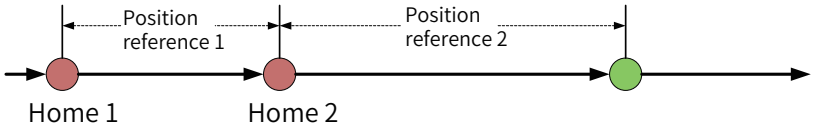
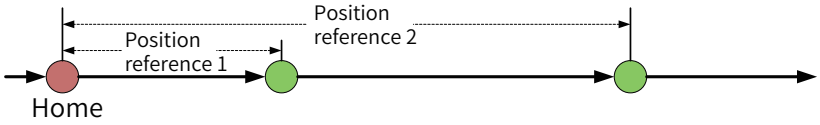
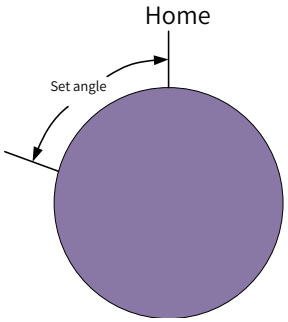
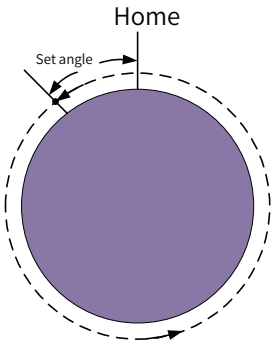
3.10.2 Group B4: Position Control Function Parameters

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-00	Position control function	0: Disable 1: Enable	0	B4-00 is used to enable or disable the position control function. The position control function must be enabled before performing position control.	-

The position control function can be enabled by setting B4-00 to 1 or allocating related functions to the DI, as described below.

Function No.	Function Name	Description
71	Switch to position control	Switch to position control without running commands
72	Switch to position control (forward running command)	Switch to position control with forward running commands
73	Switch to position control (reverse running command)	Switch to the position control mode with reverse running command

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-01	Positioning control mode	0: Incremental; 1: Absolute; 2: Degree; 3: Fixed length degree	0	This parameter is used to set the position control mode. 0: Incremental. The encoder moves the specified length with the current position as the home. 1: Absolute. The encoder moves the specified length with the mechanical position as the home. 2: Degree. The encoder moves the specified degree (angle) with the Z signal of the encoder or the fixed position of the main axis as the home. 3: Fixed length degree. The encoder rotates for one cycle with the Z signal of the encoder or the fixed position of the main axis as the home and stops at the specified degree (angle) relative to the home.	-

Positioning Mode	Diagram
Incremental	
Absolute	
Degree	
Fixed length degree	

The position control mode can be set by B4-01 or switched by the DI. The setting through the DI is prior to that through B4-01. During running, the position control mode cannot be switched by the DI. If the DI is used to switch the positioning control mode, the positioning control mode before switching applies.

Function No.	Function Name	Description

82	Switch to incremental positioning control	Switch to relative positioning control when this function is valid under positioning control mode
83	Switch to absolute positioning control	Switch to absolute positioning control when this function is valid under positioning control mode
84	Switch to degree positioning control	Switch to degree positioning control when this function is valid under positioning control mode
85	Switch to fixed length degree positioning control	Switch to fixed length degree positioning control when this function is valid under positioning control mode

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-02	Electronic gear ratio (numerator)	1 to 30000	1	In the incremental or absolute positioning mode, the conversion relationship between the position reference and pulse position reference is set by B4-02 and B4-03. In the degree or fixed length degree positioning mode with the DI as the home, the conversion relationship between the pulses per revolution (PPR) of the main axis and that of the encoder is set by B4-02 and B4-03. B4-02 and B4-03 are invalid when the Z signal of the encoder is used as the home.	ALL
B4-03	Electronic gear ratio (denominator)	1 to 30000	1		ALL

For example, the PPR of the encoder is 1000. The encoder and motor are installed on the same shaft.

(1) For the incremental or absolute positioning mode, set the position reference to 80, and set the resolution of the motor to 8.

Pulses at the position where the motor rotates for one revolution = 1000 x 4 = 4000 (frequency quadrupled)

Pulses at the position where position reference 80 is finished = 4000 x 8 = 32000 (frequency quadrupled)

Pulses at the position where position reference 80 is finished: Position reference = 32000:80 = 400:1 80 x 400 x 1

Therefore, set B4-02 to 400 and B4-03 to 1.

(2) For degree or fixed length degree positioning mode, the motor rotates for three revolutions and the main axis rotates for one revolution with the DI as the home.

Pulses at the position where the motor rotates for one revolution = 1000 x 4 = 4000 (frequency quadrupled)

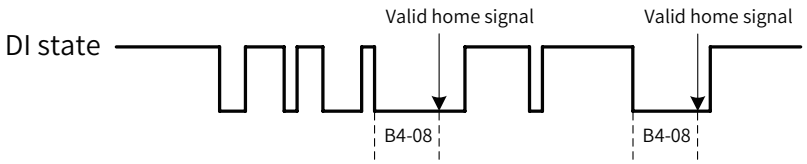
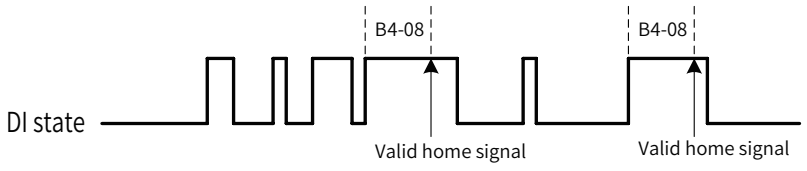
Pulses at the position where the main axis rotates for one revolution = 4000 x 3 = 12000 (frequency quadrupled)

Pulses at the position where the main axis rotates for one revolution: Pulses at the position where the motor rotates for one revolution = 12000:4000 = 3:1

Therefore, set B4-02 to 3 and B4-03 to 1.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-05	Home signal source for positioning control	Ones: Incremental 2: Current position Tens: Absolute 1: DI Hundreds: Degree 0: Encoder Z signal 1: DI Thousands: Fixed length degree 0: Encoder Z signal 1: DI	1012	This parameter is used to set the home signal source. The home source varies with different positioning control modes. If the home signal source changes, the home signal will be cleared. In this case, a new valid home signal needs to be given. When the DI is used as the home signal source, the rising or falling edge change is valid. The edge change effective mode is set by B4-07. Incremental positioning: The encoder moves the specified length with the current position as the home. Absolute positioning: The home signal is given through the DI with the fixed mechanical position as the home. Degree or fixed length degree positioning: The Z signal of the encoder or DI can be used as the home signal source.	-

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-07	DI home signal active mode	0: Active at falling edge 1: Active at rising edge	1	This parameter is used to set the effective mode of edge change when the DI is used as the home signal source.	A, I, RI
B4-08	DI home signal filter time	0s to 5.000s	0.010s	This parameter is used to set the filter time when the DI is used as the home signal source.	A, I, RI

Setting	Effective Mode	Diagram
B4-07 = 0	Valid on the falling edge	
B4-07 = 1	Valid on the rising edge	

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-09	Home enabling control	0: No operation 1: Immediate home searching 2: Current position used as home 3: Clear home 4: Automatic home searching after startup if no home is set	0	This parameter is used to control home searching. The home signal will be cleared during home searching no matter whether a valid home signal exists. 0: Home searching is not performed and it can be enabled by the DI. The searched home is retentive. 1: Home searching is performed immediately when the AC drive is running. The searched home is not retentive. 2: The current encoder position is used as the home in any AC drive state. The searched home is not retentive. 3: The home is cleared and not retentive. 4: If no home is available, home searching is performed after the AC drive is started. The searched home is retentive.	ALL

Para. Code	Para. Name	Value Range	Default	Description	Effective Mode
B4-10	Home searching mode	Ones: Incremental 0: No operation Tens: Absolute 0: Forward searching 1: Reverse searching 2: Forward searching, and direction changed automatically when the limit switch is active 3: Reverse searching, and direction changed automatically when the limit switch is active Hundreds: Degree 0: Forward searching 1: Reverse searching Thousands: Fixed length degree 0: Forward searching 1: Reverse searching	0020	This parameter is used to set the home searching mode. Ones: Home searching mode in the incremental positioning mode In the incremental positioning mode, home searching is not required and the current position is used as the valid home. Tens: Home searching mode in the absolute position mode 0: Forward home searching until the valid home signal is obtained 1: Reverse home searching until the valid home signal is obtained 2: Forward home searching at the beginning During forward home searching, if the forward limit switch is valid, the search direction changes to the reverse searching. During reverse home searching, if the reverse limit switch is valid, the search direction changes to the forward searching. This process repeats until the valid home signal is obtained, as shown in “Figure 3-59 Forward home searching at the beginning”. 3: Reverse home searching at the beginning During reserve home searching, if the reserve limit switch is valid, the search direction changes to the forward searching. During forward home searching, if the forward limit switch is valid, the search direction changes to the reverse searching. This process repeats until the valid home signal is obtained, as shown in “Figure 3-60 Reverse home searching at the beginning”. Hundreds: Home searching mode in the degree positioning mode 0: Forward home searching until the valid home signal is obtained 1: Reverse home searching until the valid home signal is obtained Thousands: Home searching mode in the fixed length degree positioning mode 0: Forward home searching until the valid home signal is obtained 1: Reverse home searching until the valid home signal is obtained Note: The DI limit must be set correctly to ensure normal home searching.	-

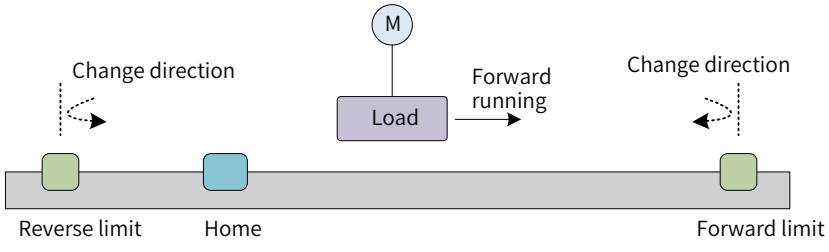


Figure 3-59 Forward home searching at the beginning

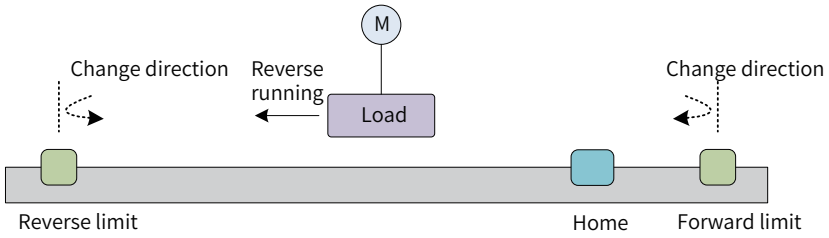


Figure 3-60 Reverse home searching at the beginning

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-11	Home searching speed	0.10 Hz to 50.00 Hz	5.00 Hz	This parameter is used to set the home searching speed.	ALL
B4-12	Home searching acceleration time	0.10s to 600.00s	10.00s	B4-12 and B4-13 are used to set the acceleration and deceleration time for home searching.	ALL
B4-13	Home searching deceleration time	0.10s to 600.00s	10.00s		ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-14	Action after home searching	0: Decelerate to 0 1: Decelerate to 0 and start position control 2: Return to mechanical home 3: Return to the offset position relative to the home	2	This parameter is used to set the action after the home is obtained. 0: Position lock enabled after decelerating to 0 1: Position control started after decelerating to 0 2: Returned to the home after decelerating to 0 3: Returned to the position offset (set by B4-15, B4-16, and B4-17) relative to home after decelerating to 0 Note: If position control is not enabled after the home is obtained, the time set by B4-12 and B4-13 is adopted as the acceleration and deceleration time.	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-15	Home offset (low-order bits)	0–65535	0	B4-15, B4-16, and B4-17 are used to set the stopping position after the home is obtained. They are valid when B4-14 is set to 3.	A, I, RI
B4-16	Home offset (high-order bits)	0–16384	0		A, I, RI
B4-17	Home offset direction	0: Forward 1: Reverse	0		A, I, RI

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode

B4-18	Home searching time limit	1.00s to 600.00s	30.00s	This parameter is used to set the maximum home searching time. If the value of B4-18 is too small or the home is not obtained within the time set by B4-18, the AC drive reports the fault E54.01 (home searching timeout).	A, I, RI

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-19	Home deviation threshold	4 to 60000 pulses	100 pulses	This parameter is used to set the allowed position deviation between adjacent homes.	A, I, RI

In the degree positioning or fixed length degree positioning mode, if the position deviation between adjacent Z signals exceeds the value of B4-19 when the Z signal of the encoder is used as the home signal, the Z signal of the encoder is abnormal. The AC drive reports the fault E54.02 (excessive home position deviation).

In the absolute positioning or fixed length degree positioning mode, when the DI is used as the home signal source and home correction is valid (tens place of B4-61 set to 1), the home signal is determined as lost if the valid home signal is not received within the range set by B4-19 around the home. In this case, the value of U2-92 (Home loss counting during home correction) is incremented by 1. When U2-92 is greater than B4-67, the AC drive reports the fault E54.03 (excessive home loss times).

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-20	Home update mode for incremental positioning	0: Update home at zero speed 1: Update home when repositioning is triggered 2: Save unexecuted position reference during running	1	This parameter is used to set the home update mode control for incremental positioning. When the AC drive stops, B4-20 is invalid. The incremental home position is updated continuously with the current position as the home. When the AC drive is running, the update mode set by B4-20 takes effect. 0: Update home at zero speed 1: Current position as the home when re-positioning signaling is received 2: Save unexecuted position reference when re-positioning signal is received during positioning	R

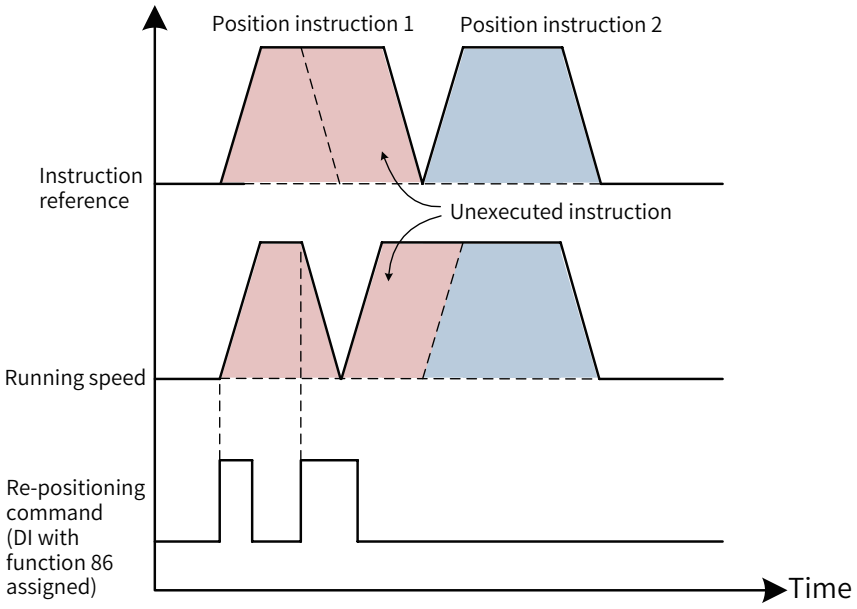
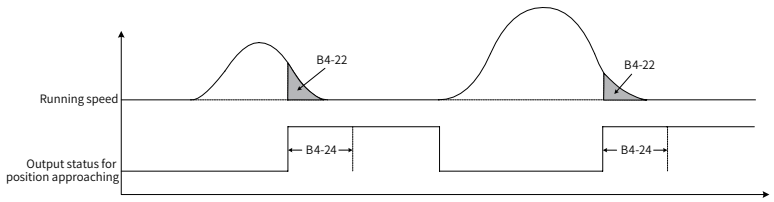
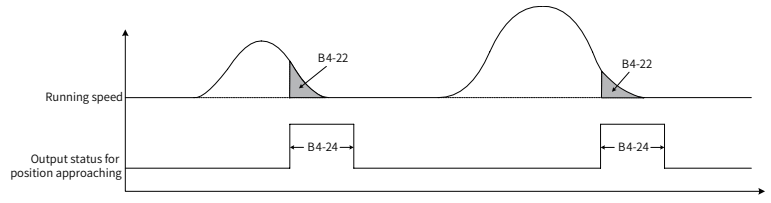


Figure 3-61 Incremental positioning when B4-20 is set to 2

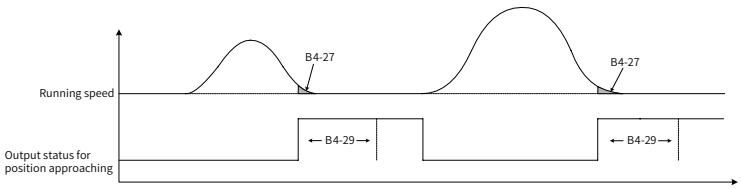
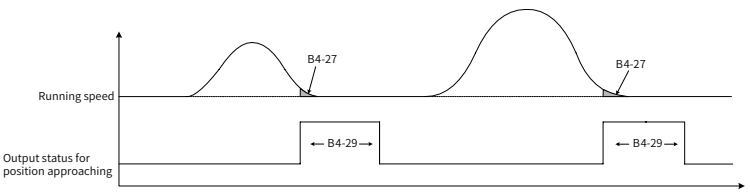
Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-21	Judge criteria of approaching the target position	0: Deviation to the target position less than B4-22 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-23 and its output time is longer than or equal to B4-24 1: Deviation to the target position less than B4-22 (unit: determined by B5-26) for the duration longer than then time set by B4-23 and its output time is longer than or equal to B4-24 2: Deviation to the target position less than B4-22 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-23 and its output time is equal to B4-24 3: Deviation to the target position less than B4-22 (unit: determined by B5-26) for the duration longer than the time set by B4-23 and its output time is equal to B4-24	0	This parameter is used to set the judge criteria of approaching the target position.	ALL
B4-22	Threshold of approaching the target position	0 to 60000	500	-	ALL
B4-23	Judge time of approaching the target position	0s to 5.000s	0.005s	-	ALL
B4-24	Output time of approaching the target position	0s to 600.00s	0.05s	-	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-25	Target position reference output for approaching the target position	0 to 24	0	This parameter is used to set the target position reference output for approaching the target position. Output for approaching the target position is valid when the target position reference is set by B4-25 and the conditions of approaching the target position are met. Even though the conditions of approaching the target position are met, output for approaching the target position is still invalid when the target position reference is set by B4-25. When B4-25 is set to 0, output for approaching the target position is valid for any position reference.	ALL

B4-21	Judgment Value	Unit	DO Output Time	Diagram
0	B4-22	Pulse	No less than B4-24	
1	B4-22	B5-26	No less than B4-24	
2	B4-22	Pulse	B4-24	
3	B4-22	B5-26	B4-24	

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-26	Judge criteria of positioning completion	0: Deviation to the target position less than B4-27 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-28 and its output time is longer than or equal to B4-29 1: Deviation to the target position less than B4-27 (unit: determined by B5-26) for the duration longer than the time set by B4-28 and its output time is longer than or equal to B4-29 2: Deviation to the target position less than B4-27 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-28 and its output time is equal to B4-29 3: Deviation to the target position less than B4-27 (unit: determined by B5-26) for the duration longer than the time set by B4-28 and its output time is equal to B4-29	0	This parameter is used to set the judge criteria of positioning completion.	ALL
B4-27	Threshold of positioning completion	0 to 60000	50	-	ALL
B4-28	Judgment time of positioning completion	0s to 5.000s	0.005s	-	ALL
B4-29	Output time of positioning completion	0s to 600.00s	0.05s	-	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-30	Target position reference output for positioning completion	0 to 24	0	This parameter is used to set the target position reference output for positioning completion. The positioning completion output is valid when the target position reference is set by B4-30 and the conditions of positioning completion are met. Even through the conditions of positioning completion are met, the positioning completion output is still invalid when the target position reference is not set by B4-30. When B4-30 is set to 0, the positioning completion output is valid for any position reference.	ALL

B4-26	Judgment Value	Unit	DO Output Time	Diagram
0	B4-27	Pulse	No less than B4-29	
1	B4-27	B5-26	No less than B4-29	
2	B4-27	Pulse	B4-29	
3	B4-27	B5-26	B4-29	

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-31	Degree position reference unit	0: Encoder resolution (quadrupled) 1: 0.1° (1 revolution corresponds to 360.0°)	0	This parameter is used to set the position reference unit for degree positioning and fixed length degree positioning. The position reference unit set by B5-26 is invalid for degree positioning and fixed length degree positioning.	I, RI

For example, if the encoder and motor are installed on the same shaft and the PPR of the encoder is 1000, the PPR of the motor is 1000 x 4 = 4000.

If B4-31 is set to 0, the position reference unit is pulse and the maximum resolution is 1:4000. 4000 degrees are included in one revolution of a motor, and each degree corresponds to 0 to 3999 respectively.

If B4-31 is set to 1, the position reference unit is 0.1 degree (0.1°). One revolution of a motor corresponds to 360° , and the angle range is 0 to 359.9° .

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-32	Degree position reference source selection	0: B4-33 1: Multi-position reference	0	B4-32 and B4-33 are used to set the degree position reference and valid for degree positioning and fixed length degree positioning. When B4-32 is set to 0, the degree reference is set by B4-33. When B4-32 is set to 1, the degree reference is set by multi-position reference. When the degree reference exceeds the maximum degree of one revolution, residue calculation is performed for the degree reference.	I, RI
B4-33	Degree position reference digital setting	0 to 60000	0		I, RI

For example, if the PPR of encoder is 1000, the degree reference range is 0 to 3999 (pulse) or 0 to 359.9 (degree).

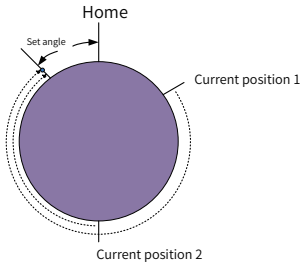
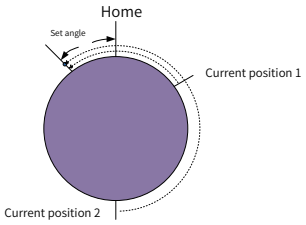
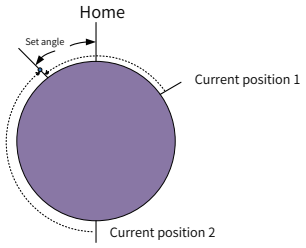
When B3-32 and B4-33 are set to 0 and 2430 respectively, the degree reference is 2430 (pulse).

When B4-32 and B4-33 are set to 0 and 5430 respectively, the degree reference is 5430%4000 = 1430 (pulse).

When B3-32 and B4-33 are set to 1 and 1325 respectively, the degree reference is 1325 = 132.5 (degree).

When B3-32 and B4-33 are set to 1 and 5325 respectively, the degree reference is 5325%3600 = 1725 = 172.5 (degree).

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-34	Positioning direction	0: Forward 1: Reverse	0	-	I, RI
B4-35	Degree positioning direction setting channel	0: Set by B4-34 1: Nearby positioning	1	B4-34 is used to set the positioning direction for degree positioning and fixed length degree positioning. When B4-35 is set to 0, the positioning direction is set by B4-34. When B4-35 is set to 1, B4-34 is invalid. The device moves to the specified position using the shortest path based on the current position.	I

B4-35	B4-34	Diagram
0	0	
	1	
1	-	

Parame-ter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-36	Nearby positioning failure speed	0.10 Hz to 10.00 Hz	2.00 Hz	In the degree positioning or fixed length degree positioning mode, if the encoder feedback speed is greater than the speed set by B4-36 when a positioning reference is received, the AC drive will perform position control using the current speed. In this case, B4-34 and B4-35 are invalid.	I, RI
B4-37	Speed feedforward gain	0.00 to 100.00%	100.00%	In the position control mode, speed feedforward is obtained by multiplying the speed signal corresponding to the position reference by the value of B4-37. The speed feedforward is used as a part of the speed reference. Increasing the speed feedforward gain improves the position reference response and reduces the position deviation at fixed speed. If the speed feedforward gain is too large, overshoot may occur during acceleration/deceleration. Speed overshoot or fluctuation may occur and even an overvoltage fault may be reported during acceleration, and reverse speed adjustment may occur during deceleration. During commissioning, gradually adjust the value of B4-37 until a proper value is obtained, as shown in the following figure.	

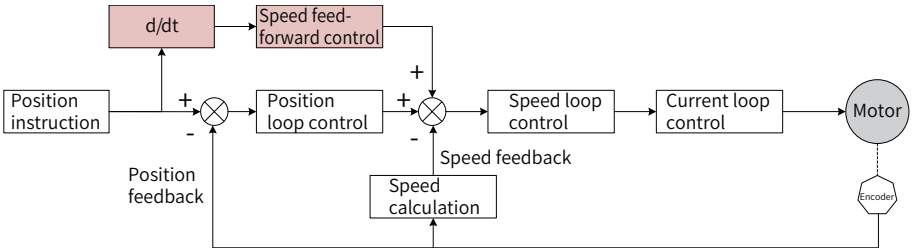


Figure 3-62 Speed feedforward control

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-38	Position loop proportional gain 1	0.01 to 100.00	1.50	In the position control mode, the larger the position loop proportional gain is, the greater the position loop regulating intensity is. If the position loop proportional gain is too large, vibration may be caused. Therefore, gradually adjust the position loop proportional gain to get a proper value.	ALL
B4-39	Position loop proportional gain 2	0.01 to 100.00	10.00		ALL
B4-40	Position loop proportional gain switchover condition	0: No switchover, fixed to position loop proportional gain 1 1: Switchover based on position deviation 2: Switchover based on speed	0	When B4-40 is set to 0, the position loop proportional gain is fixed to B4-38 (Position loop proportional gain 1). When B4-40 is set to 1, the position loop proportional gain automatically changes based on the position. If the absolute value of position tracking deviation is less than B4-41, the value of B4-38 is used as the position loop proportional gain. If the absolute value of position tracking deviation is greater than B4-42, the value of B4-39 is used as the position loop proportional gain. If the absolute value of position tracking deviation falls between B4-41 and B4-42, the position loop proportional gain changes linearly based on the position, as shown in “Figure 3-63 Position loop proportional gain changing linearly based on the position tracking deviation”. When B4-40 is set to 2, the position loop proportional gain automatically changes based on the frequency. If the specified frequency is less than B4-43, the value of B4-38 is used as the position loop proportional gain. If the specified frequency is greater than B4-44, the value of B4-39 is used as the position loop proportional gain. If the specified frequency falls between B4-43 and B4-44, the position loop proportional gain changes linearly based on the frequency, as shown in “Figure 3-64 Position loop proportional gain changing linearly based on the specified frequency”.	ALL
B4-41	Deviation 1 for position loop proportional gain switchover	0 to B4-42	20	-	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-42	Deviation 2 for position loop proportional gain switchover	B4-41 to 60000	100	-	ALL
B4-43	Frequency 1 for position loop proportional gain switchover	0.00 Hz to B4-44	5.00 Hz	-	ALL
B4-44	Frequency 2 for position loop proportional gain switchover	B4-43 to 500.00 Hz	20.00 Hz	-	ALL

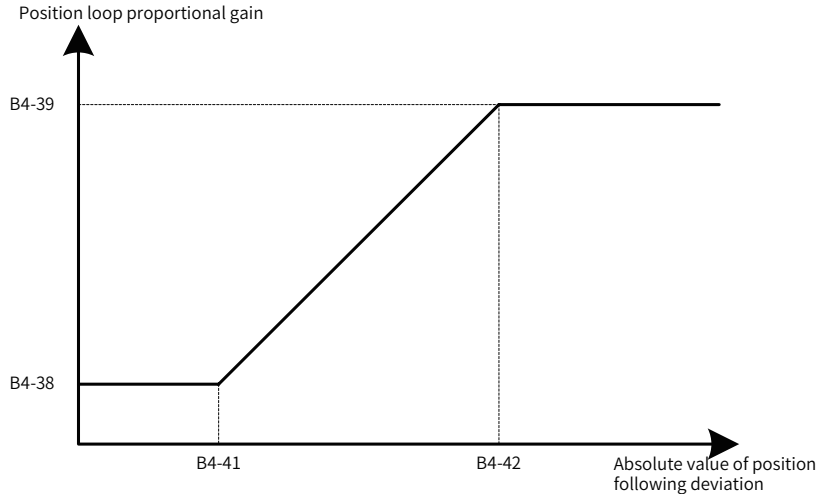


Figure 3-63 Position loop proportional gain changing linearly based on the position tracking deviation

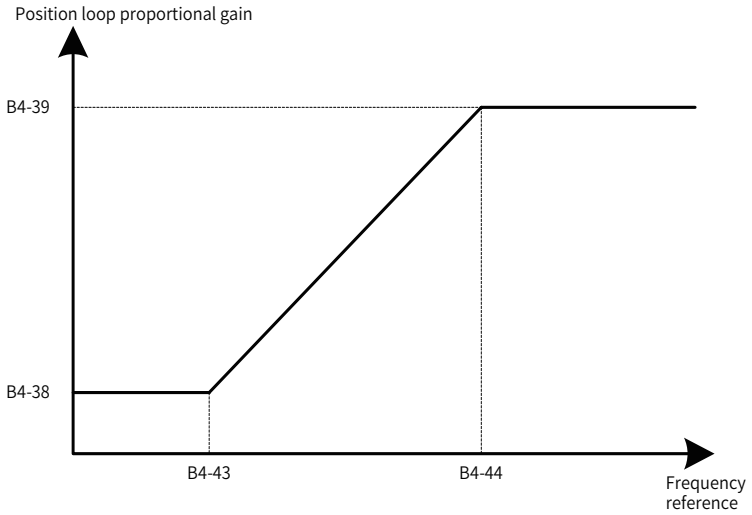


Figure 3-64 Position loop proportional gain changing linearly based on the specified frequency

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode

B4-46	Positioning deviation threshold	0 to 500	2	If the position deviation is less than B4-46 after positioning is finished, position loop adjustment is invalid. If the positioning accuracy meets the requirements, adjusting B4-46 can reduce the vibration after positioning is completed. In scenarios that require fast system response and high accuracy, set B4-46 to a small value. In scenarios that require slow system response and low accuracy, increase B4-46 properly. Note that B4-46 must be set to a small value to avoid vibration, as shown in the following figure.	ALL

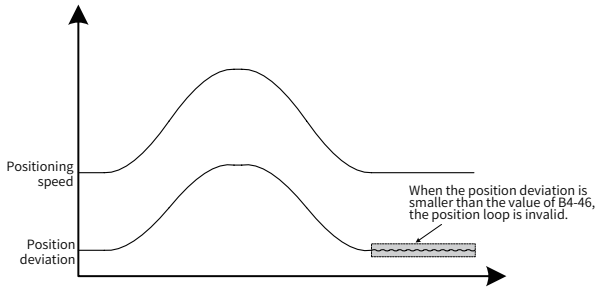


Figure 3-65 Positioning speed and position deviation

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-49	Multi-position reference digital setting	1 to 24	1	The AC drive supports a maximum of 24 position references, each of which can be set with reference length and direction. For settings about the multi-position reference, see the description of parameters in group B5.	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-50	Multi-position reference running mode	0: Not switched, and fixed to the position reference defined by B4-49 1: Switched by DI 2: Operation in sequence for once 3: Cyclic operation 4: Communication	0	When B4-50 is set to 0, the position reference segment number fixed to the position reference segment number set by B4-49. When B4-50 is set to 1, the position reference segment number is switched over by the DI. When B4-50 is set to 2, the start segment number and end segment number are set by B4-51 and B4-52, respectively. The segment number increases from the start segment number to the end segment number. Once the end segment number is reached, the segment number remains unchanged. When B4-50 is set to 3, the start segment number and end segment number are set by B4-51 and B4-52, respectively. The segment number increases from the start segment number to the end segment number. Once the end segment number is reached, the segment number starts cyclically from the start segment number. When B4-50 is set to 4, the position reference is set by communication and the multi-position reference setting is invalid. The acceleration time, deceleration time, and positioning completion waiting time are fixed to the value corresponding to multi-position reference 1.1	ALL
B4-51	Start segment No. of multi-position reference	1 to B4-52	1	-	ALL
B4-52	End segment No. of multi-position reference	B4-51 to 24	1	-	ALL

When the position reference is set by communication, the high 16 bits (7321H) and low 16 bits (7322H) of the position reference must be set at the same time.

The following table describes the relationship between the DI function state and position reference.

DI Function State					Corresponding Position Reference
79	78	77	76	75	
OFF	OFF	OFF	OFF	OFF	Position reference 1
OFF	OFF	OFF	OFF	ON	Position reference 2
OFF	OFF	OFF	ON	OFF	Position reference 3
OFF	OFF	OFF	ON	ON	Position reference 4
OFF	OFF	ON	OFF	OFF	Position reference 5
OFF	OFF	ON	OFF	ON	Position reference 6
OFF	OFF	ON	ON	OFF	Position reference 7
OFF	OFF	ON	ON	ON	Position reference 8
OFF	ON	OFF	OFF	OFF	Position reference 9
OFF	ON	OFF	OFF	ON	Position reference 10
OFF	ON	OFF	ON	OFF	Position reference 11
OFF	ON	OFF	ON	ON	Position reference 12
OFF	ON	ON	OFF	OFF	Position reference 13
OFF	ON	ON	OFF	ON	Position reference 14
OFF	ON	ON	ON	OFF	Position reference 15
OFF	ON	ON	ON	ON	Position reference 16
ON	OFF	OFF	OFF	OFF	Position reference 17
ON	OFF	OFF	OFF	ON	Position reference 18
ON	OFF	OFF	ON	OFF	Position reference 19
ON	OFF	OFF	ON	ON	Position reference 20
ON	OFF	ON	OFF	OFF	Position reference 21
ON	OFF	ON	OFF	ON	Position reference 22
ON	OFF	ON	ON	OFF	Position reference 23
ON	OFF	ON	ON	ON	Position reference 24
ON	ON	OFF	OFF	OFF	Invalid
ON	ON	OFF	OFF	ON	Invalid
ON	ON	OFF	ON	OFF	Invalid
ON	ON	OFF	ON	ON	Invalid
ON	ON	ON	OFF	OFF	Invalid
ON	ON	ON	OFF	ON	Invalid
ON	ON	ON	ON	OFF	Invalid
ON	ON	ON	ON	ON	Invalid

Parame-ter Code	Parameter Name	Value Range	Default	Description	Effective Mode

B4-53	Continue multi-position running mode	0: Restart from the startup segment 1: Continue uncompleted position reference segment	1	B4-53 is used to set the start segment number when the multi-position reference is continued after the AC drive stops. When B4-53 is set to 0, the position reference is not retentive after the device is stopped. The device starts to run from the start segment number again. When B4-53 is set to 1, the position reference is retentive after the device is stopped. The device starts to run from the position reference before stopping.	ALL
B4-55	Position control mode	0: Open-loop 1: Closed-loop	1	B4-55 is used to set the position control mode. The open-loop position control mode can be adopted in special scenarios requiring low positioning accuracy and stable positioning. In other scenarios, the closed-loop position control mode must be adopted to ensure positioning accuracy and effect.	ALL
B4-56	Switchover of position control start speed during running	0.50 Hz to 100.00 Hz	10.00 Hz	After the speed mode is switched to the position control mode, the AC drive decelerates. When both the speed reference and the encoder feedback speed are lower than B4-56, the position control is enabled, as shown in the "Figure 3-66 Running in the position control mode". B4-56 is valid in degree positioning and fixed length degree positioning modes. It is invalid in absolute positioning and incremental positioning modes. When the AC drive switches from the speed mode to the position control mode, the AC drive decelerates to 0 and then starts positioning.	ALL

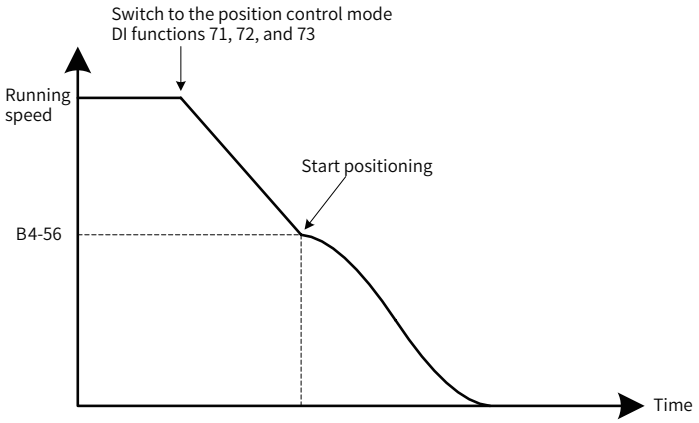


Figure 3-66 Running in the position control mode

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-57	Position control source selection	0: Positioning enabled when position control is switched 1: DI (DI-70) 2: Communication (731EH)	0	B4-57 is used to set the position control source. In the position mode, the positioning can be started only when position control is enabled. If position control is disabled during positioning, the AC drive decelerates to 0 and starts the position lock mode. If position control is enabled during positioning, a new positioning command must be given. The position control pause function can be enabled using the position control enabling command. When B4-57 is set to 0, position control is enabled by default, and the AC drive starts positioning immediately when it switches to the position mode. When B4-57 is set to 1, position control is enabled by the DI. The DI level active mode is set by B4-58. When B4-57 is set to 2, position control is enabled through communication. If 1 is written for the communication address 7319H, the position control is enabled. If 0 is written for the communication address 7319H, the position control is disabled. If no data is written for the communication address 7319H, the current state keeps unchanged.	ALL
B4-58	Active mode for position control by DI	0: Active low 1: Active high	1	-	ALL

B4-59	Repositioning command source selection	0: DI 1: Communication (731EH)	0	The re-positioning command is mainly used for incremental and fixed length degree positioning. When this command is valid, positioning will be triggered for once. When B4-59 is set to 0, the rising edge of the DI (function 86) triggers position control for once. When B4-59 is set to 1 and 1 is written into the communication address 731EH, position control is triggered for once, as shown in "Figure 3-67 Positioning triggered".	ALL

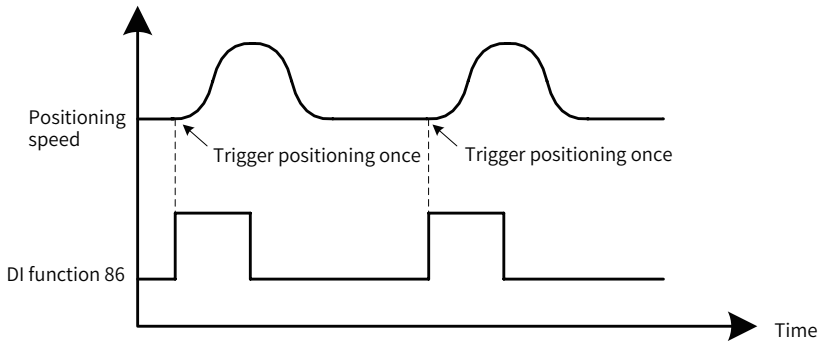


Figure 3-67 Positioning triggered

Parame-ter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-61	Position control function 1	Ones: Home retentive at power failure 0: Disable 1: Enable Tens: Home correction 0: Disable 1: Enable Hundreds: Nearby positioning upon startup in fixed length degree mode 0: Disable 1: Enable Thousands: Soft limit 0: Disable 1: Enable	0010	B4-61 is used to enable or disable the auxiliary function related to position control.	-

Ones: Home retentive at power failure

When home retention at power failure is valid, the home position and current position will be retentive at the drive power failure. The home position and current position will be recovered upon the next power-on.

Note:

(1) Home retention at power failure is valid only for absolute positioning.

(2) The home can be retentive only when the motor or main shaft is static at power failure, that is, the encoder feedback position does not change within 100 ms.

(3) When home retention at power failure is valid, the motor or main shaft position is required to be unchanged after power failure. Otherwise, the home position and current position recovered upon the next power-on will be different from the actual position.

Tens: Home correction

When home correction is valid, the home position will be refreshed every time a home signal is received.

When home correction is invalid, the fault for excessive home loss times (E54.03) is not detected.

Note:

(1) Home correction is valid only for absolute positioning. For fixed length degree positioning and degree positioning, the home position is always refreshed when a home signal is refreshed.

(2) The home correction function can be enabled to avoid mechanical home position change after long-time running or position deviation caused by slip during running.

Hundreds: Nearby positioning upon startup in fixed length degree mode

If nearby degree positioning is valid upon startup, nearby positioning is performed after startup and the device stops at the specified position based on the shortest path.

This function is generally used for cutter control during fixed length degree positioning. The cutter may be at any position other than the initial position upon startup, and this function can automatically adjust the cutter to the specified initial position.

Thousands: Soft limit

The soft limit function allows you to set the limit position using the parameter. When the load position exceeds the specified limit position, the AC drive reports E58.03 or E58.04.

Note:

The soft limit is valid only when the AC drive is running and a valid home signal is given in the absolute positioning mode.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode

B4-63	Soft limit forward position (low-order bits)	0–65535	0	B4-63 and B4-64 are used to set the forward limit position in soft limit and the length to the home position in the unit of pulse (frequency quadrupled), respectively. B4-65 and B4-66 are used to set the reverse limit position in soft limit and the length to the home position in the unit of pulse (frequency quadrupled), respectively. Forward position limit = B4-64 x 65536 + B4-63 Reverse position limit = B4-66 x 65536 + B4-65 Note: (1) The soft limit function and DI limit function can be used at the same time. (2) The limit position must be set correctly when the soft limit function is enabled. Otherwise, the limit function may fail, affecting the device performance.	A
B4-64	Soft limit forward position (high-order bits)	0–16384	0		A
B4-65	Soft limit reverse position (low-order bits)	0–65535	0		A
B4-66	Soft limit reverse position (high-order bits)	0–16384	0		A
B4-67	Home loss threshold during home correction	0 to 1000	0	If home correction is valid (tens place of B4-61 set to 1), the AC drive reports the fault E54.03 when the number of detected home loss times is greater than B4-67. When B4-67 is set to 0, the fault for excessive home loss times is not detected, and U2-92 displays the number of current home loss times.	A, RI
B4-68	DI limit protection function	0: Coast to stop 1: Decelerate to stop 2: Lock shaft after deceleration to 0	0	B4-68 is used to set the protection action of the AC drive when the DI limit function is valid. The values used in the speed mode and position mode are described as follows: 0: The AC drive reports a fault and the motor coasts to stop. When the forward limit is valid, the AC drive reports the fault E58.01. When the reverse limit is valid, the AC drive reports the fault E58.02. 1: The AC drive reports a fault and the motor decelerates to stop. When the forward limit is valid, the AC drive reports the fault E58.01. When the reverse limit is valid, the AC drive reports the fault E58.02. 2: The AC drive reports an alarm and the current position is locked when the speed is decelerated to 0. When the forward limit is valid, the AC drive reports the alarm A58.01. When the reverse limit is valid, the AC drive reports the alarm A58.02. Note: In the torque mode, when B4-68 is set to 2, the drive will not decelerate to 0 and lock the shaft. When the DI limit is valid, the AC drive reports a fault and coasts to stop. In the torque mode, when B4-68 is set to 1 and the DI limit is valid, the AC drive reports a fault and coasts to stop.	ALL

B4-69	Minimum direction change frequency upon valid DI limit	0.10 Hz to 10.00 Hz	1.50 Hz	B4-69 and B4-70 are used to set the conditions for exiting the position lock at zero speed.	ALL
B4-70	Direction change frequency active time upon valid DI limit	1-500 ms	1 ms		ALL

B4-69 and B4-70 are valid only when B4-68 is set to 2 in the speed mode.

B4-68 = 2: When the motor runs in the forward direction and the DI forward limit is valid, the AC drive reports the alarm A58.01 and decelerates to 0 with the current position locked. When a new target frequency is reverse, exceeds B4-69, and lasts for B4-70, the AC drive responds to the new reverse target frequency and the motor runs in the reverse direction. When a new given target frequency is reverse but less than B4-69, the AC drive does not respond to the new target frequency. See Figure 3-68 Forward limit (B4-68 = 2).

B4-68 = 2: When the motor runs in the reverse direction and the DI reverse limit is valid, the AC drive reports the alarm A58.02 and decelerates to 0 with the current position locked. When a new target frequency is forward, exceeds B4-69, and lasts for B4-70, the AC drive responds to the new forward target frequency and the motor runs in the forward direction. When a new target frequency is forward but less than B4-69, the AC drive does not respond to the new target frequency. See Figure 3-69 Reverse limit (B4-68 = 2).

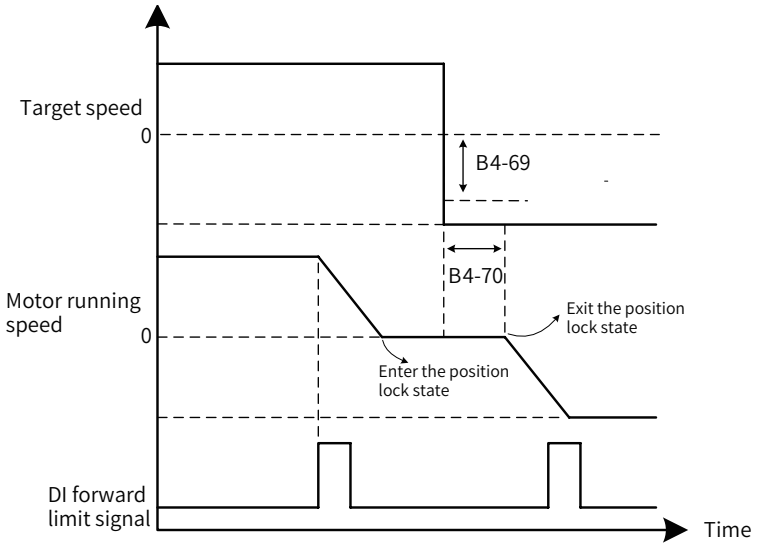


Figure 3-68 Forward limit (B4-68 = 2)

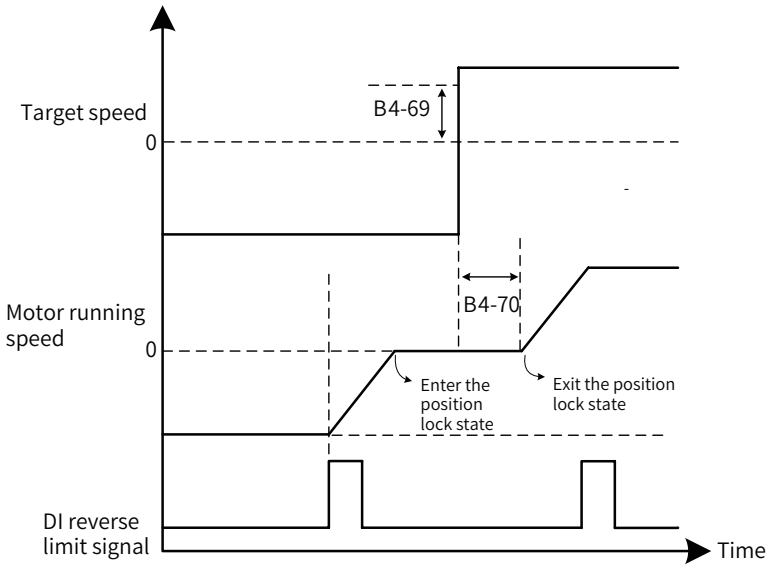


Figure 3-69 Reverse limit (B4-68 = 2)

Note:

If B4-68 is set to 2 in position control, when the motor runs in the forward direction and DI forward limit is valid, the AC drive reports the alarm A58.01 and decelerates to 0 with the current position locked. When a new reverse running position command is given, the position control is triggered again. The AC drive responds to the reverse running command and the motor runs in the reverse direction.

If B4-68 is set to 2 in position control, when the motor runs in the reverse direction and DI reverse limit is valid, the AC drive reports the alarm A58.02 and decelerates to 0 with the current position locked. When a new forward running position command is given, the position control is triggered again. The AC drive responds to the forward running command and the motor runs in the forward direction.

When B4-71, B4-72, B4-73, and B4-74 are enabled (DI63 function) and no running command is available, the position lock state remains relevant.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-72	Output limit for position loop upon position loop	0.00 Hz to 10.00 Hz	1.00 Hz	B4-72 is used to set the speed limit for the position loop upon position lock. Reducing the value of this parameter can avoid severe mechanical load vibration caused by improper settings of position loop parameters to some extent.	ALL

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B4-73	Position deviation threshold upon position lock	0 to 5000	2	B4-73 is used to set the allowable position deviation upon position lock. When the position deviation is less than B4-73, the adjustment function of the position loop is invalid. In some flexible scenarios or in scenarios where the motor and encoder are not mounted on the same shaft, oscillation can be prevented.	ALL

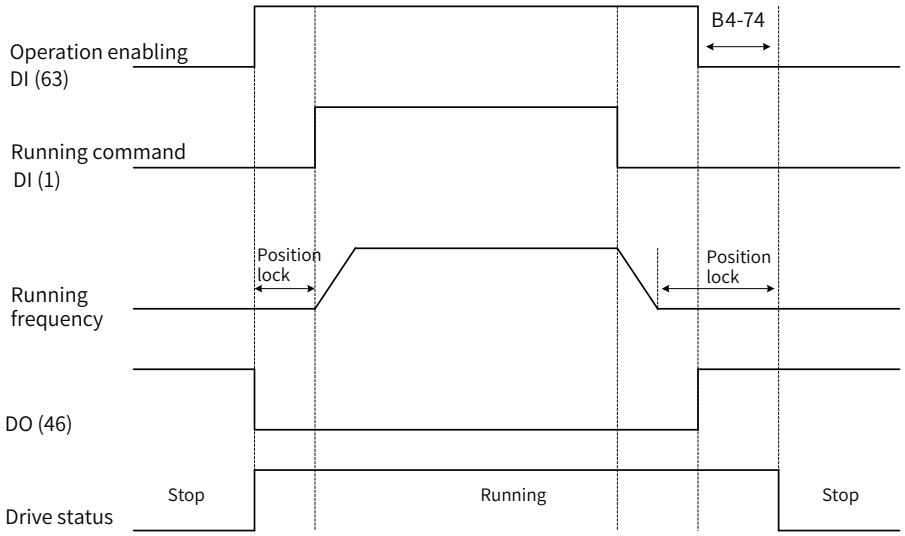


Figure 3-70 Position lock and output delay

3.10.3 Group B5: Multi-position Reference Parameters

A total of 24 position references are supported with the segment numbers ranging from 1 to 24.

The positioning length and direction, acceleration time, deceleration time, speed upper limit, and waiting time can be set independently for each position reference segment.

The range of the position reference length is -1073741824 to +1073741824 (pulse). If pulse is not used as the unit of the position reference, the position reference will be converted to the unit of pulses (frequency quadrupled). The reference length must be within -1073741824 to +1073741824 after electronic gear ratio conversion.

Four groups of acceleration/deceleration time can be set for position control. The acceleration/deceleration time can be selected for each position reference.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-00	Position control acceleration time 1	0.01s to 600.00s	10.00s		
B5-01	Position control deceleration time 1	0.01s to 600.00s	10.00s		

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-02	Position control acceleration time 2	0.01s to 600.00s	10.00s		
B5-03	Position control deceleration time 2	0.01s to 600.00s	10.00s		
B5-04	Position control acceleration time 3	0.01s to 600.00s	10.00s		
B5-05	Position control deceleration time 3	0.01s to 600.00s	10.00s		
B5-06	Position control acceleration time 4	0.01s to 600.00s	10.00s		
B5-07	Position control deceleration time 4	0.01s to 600.00s	10.00s		

Four groups of waiting time can be set. The waiting time can be selected for each position reference.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-08	Waiting time 1 of positioning completion	0.00s to 600.00s	0.01s		ALL
B5-09	Waiting time 2 of positioning completion	0.00s to 600.00s	0.01s		ALL
B5-10	Waiting time 3 of positioning completion	0.00s to 600.00s	0.01s		ALL
B5-11	Waiting time 4 of positioning completion	0.00s to 600.00s	0.01s		ALL

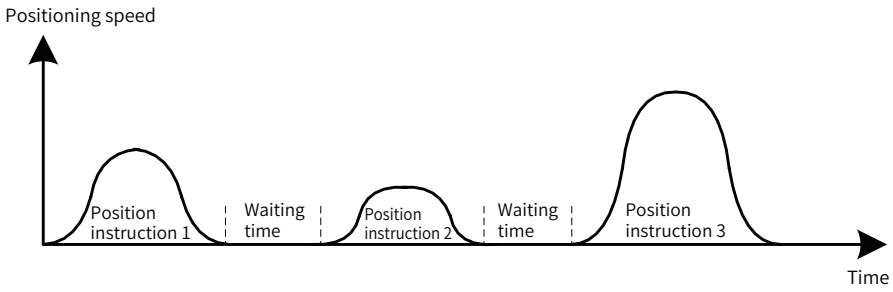


Figure 3-71 Positioning speed and position reference

Eight groups of frequency upper limits can be set. The frequency upper limit can be selected for each position reference.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-12	Maximum frequency source selection in position control	0: 100.00% 1: AI1 2: AI2 3: Comm. setting (7302H)	0	B5-12 is used to set the maximum frequency source for position control in the unit of percentage. The base value is the frequency set by B5-13. When B5-12 is set to 0, the maximum frequency for position control is B5-13. When B5-12 is set to 1, the maximum frequency for position control is set by AI1. The relationship between the AI1 voltage and percentage is set through the AI curve of group F4. Its base value is the frequency set by B5-13. When B5-12 is set to 2, the maximum frequency for position control is set by AI2. The relationship between the AI2 voltage and percentage is set through the AI curve of group F4. Its base value is the frequency set by B5-13. When B5-12 is set to 3, the maximum frequency for position control is given through communication. The communication address is 7320H and the range is 0 to 65535 rpm.	ALL
B5-13	Maximum frequency digital setting for position control	1.00 Hz to 600.00 Hz	50.00 Hz	-	ALL
B5-14	Position control frequency upper limit 1	0 to 100.00%	50.00%	B5-14 to B5-21 are used to set the frequency upper limit for position control in the unit of percentage. The base value is the maximum frequency for position control, which is determined by B5-12 and B5-13. Note: The frequency upper limit for position control is limited by the maximum frequency (F0-10) and frequency upper limit (F0-12).	ALL
B5-15	Position control frequency upper limit 2	0 to 100.00%	50.00%		ALL
B5-16	Position control frequency upper limit 3	0 to 100.00%	50.00%		ALL
B5-17	Position control frequency upper limit 4	0 to 100.00%	50.00%		ALL
B5-18	Position control frequency upper limit 5	0 to 100.00%	50.00%		ALL
B5-19	Position control frequency upper limit 6	0 to 100.00%	50.00%		ALL
B5-20	Position control frequency upper limit 7	0 to 100.00%	50.00%		ALL
B5-21	Position control frequency upper limit 8	0 to 100.00%	50.00%	-	ALL

Example:

(1) B5-12 = 1, AI1 = 5 V, F4-13 = 0, F4-14 = 0.0%, F4-15 = 10 V, F4-16 = 100.0%, B5-13 = 50.00 Hz,

B5-14 = 10.00%, B5-15 = 20.00%, B5-16 = 30.00%, B5-17 = 40.00%, B5-18 = 40.00%, B5-19 = 50.00%, B5-20 = 60.00%, and B5-21 = 70.00%.

AI1 is used as the maximum frequency for position control, and 5 V corresponds to 50.0%.

Maximum frequency for position control = B5-13 x 50.0% = 25.00 Hz

Position control frequency upper limit 1 = Maximum frequency for position control x B5-14 = 25 x 10.00% = 2.50 Hz

Position control frequency upper limit 2 = Maximum frequency for position control x B5-15 = 25 x 20.00% = 5.00 Hz

Position control frequency upper limit 3 = Maximum frequency for position control x B5-16 = 25 x 30.00% = 7.50 Hz

Position control frequency upper limit 4 = Maximum frequency for position control x B5-17 = 25 x 40.00% = 10.00 Hz

Position control frequency upper limit 5 = Maximum frequency for position control x B5-18 = 25 x 50.00% = 12.50 Hz

Position control frequency upper limit 6 = Maximum frequency for position control x B5-19 = 25 x 60.00% = 15.00 Hz

Position control frequency upper limit 7 = Maximum frequency for position control x B5-20 = 25 x 70.00% = 17.50 Hz

Position control frequency upper limit 8 = Maximum frequency for position control x B5-21 = 25 x 80.00% = 20.00 Hz

(2) B5-12 = 3, communication setting value = 5000, B5-13 = 100.00 Hz, B5-14 = 50.00%, B5-15 = 80.00%, F0-10 = 50.00 Hz, and F0-12 = 30.00 Hz

The maximum frequency for position control is set through communication, and 5000 corresponds to 50.00%.

Maximum frequency for position control = B5-13 x 50.00% = 50.00 Hz

Position control frequency upper limit 1 = Maximum frequency for position control x B5-14 = 50 x 50.00% = 25.00 Hz

Position control frequency upper limit 2 = Maximum frequency for position control x B5-15 = 50 x 80.00% = 40.00 Hz (> F0-12; effective position control frequency upper limit 2: 30.00 Hz)

The acceleration/deceleration base frequency for position control is set by B5-25.

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-25	Acceleration/deceleration base frequency in position control	0: F0-10 (Maximum frequency) 1: 50.00 Hz	1	When B5-25 is set to 0, the acceleration/deceleration base frequency for position control is the maximum frequency (F0-10). When B5-25 is set to 1, the acceleration/deceleration base frequency for position control is fixed to 50.00 Hz.	ALL

The acceleration time indicates the time for the AC drive to increase from 0 Hz to the frequency set by B5-25. The deceleration time indicates the time for the AC drive to decrease from the frequency set by B5-25 to 0 Hz, as shown in the following figure.

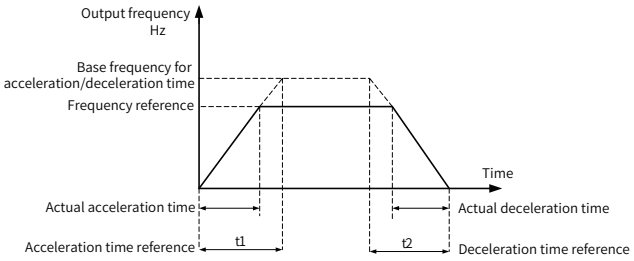
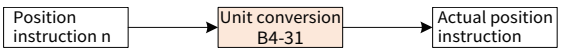


Figure 3-72 Acceleration/deceleration time

Parameter Code	Parameter Name	Value Range	Default	Description	Effective Mode
B5-26	Position reference unit	0: Pulse (encoder resolution quadrupled) 1: mm 2: cm	0	B5-26 is used to set the position reference unit, which is valid for incremental and absolute positioning.	R, A
B5-27	Conversion coefficient between reference unit and pulse	0 to 6553.5	1.0	-	R, A

For incremental positioning and absolute positioning, the conversion of position reference is as follows:

For degree positioning and fixed length degree positioning, the conversion of position reference is as follows:



For example, during the incremental positioning, the moving length is 500 mm, and the PPR of the encoder is 1000. The motor and encoder are installed on the same shaft, and the load moves for 2.5 mm after the motor rotates for one revolution.

Pulses for the motor rotating for one revolution = 1000 x 4 = 4000 (pulse)

Pulses for the load moving for 1 mm = 4000/2.5 = 1600

Pulses corresponding to the 500 mm reference = 1600 x 500 = 800000

Setting method 1:

The reference unit is pulse, and B5-26 is set to 0.

The reference length is 800000 (12 x 65536 + 13568). That is, the low bits and high bits of the position reference are 13568 and 12, respectively.

The electronic gear ratio is 1:1.

Setting method 2:

The reference unit is mm and B5-26 is set to 1.

The reference length is 500 and B5-27 is set to 1600.

The electronic gear ratio is 1:1.

B5-28 to B5-99 are used for setting 24 position references.

No.	Parameter Name	Parameter Code	Reference Length	Remarks
1	Position reference 1	B5-28 B5-29 B5-30	B5-29 x 65536 + B5-28	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-30.
2	Position reference 2	B5-31 B5-32 B5-33	B5-32 x 65536 + B5-31	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-33.
3	Position reference 3	B5-34 B5-35 B5-36	B5-35 x 65536 + B5-34	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-36.
4	Position reference 4	B5-37 B5-38 B5-39	B5-38 x 65536 + B5-37	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-39.
5	Position reference 5	B5-40 B5-41 B5-42	B5-41 x 65536 + B5-40	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-42.
6	Position reference 6	B5-43 B5-44 B5-45	B5-44 x 65536 + B5-43	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-45.
7	Position reference 7	B5-46 B5-47 B5-48	B5-47 x 65536 + B5-46	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-48.
8	Position reference 8	B5-49 B5-50 B5-51	B5-50 x 65536 + B5-49	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-51.
9	Position reference 9	B5-52 B5-53 B5-54	B5-53 x 65536 + B5-52	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-54.
10	Position reference 10	B5-55 B5-56 B5-57	B5-56 x 65536 + B5-55	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-57.

No.	Parameter Name	Parameter Code	Reference Length	Remarks
11	Position reference 11	B5-58 B5-59 B5-60	B5-59 x 65536 + B5-58	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-60.
12	Position reference 12	B5-61 B5-62 B5-63	B5-62 x 65536 + B5-61	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-63.
13	Position reference 13	B5-64 B5-65 B5-66	B5-65 x 65536 + B5-64	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-66.
14	Position reference 14	B5-67 B5-68 B5-69	B5-68 x 65536 + B5-67	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-69.
15	Position reference 15	B5-70 B5-71 B5-72	B5-71 x 65536 + B5-70	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-72.
16	Position reference 16	B5-73 B5-74 B5-75	B5-74 x 65536 + B5-73	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-75.
17	Position reference 17	B5-76 B5-77 B5-78	B5-77 x 65536 + B5-76	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-78.
18	Position reference 18	B5-79 B5-80 B5-81	B5-80 x 65536 + B5-79	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-81.
19	Position reference 19	B5-82 B5-83 B5-84	B5-83 x 65536 + B5-82	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-84.
20	Position reference 20	B5-85 B5-86 B5-87	B5-86 x 65536 + B5-85	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-87.
21	Position reference 21	B5-88 B5-89 B5-90	B5-89 x 65536 + B5-88	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-90.
22	Position reference 22	B5-91 B5-92 B5-93	B5-92 x 65536 + B5-91	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-93.
23	Position reference 23	B5-94 B5-95 B5-96	B5-95 x 65536 + B5-94	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-96.
24	Position reference 24	B5-97 B5-98 B5-99	B5-98 x 65536 + B5-97	The direction, acceleration/deceleration time, waiting time, and speed upper limit are set by B5-99.

3.10.4 Group U2: Position Control Monitoring Parameters

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-60	Real-time position deviation during position control	U2-60 indicates the real-time position deviation during position in the unit of pulse. U2-79 indicates the real-time position deviation during position in the unit of the reference unit. U2-60 and U2-79 indicate the pulse deviation between the current feedback position and current given position, rather than the pulse deviation between the current feedback position and target position. Their values reflect the system following feature.	-32768 to 32767	Pulse	Quadrupled frequency
U2-79	Real-time position deviation during position control		-3276.8 to 3276.7	Reference unit	
U2-61	Valid home tag	U2-61 indicates whether there is a valid home signal. You can check the TUNE/TC indicator status to determine whether a home signal is specified. U2-62 and U2-63 display the home position (U2-63 x 65536 + U2-62).	0–1	-	0: Home invalid 1: Home valid
U2-62	Home position (low 16 bits)		0–65535	-	
U2-63	Home position (high 16 bits)		0–65535	-	
U2-64	Z signal position (low 16 bits)	U2-64 and U2-65 indicate the encoder Z signal position. Z signal position = U2-65 x 65536 + U2-64	0 to 65535	-	
U2-65	Z signal position (high 16 bits)		0 to 65535	-	
U2-66	Current position reference	U2-66 displays the target position reference during the current positioning.	1 to 24	-	
U2-67	Output flag for approaching the target position	The conditions and output mode for approaching the target position are set by B4-21, B4-22, B4-23, B4-24, and B4-25. When the output for approaching the target position is valid, the value of U2-67 is 1.	0–1	-	0: The output for approaching the target position is invalid. 1: The output for approaching the target position is valid.
U2-68	Positioning completion output flag	The conditions and output mode for positioning completion are set by B4-26, B4-27, B4-28, B4-29, and B4-30. When the output for positioning completion is valid, the value of U2-68 is 1.	0–1	-	0: The output for positioning completion is invalid. 1: The output for positioning completion is valid.

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-69	Position control mode	U2-69 displays the current position control mode. When the position control mode is switched over using the DI, the actual position control mode may be different from that set by B4-01.	0 to 3	-	0: Incremental 1: Absolute 2: Degree 3: Fixed length degree

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-70	Number of pulses per revolution of encoder	U2-70 indicates the theoretical number of pulses per revolution of the encoder, which is four times the frequency.	0 to 65535	Pulse	Quadrupled frequency
U2-71	Number of pulses per revolution of main shaft	U2-71 indicates the theoretical number of pulses per revolution of the main shaft, which is four times the number of pulses per revolution of the encoder.	0 to 65535	Pulse	Quadrupled frequency
U2-72	Number of pulses per revolution of motor	U2-72 indicates the theoretical number of pulses per revolution of the motor, which is four times the number of pulses per revolution of the encoder.	0 to 65535	Pulse	Quadrupled frequency

For example, the PPR of the encoder is 1000, the transmission ratio of the motor and encoder is 1:2, and the transmission ratio of the motor and main shaft is 4:1. That is, when the motor rotates for four revolutions, the main shaft rotates for one revolution, and the encoder rotates for eight revolutions. In this case, the transmission ratio F1-32 is 1 and F1-33 is 2, and the electronic gear ratio B4-02 is 8 and B4-03 is 1.

U2-70 = 1000 x 4 = 4000

U2-71 = U2-70 x F1-33/F1-32 = 24000

U2-72 = U2-70 x B4-02/B4-03 = 8000

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-73	Current encoder degree	U2-73 displays the current degree position of the encoder.	0 to 65535	Pulse	Quadrupled frequency
U2-74	Current encoder degree (angle)	U2-74 displays the current angle position of the encoder.	0 to 359.9	°	

For example, if the PPR of the encoder is 1000, one revolution of the encoder is divided into 4000 degrees. The degree range of U2-73 is 0 to 3999.

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-75	Adjacent home position deviation (low 16 bits)	U2-75 and U2-76 display the length between adjacent home positions. Length between adjacent home positions = U2-76 x 65536 + U2-75	0 to 65535	Pulse	
U2-76	Adjacent home position deviation (high 16 bits)		0 to 65535	Pulse	

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-77	Home counter	U2-77 displays the counts of the home signals.	0 to 65535	-	
U2-78	Position control status	-	0 to 65535	-	

U2-78 displays the position control stages.

Value	Stage	Value	Stage
0	Position control invalid	5	Acceleration
1	Initialization	6	Constant speed
2	Position control preparing	7	Deceleration
3	Home searching	8	Waiting for positioning completion
4	Position curve planning	9	Position control paused

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-80	Relative home position direction	U2-80 indicates the direction of the current position relative to the home. U2-81 and U2-82 display the length between the current position and the home position. Length to the home = U2-82 x 65536 + U2-81	0–1	-	0: Forward 1: Reverse
U2-81	Relative home position deviation (low 16 bits)		0 to 65535	Pulse	
U2-82	Relative home position deviation (high 16 bits)		0 to 65535	Pulse	
U2-83	Position	U2-83 indicates the real-time position generated by the motion curve generator.	0 to 65535	-	
U2-84	Speed	U2-84 indicates the real-time speed generated by the motion curve generator.	0 to 655.35	0.01 Hz	Fixed to two decimal places
U2-85	Current main shaft degree	U2-85 displays the current degree position of the main shaft.	0 to 65535	Pulse	
U2-86	Current main shaft degree (angle)	U2-86 displays the current angle position of the main shaft.	0 to 359.9	°	

For example, if the PPR of the encoder is 1000 and the electronic gear ratio is 2:1, one revolution of the encoder and main shaft is divided into 4000 degrees and 8000 degrees respectively. The degree range of U2-85 is 0 to 7999.

Parameter Code	Parameter Name	Description	Value Range	Unit	Remarks
U2-87	Position control enabling flag	U2-87 displays the enabling flag of position control. 0 indicates that position control is disabled. 1 indicates that position control is enabled.	0–1	-	0: Disable 1: Enable

U2-88	Position control enabling command set by communication	U2-88 indicates the position control enabling command send through the communication address 7318H. 0 indicates that position control is disabled. 1 indicates that position control is enabled.	0–1	-	0: Disable 1: Enable
U2-89	Position lock operation flag in position control	U2-89 indicates whether the drive is in the position lock state during position control. 0 indicates that the drive is not in the position lock state and 1 indicates that the drive is in the position lock state. If the position control is prohibited or the AC drive decelerates to 0 after home searching is complete, the AC drive enters the position lock state.	0–1	-	0: Disable 1: Enable
U2-90	Frequency upper limit in position control	U2-90 displays the frequency upper limit set for position control. When the travel length is short for positioning, the actual frequency upper limit may be less than U2-90.	0 to 655.35	0.01 Hz	Fixed to two decimal places
U2-91	Main shaft static flag	U2-91 indicates whether the main shaft is static. If no encoder fault is reported in the FVC mode, the main shaft is determined as static when the encoder feedback position does not change for 100 ms. If the main shaft is not static when the AC drive is powered off, the home retention at power failure function is invalid and the home will be cleared.	0–1	-	0: Not static 1: Static
U2-92	Home loss counting during home correction	U2-92 indicates the number of home loss times during home correction. The AC drive will report the fault of excessive home loss times (E54.03) when the number of home loss times exceeds the value of B4-67.	0 to 65535	-	
U2-93	Encoder Z signal counter	U2-93 indicates the number of times that the encoder Z signal is received.	0 to 65535	-	
U2-95	Number of encoder pulse counts (low 16 bits)	U2-95 and U2-96 display the number of encoder pulse counts. Number of encoder pulse counts = U2-96 x 65536 + U2-95	0 to 65535	Pulse	
U2-96	Number of encoder pulse counts (high 16 bits)		0–65535	Pulse	

3.11 DI and DO Functions

3.11.1 Position Control DI Functions

DI function	Parameter Name	Description
63	Running enabling	When this function is invalid, the AC drive does not respond to the running and jog commands sent through the terminal. When this function is valid, the AC drive enters the position lock state when no running and jog command is delivered. When this function is valid, the AC drive runs normally according to the given running or jog command. This function is valid when the command source is terminal control (F0-02 = 1).
64	Switchover between speed synchronization and position synchronization	When this function (function 64) is valid, the synchronization mode is switched from speed synchronization to position synchronization or reversely, depending on the current synchronization mode.
65	Position increment	When this function is valid, the position increments.
66	Position decrement	When this function is valid, the position decrements.
67	Clear position synchronization deviation	When this function is valid, the tracking deviation during position synchronization is cleared.
68	Home signal	The home signal is received from the DI.
69	Home searching	When this function is valid, home searching is performed.
70	Position control paused	
71	Switch to position control	When this function is valid, the AC drive switches to the position control mode.
72	Switch to position control (forward running command)	When this function is valid, the AC drive switches to the position control mode with the forward running command.
73	Switch to position control (reverse running command)	Switch to the position control mode with reverse running command
74	Reserved	
75	Multi-position reference selection 1	This function is used to select the 24 multi-position references.
76	Multi-position reference selection 2	
77	Multi-position reference selection 3	
78	Multi-position reference selection 4	
79	Multi-position reference selection 5	
80	Forward limit switch	This function is used to connect the forward limit signal.
81	Reverse limit switch	This function is used to connect the reverse limit signal.
82	Switch to incremental positioning control	When this function is valid in the position control mode, the AC drive switches to the incremental position control mode.
83	Switch to absolute positioning control	When this function is valid in the position control mode, the AC drive switches to the absolute position control mode.
84	Switch to degree positioning control	When this function is valid in the position control mode, the AC drive switches to the degree position control mode.
85	Switch to fixed length degree positioning control	When this function is valid in the position control mode, the AC drive switches to the fixed length degree position control mode.
86	Re-positioning	Position control is triggered again.

3.11.2 Position Control DO Functions

DO function	Parameter Name	Description
21	Positioning completed	
22	Target position approach	
36	Positioning home valid	
37	Flag of home searching completion	
46	Running enabling state output (brake control)	The output is valid when the AC drive stops. If running enabling is invalid, the output is valid when the AC drive enters the position lock state. If running enabling is valid, the output is invalid when the AC drive is running or jogging. This function is used with the terminal function 63 to realize the simple brake control logic. For details about the control time sequence, see the description of B4-74.

4 Parameters of the Power Supply Unit

4.1 Basic Information

Basic information about the MD810 series power supply unit includes the product model, software version and other information, which has been determined upon product delivery. Parameters in this group can be displayed, but cannot be modified.

Parameter Code	Parameter Name	Default	Value Range	Description
F0-01	Product model	810	810	MD810
F0-02	Software version	uxx.xx	uxx.xx	Software version
F0-03	Temporary software version	Lxx.xx	Lxx.xx	This parameter indicates the temporary software version.
F0-04	Customized software version	Fxx.xx	Fxx.xx	This parameter indicates the customized software version.

xx.xx in the software version indicates specific version upon factory delivery.

4.2 Parameter Settings of Basic Functions

Parameter Code	Parameter Name	Default	Value Range	Description
F1-00	Bus undervoltage threshold	350 V	300 V to 500 V	Undervoltage threshold of bus voltage

When the bus voltage is lower than the value of F1-00 (Bus undervoltage threshold), undervoltage occurs. When the system is in the undervoltage state, the drive unit with load may fail to run. Set this parameter based on actual conditions.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-01	Bus overvoltage threshold	820 V	700 V to 850 V	Overvoltage threshold of bus voltage

When the bus voltage is higher than F1-01, overvoltage occurs. When the system is in the overvoltage state, the keypad of the power supply unit flashes. If the motor runs in the generation state, it may result in continuous rise of the bus voltage. If the bus voltage is too hight, the system may be damaged. Set this parameter based on actual conditions.

Parameter Code	Parameter Name	Default	Value Range	Description

F1-02	Braking unit action start voltage	760 V	700 V to 800 V	When the bus voltage is higher than the setting value, the braking unit is actuated.

When the bus voltage is higher than the value of F1-02, the braking unit is actuated to reduce the bus voltage. When the braking transistor is connected, large energy is consumed on the braking resistor instantaneously. Configure the braking resistor reasonably according to actual application to ensure good ventilation.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-03	Soft start of single power supply unit	0	0: Soft start of power supply unit with drive unit in parallel 1: Soft start of power supply unit without drive unit in parallel	This parameter is used to enable the soft start of a single power supply unit.

When a single power supply unit without the drive unit in parallel is running, set F1-03 to 1 if you need to enable soft start of the power supply unit.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-09	Fan control mode	1	0: The fan runs automatically.	When the temperature is higher than 45°C , the fan runs. When the temperature is lower than 40°C , the fan stops.
			1: The fan always runs.	The fan always runs after the system is powered on.

If F1-09 is set to 0 and the heatsink or braking transistor temperature is higher than 45°C , the fan starts to run. When the temperature is lower than 40°C , the fan stops.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-10	Braking unit fault protection	111	0: Disable	The system forcibly enables braking unit fault protection.
			1: Enable	

This parameter is unmodifiable. When overcurrent, overload, or shoot through occurs on the braking unit, the system forcibly performs protection to avoid damage to the braking unit.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-11	Three-phase input exception protection	111	0: Disable	When three-phase input is abnormal, this parameter is used to set whether protection is enabled.
			1: Enable	

Three-phase input abnormalities include phase loss, three-phase imbalance, and high power grid voltage. When the ones place is set to 0, protection against power grid phase loss is not enabled. When the ones place is set to 1, protection against power grid phase loss is enabled. When the tens place is set to 0, protection against high power grid voltage is not enabled. When the tens position is set to 1, protection against high power grid voltage is enabled. When the hundreds place is set to 0, protection against three-phase imbalance is not enabled. When the hundreds place is set to 1, protection against three-phase imbalance is enabled.

When F1-11 is set to 0, the power supply unit does not detect any fault. When the system continues to run, the risk of damage to the system will increase.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-13	Communication exception protection	1	0: Disable	The system forcibly performs protection in case of communication abnormality.
			1: Enable	
F1-14	Module over-temperature protection	1	0: Disable	The system forcibly performs protection in case of module overheat.
			1: Enable	

F1-15	EEPROM exception protection	1	0: Disable 1: Enable	The system forcibly performs protection in case of EEPROM abnormality.

The preceding three parameters are unmodifiable. When communication abnormality, module overheating, or EEPROM abnormality occurs, the system forcibly performs protection to ensure system reliability.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-17	Protection of abnormal communication between power supply unit and drive unit	1	0: Disable 1: Enable	This parameter is used to set whether protection is triggered when abnormality occurs in communication between the power supply unit and drive unit.

When communication between the power supply unit and the drive unit is abnormal and F1-17 is set to 1, the power supply unit reports the A16.13 alarm. When communication between the power supply unit and the drive unit is abnormal and F1-17 is set to 0, the power supply unit does not report the alarm.

Parameter Code	Parameter Name	Default	Value Range	Description
F1-18	Timeout time of communication between power supply unit and drive unit	5.00s	1.00s to 20.00s	When communication between the power supply unit and the drive unit fails for the time longer than the value of F1-18, the power supply reports an alarm.

4.3 Settings of Information Exchange Between Power Supply Unit and Drive Unit

When the power supply unit is faulty, it transfers a message to the drive unit. Then the drive unit performs corresponding actions according to the message.

Parameter Code	Parameter Name	Default	Value Range	Description
F2-00	Drive unit protection upon high grid voltage	2	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a high power grid voltage fault, it transfers the "Coast to stop" command to the drive unit.

Parameter Code	Parameter Name	Default	Value Range	Description
F2-01	Drive unit protection upon low grid voltage	1	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a low power grid voltage fault, it transfers the "Run" command to the drive unit.
F2-02	Drive unit protection upon three-phase unbalance	3	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a three-phase unbalance fault, it transfers the "Stop according to the setting method" command to the drive unit.
F2-03	Drive unit protection upon input phase loss	3	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects an input phase loss fault, it transfers the "Stop according to the setting method" command to the drive unit.
F2-04	Drive unit protection upon braking unit shoot through	2	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a braking unit shoot through fault, it transfers the "Coast to stop" command to the drive unit.
F2-05	Drive unit protection upon braking unit overcurrent	1	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a braking unit overcurrent fault, it transfers the "Run" command to the drive unit.
F2-06	Drive unit protection upon braking unit overload	1	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a braking unit overload fault, it transfers the "Run" command to the drive unit.
F2-09	Drive unit protection upon communication fault	1	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a communication fault, it transfers the "Run" command to the drive unit.

Parameter Code	Parameter Name	Default	Value Range	Description
F2-11	Drive unit protection upon EEPROM fault	3	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects an EEPROM fault, it transfers the "Stop according to the setting method" command to the drive unit.
F2-12	Drive unit protection upon module overheat	2	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects a module overheat fault, it transfers the "Coast to stop" command to the drive unit.

All preceding parameters are unmodifiable. When the power supply unit is faulty, the drive unit performs related actions according to the preceding parameters. The table shows specific meanings of parameters.

Parameter Code	Parameter Name	Default	Value Range	Description
F2-13	Drive unit protection upon module overheat warning	3	1: Run 2: Coast to stop 3: Stop according to the setting method	When the power supply unit detects that the module temperature reaches the warning value, it transfers the "Stop according to the setting method" command to the drive unit.

When the power supply unit detects that the module temperature reaches the warning value, it transfers the "Stop according to the setting method" command to the drive unit. You can change F2-13 according to actual application.

Parameter Code	Parameter Name	Default	Value Range	Description
F2-14	Power supply unit protection upon high grid voltage	1	0: Run 1: Stop	When the power grid voltage exceeds an input range, the power supply unit stops by default.

When the power grid voltage exceeds an input range, the power supply unit detects a high power grid voltage fault, the power supply stops, and the bus voltage lowers down. You can change F2-14 according to actual applications. High power grid voltage will result in rise in bus voltage, causing braking unit actuation or triggering drive unit overvoltage suppression. Excessive bus voltage may result in a risk of damage to the system.

4.4 Input Terminal Functions

The MD810 series power supply unit provides five multi-functional DIs as standard. You can assign different functions to DIs according to the actual application.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-00	DI1 function selection	5	0 to 9	For details, refer to the following table.
F4-01	DI2 function selection	0		
F4-02	DI3 function selection	0		
F4-03	DI4 function selection	0		
F4-04	DI5 function selection	0		

These parameters are used to set the functions of multi-functional DIs, as described in the following table.

Value	Function	Description
0	No function	Set 0 for reserved terminals to avoid malfunction.
1	Drive unit operation	The power supply unit sends the operation command to the drive unit.
2	Cable inlet circuit breaker feedback	The power supply unit sends the operation command to the drive unit according to feedback signals.
3	Auxiliary circuit breaker feedback	The power supply unit sends the operation command to the drive unit according to feedback signals.
4	Leakage protection switch feedback	The power supply unit sends the operation command to the drive unit according to feedback signals.
5	Fault reset	A terminal is used for fault reset. It has the same function as the RESET key on the keypad. Remote fault reset can be implemented through this terminal.
6	Drive unit operation disabled	The power supply unit sends the "operation disabled" command to the drive unit.
7	Drive unit coasts to stop	The power supply unit sends the "Coast to stop" command to the drive unit.
8	Drive unit stops according to the setting method	The power supply unit sends the "Stop according to the setting method" command to the drive unit.
9	Power supply unit operation enabled	The bus voltage is established and constant bus voltage is remained.

If the DI is prone to be interfered and malfunctions, you can increase the values of parameters in the following table to enhance anti-interference performance However, increase of the DI filter time will slow down the response of the DI.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-05	DI1 filter time	0.010s	0.010s to 5.000s	These parameters are used to set the software filter time of the DI status.
F4-06	DI2 filter time	0.010s	0.010s to 5.000s	
F4-07	DI3 filter time	0.010s	0.010s to 5.000s	
F4-08	DI4 filter time	0.010s	0.010s to 5.000s	
F4-09	DI5 filter time	0.010s	0.010s to 5.000s	
F4-10	DI1 valid delay	0.00s	0.00s to 600.00s	These parameters are used to set the delay time of the DI state change.
F4-11	DI2 valid delay	0.00s	0.00s to 600.00s	
F4-12	DI3 valid delay	0.00s	0.00s to 600.00s	
F4-13	DI4 valid delay	0.00s	0.00s to 600.00s	
F4-14	DI5 valid delay	0.00s	0.00s to 600.00s	
F4-15	DI1 invalid delay	0.00s	0.00s to 600.00s	
F4-16	DI2 inactive delay	0.00s	0.00s to 600.00s	
F4-17	DI3 invalid delay	0.00s	0.00s to 600.00s	
F4-18	DI4 invalid delay	0.00s	0.00s to 600.00s	
F4-19	DI5 invalid delay	0.00s	0.00s to 600.00s	

F4-10 to F4-19 are used to set the delay time of the DI state change.

Parameter Code	Parameter Name	Default	Value Range	Description
F4-20	DI active mode selection	0	0: Active low	Ones place: DI1 Tens place: DI2 Hundreds: DI3 Thousands: DI4 Ten thousands: DI5
			1: Active high	

F4-20 is used to set an active status mode of a DI.

When it is set to active low, the DI is active at low level between the DI and COM.

When it is set to active high, the DI is active at high level between the DI and COM.

4.5 Relay Output Terminal Functions

The MD10 series power supply unit provides three groups of multi-functional relay output terminals.

Parameter Code	Parameter Name	De-fault	Value Range	Description
F5-00	T1A/T1B/T1C output function selection	0	0 to 15	For details, refer to the following table.
F5-01	T2A/T2B/T2C output function selection	0		
F5-02	T3A/T3B/T3C output function selection	0		
F5-09	Relay output terminal active status selection	000	0: Active high 1: Active low	Ones: T1A, T1B, and T1C Tens: T2A, T2B, and T2C Hundreds: T3A, T3B, and T3C

These parameters define output logic of output terminals T1A, T1B, T1C, T2A, T2B, T2C, T3A, T3B, and T3C.

0: Active high. The relay output terminal is active at high level between it and the corresponding common terminal.

1: Active low. The relay output terminal is active at low level between it and the corresponding common terminal.

The following table describes the output terminal functions.

Value	Function	Description
0	No output	The output terminal has no function.
1	Running allowed	The power supply unit is normal. When the power supply unit sends the "Run" command to the drive unit, the terminal outputs ON signals.
2	Fault output	When the power supply unit is faulty, the terminal outputs ON signals.
3	Alarm output	When the power supply unit reports an alarm, the terminal outputs ON signals.
4	Breaker actuation output	When three-phase input voltage is too high or the braking transistor is shoot through, the terminal outputs ON signals to actuate the breaker.
5	Bus undervoltage	When the power supply unit detects bus undervoltage, the terminal outputs ON signals.
6	Bus overvoltage	When the power supply unit detects bus overvoltage, the terminal outputs ON signals.
7	Bus voltage normal	When the power supply unit detects that the bus voltage is normal, the terminal outputs ON signals.
8	Bus voltage abnormal	When the power supply unit detects that the bus voltage is abnormal, the terminal outputs ON signals.
9	Three-phase input abnormal	When the power supply unit detects that three-phase input is abnormal, the terminal outputs ON signals.
10	Three-phase input normal	When the power supply unit detects that three-phase input is normal, the terminal outputs ON signals.
11	Module overtemperature fault output	When the power supply unit detects a module overtemperature fault, the terminal outputs ON signals.

Value	Function	Description
12	Module overtemperature warning output	When the power supply unit detects that the module temperature exceeds the module warning temperature, the terminal outputs ON signals.

4.6 Fault Record Group

The last five faults of the power supply unit are recorded. For possible causes and solutions of every fault, refer to "6.4 Fault List and Solution".

FA-00	Fault code of the fifth fault	Fault code of the last fault
FA-01	Fault subcode of the 5th fault	Fault subcode of the last fault
FA-02	Bus voltage upon the 5th fault	Bus voltage upon the last fault
FA-03	Module temperature upon the fifth fault	Module temperature upon the last fault
FA-04	Braking transistor temperature upon the fifth fault	Braking transistor temperature upon the last fault
FA-05	Braking circuit current upon the 5th fault	Braking circuit current upon the last fault
FA-06	Grid voltage (Usr) upon the 5th fault	Grid voltage (Usr) upon the last fault
FA-07	Grid voltage (Ust) upon the 5th fault	Grid voltage (Ust) upon the last fault
FA-08	Grid voltage (Utr) upon the 5th fault	Grid voltage (Utr) upon the last fault
FA-09	Three-phase imbalance degree upon the 5th fault	Three-phase imbalance degree upon the last fault
FA-10	DI status upon the 5th fault	DI status upon the last fault
FA-11	RO status upon the 5th fault	RO status upon the last fault
FA-12	Stop command sent by the power supply unit upon the 5th fault	Stop command sent from the power supply unit upon the last fault
FA-13	Total power-on time upon the fifth fault (h)	Total power-on time upon the last fault (h)
FA-14	Total power-on time upon the fifth fault (min)	Total power-on time upon the last fault (min)
FA-15	Total power-on time upon the fifth fault (s)	Total power-on time upon the last fault (s)
FA-20	Fault code of the fourth fault	Same as FA-00 to FA-15
FA-21	Fault subcode of the 4th fault	
FA-22	Bus voltage upon the 4th fault	
FA-23	Module temperature upon the fourth fault	
FA-24	Braking transistor temperature upon the fourth fault	
FA-25	Braking circuit current upon the 4th fault	
FA-26	Grid voltage (Usr) upon the 4th fault	
FA-27	Grid voltage (Ust) upon the 4th fault	
FA-28	Grid voltage (Utr) upon the 4th fault	
FA-29	Three-phase imbalance degree upon the 4th fault	
FA-30	DI status upon the 4th fault	

FA-31	RO status upon the 4th fault	Same as FA-00 to FA-15
FA-32	Stop command sent by the power supply unit upon the 4th fault	
FA-33	Total power-on time upon the fourth fault (h)	
FA-34	Total power-on time upon the fourth fault (min)	
FA-35	Total power-on time upon the fourth fault (s)	
FA-40	Fault code of the third fault	
FA-41	Fault subcode of the 3rd fault	
FA-42	Bus voltage upon the 3rd fault	
FA-43	Module temperature upon the third fault	
FA-44	Braking transistor temperature upon the third fault	
FA-45	Braking circuit current upon the 3rd fault	
FA-46	Grid voltage (Usr) upon the 3rd fault	
FA-47	Grid voltage (Ust) upon the 3rd fault	
FA-48	Grid voltage (Utr) upon the 3rd fault	
FA-49	Three-phase imbalance degree upon the 3rd fault	
FA-50	DI status upon the 3rd fault	
FA-51	RO status upon the 3rd fault	
FA-52	Stop command sent by the power supply unit upon the 3rd fault	
FA-53	Total power-on time upon the third fault (h)	
FA-54	Total power-on time upon the third fault (min)	
FA-55	Total power-on time upon the third fault (s)	
FA-60	Fault code of the second fault	
FA-61	Fault subcode of the 2nd fault	
FA-62	Bus voltage upon the second fault	
FA-63	Module temperature upon the second fault	
FA-64	Braking transistor temperature upon the second fault	
FA-65	Braking circuit current upon the 2nd fault	
FA-66	Grid voltage (Usr) upon the 2nd fault	
FA-67	Grid voltage (Ust) upon the 2nd fault	
FA-68	Grid voltage (Utr) upon the 2nd fault	
FA-69	Three-phase imbalance degree upon the 2nd fault	
FA-70	DI status upon the 2nd fault	
FA-71	RO status upon the 2nd fault	
FA-72	Stop command sent by the power supply unit upon the 2nd fault	
FA-73	Total power-on time upon the second fault (h)	
FA-74	Total power-on time upon the second fault (min)	
FA-75	Total power-on time upon the second fault (s)	
FA-80	Fault code upon the first fault	
FA-81	Fault subcode of the 1st fault	
FA-82	Bus voltage upon the 1st fault	
FA-83	Module temperature upon the first fault	
FA-84	Braking transistor temperature upon the first fault	
FA-85	Braking circuit current upon the 1st fault	
FA-86	Grid voltage (Usr) upon the 1st fault	
FA-87	Grid voltage (Ust) upon the 1st fault	
FA-88	Grid voltage (Utr) upon the 1st fault	
FA-89	Three-phase imbalance degree upon the 1st fault	
FA-90	DI status upon the first fault	
FA-91	RO status upon the first fault	
FA-92	Stop command sent by the power supply unit upon the first fault	
FA-93	Total power-on time upon the first fault (h)	
FA-94	Total power-on time upon the first fault (min)	
FA-95	Total power-on time upon the first fault (s)	

4.7 Parameter Management

Parameter Code	Parameter Name	Default	Value Range	Description
FP-00	User password	0	0 to 65535	It is used to set a password.

If FP-00 is set to any non-zero number, the password protection function is enabled. You must input the password correctly to enter the function parameter editing mode. Otherwise, you cannot view or modify the parameters. Make sure to remember the password you set.

If this parameter is set to 00000, the previously set user password is cleared, and the password protection function is disabled.

Parame-ter Code	Parameter Name	Default	Value Range	Description
FP-01	Parameter initialization	0	0: No operation 1: Restore parameters (excluding groups FA and FP) to default settings 2: Clear records 4: Back up current user parameters 501: Restore user backup parameters	These parameters allow you to perform operations such as parameter restoration and backup.

1: Restore parameters (excluding groups FA and FP) to default settings

2: Clear records. Fault records and cumulated running time of the power supply unit are cleared.

4: Back up current user parameters

Settings of current parameters are backed up, so that these parameters can be restored after the user sets the parameters incorrectly.

501: Restore parameters that are backed up by setting FP-01 to 4.

Parameter Code	Parameter Name	Default	Value Range	Description
FP-02	Parameter modification selection	0	0: Enable 1: Disable	After it is set to 1, all parameters cannot be modified.

Set FP-02 to 1 to prevent any modification after you set parameters.

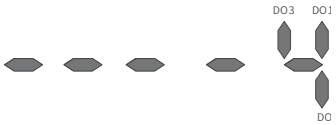
Parameter Code	Parameter Name	Default	Value Range	Description
FP-03	Parameter display attribute	0	0: Hide 1: Display	When it is set to 0, a corresponding monitoring parameter is not displayed in level 0 menu through the switchover of the shift key.

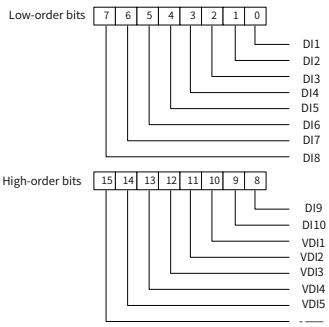
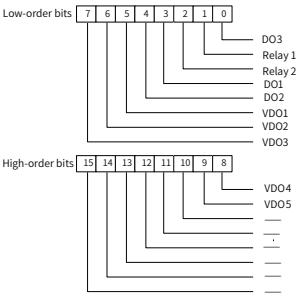
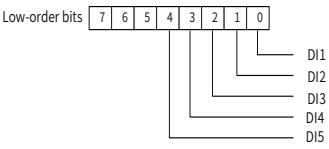
The following table describes the mapping between values of FP-03 and parameters. In the level 0 menu, you can switch among the following parameters through the shift key.

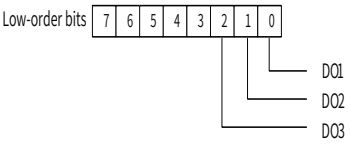
FP-03	Definition	Description
DATA0	Bus voltage	0: Hide 1: Display
DATA1	Heatsink temperature	
DATA2	Braking transistor temperature	
DATA3	Braking circuit current	
DATA4	Input voltage Usr	
DATA5	Input voltage Ust	
DATA6	Input voltage Utr	
DATA7	Three-phase imbalance degree	
DATA8	DI state	
DATA9	RO state	
DATA10	0	
DATA11	0	
DATA12	Fault code	
DATA13	Fault subcode	

4.8 Monitoring Parameters

Parameters in group U0 are used to monitor running status of the power supply unit. You can view them via the keypad to facilitate site commissioning or read parameter groups via communication for host controller monitoring. The communication address is 0x7000 to 0x7021.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-00	Bus voltage (V)	0.1 V	0.0 V to 2000.0 V	It displays the bus voltage of the power supply unit.
U0-01	Heatsink temperature (°C)	1° C	-20° C to 124° C	It displays the heatsink temperature of the power supply unit.
U0-02	Braking transistor temperature (°C)	1° C	-20° C to 124° C	It displays the braking transistor temperature of the power supply unit.
U0-03	Braking circuit current (A)	0.01 A	-	It displays the braking circuit current of the power supply unit.
U0-04	Input voltage Usr	1 V	0 V to 1000 V	It displays the effective value of input voltage Usr.
U0-05	Input voltage Ust	1 V	0 V to 1000 V	It displays the effective value of input voltage Ust.
U0-06	Input voltage Utr	1 V	0 V to 1000 V	It displays the effective value of input voltage Utr.
U0-07	Three-phase imbalance degree	-	0.00% to 100.00%	It displays the degree of three-phase voltage imbalance.
U0-08	DI input state	-	-	DI state indication: "ON" represents high level and "OFF" represents low level.
U0-09	DO output state	-	-	DO state indication: "ON" represents high level and "OFF" represents low level. 

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-08	DI input state	1	0x0000 to 0x7FFF	It displays the state value of the DI. After the value is converted to a binary number, each bit corresponds to one DI signal. The value 1 indicates that the input is high level. The value 0 indicates that the input is low level. The corresponding relationship between bits and DIs is as follows. 
U0-09	DO output state	1	0x0000 to 0x03FF	It displays the state value of the DO. After the value is converted to a binary number, every bit of the binary number corresponds to one DO signal. The value 1 indicates high level, and the value 0 indicates low level. The relationship between bits and DOs is as follows. 
U0-12	Code of current fault	1	1 to 65535	It displays the current fault code of the power supply unit.
U0-13	Subcode of current fault	1	1 to 65535	It displays the fault subcode corresponding to the current fault code of the power supply unit.
U0-14	DI status after delay	1	0 to 31	It displays the state value of the DI. After the value is converted to a binary number, each bit corresponds to one DI signal. The value 1 indicates that the input is high level. The value 0 indicates that the input is low level. The corresponding relationship between bits and DIs is as follows. 
U0-15	DI status after positive and negative logic processing	1	0 to 31	It displays the input status after positive and negative logic judgment on the DI value in U0-14.

Parameter Code	Parameter Name	Minimum Unit	Value Range	Description
U0-17	RO status after delay	1	0 to 7	It displays the status of the DO after delay and after being processed by positive and negative logic. After the value is converted to a binary number, each bit corresponds to one DO signal. The value 1 indicates that the input is high level. The value 0 indicates that the input is low level. The corresponding relationship between bits and DIs is as follows. 
U0-18	RO status after positive and negative logic judgment	1	0 to 7	It displays the output status after positive and negative logic judgment on the DO value in U0-17.
U0-20	Current power-on time (h)	1h	0 to 65535	It displays the running hours of the power supply unit from power-on to the current time.
U0-21	Current power-on time (min)	1 min	0 to 59	It displays the running minutes of the power supply unit from power-on to the current time.
U0-22	Current power-on time (s)	1	0 to 59	It displays the running seconds of the power supply unit from power-on to the current time.
U0-23	Current power-on time (ms)	1	0 to 999	It displays the running milliseconds of the power supply unit from power-on to the current time.
U0-24	Fan control command word	1	0 to 1	0: The fan stops running. 1: The fan always runs.
U0-25	Control command word of braking unit	1	0 to 1	0: The braking transistor is turned off. 1: The braking transistor is turned on.
U0-27	Power supply unit and drive unit interaction command word	1	1 to 3	1: Run 2: Coast to stop 3: Stop according to the setting method
U0-30	Total power-on time (h)	1	0 to 65535	It displays the running hours of the power supply unit from the first power-on to the current time.
U0-31	Total power-on time (min)	1	0 to 59	It displays the running minutes of the power supply unit from the first power-on to the current time.
U0-32	Total power-on time (s)	1	0 to 59	It displays the running seconds of the power supply unit from the first power-on to the current time.
U0-33	Total power-on time (ms)	1	0 to 999	It displays the running milliseconds of the power supply unit from the first power-on to the current time.

5 Process Application

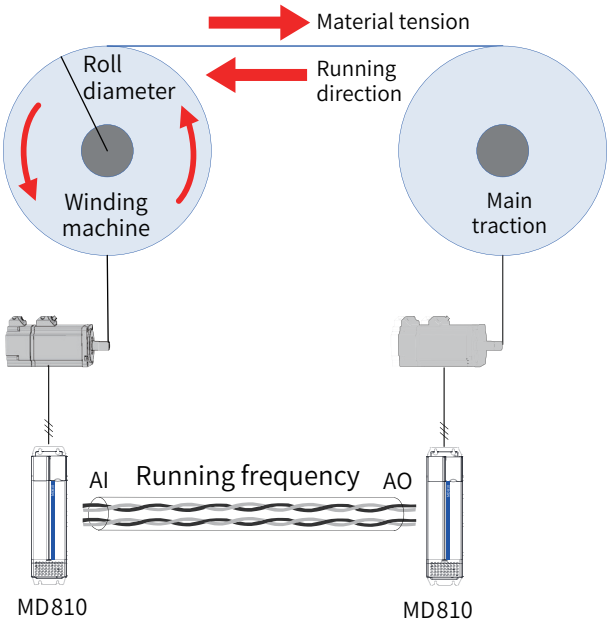
This section introduces four commonly used process functions, including tension control, wobble control, fixed length, and counting.

5.1 Tension Control

This section describes several tension control schemes, including open-loop tension torque control, closed-loop tension speed control, closed-loop tension torque control, and constant linear speed control, which is selected by B0-00.

1) Open-loop tension torque control

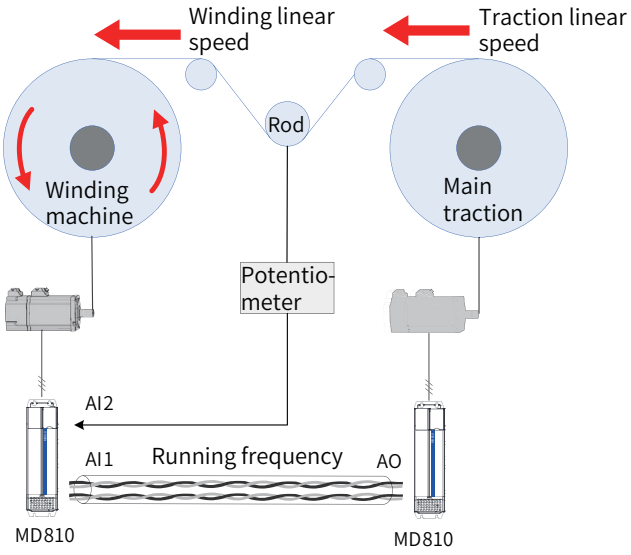
In this mode, no swing rod (floating roller) or tension sensor is required. Tension accuracy is slightly low. This control mode is applicable to scenarios where tension accuracy is not critical.



The winding machine runs in open-loop tension torque control mode. The roll diameter is calculated based on the linear speed and the output torque is calculated based on the material tension requirement. You can set the friction compensation torque and inertia compensation torque as needed.

2) Closed-loop tension speed control

In this mode, a swing rod (floating roller) or tension sensor is used to feed back material tension. The output frequency of the AC drive is regulated in the closed-loop mode to ensure stable swing rod position or constant tension control. It is suitable for applications with a swing rod or tension sensor (speed change affects tension change slowly) and speed adjustment margin.

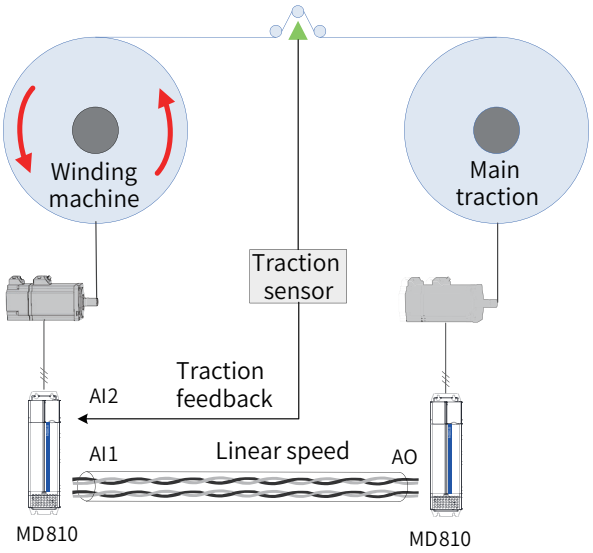


When the winding machine works in closed-loop tension speed control mode, two AI signal channels receive potentiometer signals of the swing rod position and running frequency signals of the main traction motor, respectively. The roll diameter is calculated based on linear speed control. The output frequency depends on the main frequency calculated based on the linear speed and the closed-loop regulation based on swing rod position feedback.

Compared with the main frequency + PID mode of the general-purpose drive, this control mode features the following with the roll diameter calculation: The main frequency can follow the change of the linear speed more accurately, and the position control of the swing rod can be more stable.

3) Closed-loop tension torque control

Material tension is fed back through the tension sensor. Closed-loop adjustment of the drive output torque achieves constant tension control. This mode integrates the function of open-loop tension control torque mode (mode 1). The tension accuracy is high through open-loop tension calculation and close-loop tension adjustment. It is suitable for rigid elastic materials or applications where there is no speed adjustment margin.

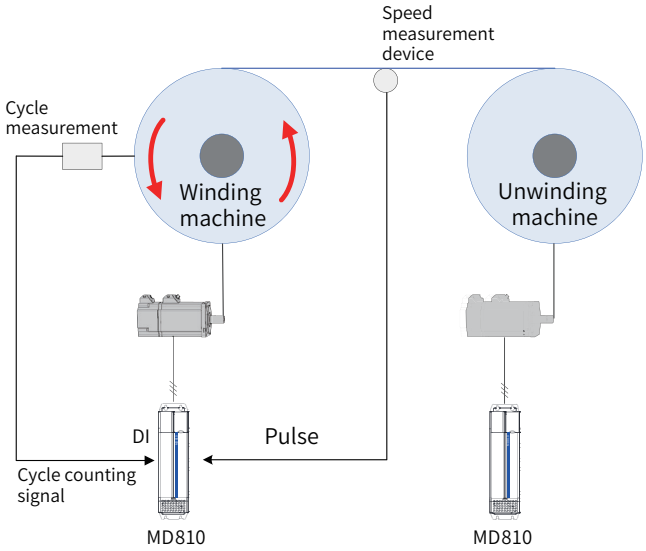


When the winding machine works in closed-loop torque control mode, two AI signal channels receive tension sensor signals and running frequency signals of the main traction motor, respectively. The open-loop tension reference and closed-loop adjustment of the tension sensor are used together. The roll diameter calculation in the open-loop tension mode is reserved. Inertia and friction compensation are calculated in the closed-loop adjustment and do not need to be set. However, setting the inertia and friction compensation can optimize response performance.

For scenarios where elastic materials (speed adjustment margin and tension sensor) and tension sensors are used, the closed-loop speed control mode (mode 2) can also be applied.

4) Constant linear speed control

This mode is applicable to scenarios without the main traction motor. The winding or unwinding machine runs at a constant linear speed and serves as the traction motor.



To keep the material running at a constant linear speed, the winding diameter must be obtained. Two possible methods are shown in the preceding figure. 1) Use the DI to input the revolution counting signal and use the cumulated thickness to calculate the roll diameter. 2) Add a speed measuring device to the material. The speed is transmitted to the drive through pulses. Calculate the roll diameter using the linear speed. Select one from the preceding two methods or select other possible methods. Calculate the frequency according to the running linear speed and roll diameter to achieve constant running speed without the main traction motor. Select one from the three tension control modes for the unwinding machine according to actual conditions.

Note

- Note: The preceding section only describes the scenarios of the four tension control modes. You can also use other applicable modes as required if the basic conditions are met.

The preceding section describes four typical tension control applications, which are determined by roll diameter, linear speed, and control feedback.

Control Mode	Roll Diameter Note 1	Linear Speed	Control Feedback
Open-loop tension torque control	Required	Not required Note 2	Not required
Closed-loop tension speed control	Required	Required	Required
Closed-loop tension torque control	Required	Not required	Required
Constant linear speed control	Required	Not required	Not required

Note 1: If the roll diameter is calculated based on linear speed control (B0-07 = 0), the linear speed is required.

Note 2: Inertia and friction compensation are associated with the linear speed. To improve open-loop tension torque control accuracy, the linear speed is required.

5.1.1 Control Mode Selection

Select a proper tension control mode and winding mode based on actual situations. Correct running direction setting is necessary for proper tension control.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-00	Tension control mode selection	0	0 to 4	0: Disable 1: Open-loop torque control mode 2: Closed-loop speed control mode 3: Closed-loop torque control mode 4: Constant linear speed control mode

B0-00 is used to select the tension control mode.

0: Disable

The MD810 has the same function as the general-purpose drive and can be used for direction judgment and parameter auto-tuning.

1: Open-loop tension torque control mode

Tension/Position detection and feedback are not required. The drive controls torque output to control the tension on the material in the torque control mode. It is recommended to use the FVC mode to achieve optimal control effect.

2: Closed-loop tension speed control mode

Tension/Position detection and feedback are required. Based on the set main frequency calculated through linear speed and roll diameter, the AC drive adjusts the output frequency by superposing the PID closed-loop operation to achieve stable tension or position in the speed control mode. The SVC, V/f, or FVC mode can be selected.

3: Closed-loop tension torque control mode

Tension detection and feedback are required. Based on the set torque in the open-loop torque control mode, the AC drive controls the output torque to obtain the required tension by superposing the PID closed-loop operation. It is recommended to use the FVC mode to achieve optimal control effect.

4: Constant speed control mode

In the speed mode, the AC drive adjusts its operating frequency according to the change of the roll diameter to ensure that the drive runs at a constant linear speed. The SVC, V/f, or FVC mode can be selected.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-01	Winding mode	0	0 to 1	0: Winding 1: Unwinding

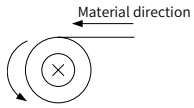
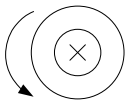
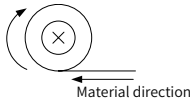
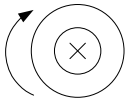
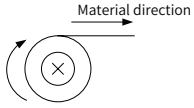
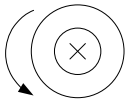
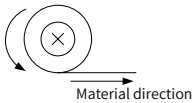
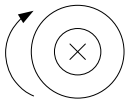
This parameter is used together with function 58 of the DI (winding/unwinding switchover terminal) to determine the winding mode. When the winding/unwinding switchover terminal is disabled, the winding mode is the same as the parameter setting. When the winding/unwinding switchover terminal is enabled, the winding mode is opposite to the parameter setting.

Parameter Code	Parameter Name	Default	Value Range	Description
F0-09	Running direction selection	0	0 to 1	0: Default direction 1: Opposite to the default direction

Set this parameter to ensure that the motor running direction meets the winding/unwinding requirements.

◆ Initial running direction commissioning

The tension mode is not active (B0-00 = 0). In the speed control mode, the running direction is described in the following table.

	With-load Running Direction	No-load Running Direction (Speed Control Mode)
Winding		
		
Unwinding		
		

Note

- For the first run, determine the running direction and set the parameter properly. When the switchover between winding and unwinding is required, either modify B0-01 directly, or change the state of the winding/unwinding switchover terminal. Otherwise, malfunction may occur.

5.1.2 Roll Diameter Calculation

The roll diameter is a required parameter in any tension control mode. Select a proper calculation method and set the related parameters correctly to ensure accuracy of the roll diameter. Otherwise, the tension control function may fail.

◆ Roll diameter calculation parameter

Parameter Code	Parameter Name	Default	Value Range	Description
B0-07	Roll diameter calculation method	0	0 to 6	0: Calculate the roll diameter based on the linear speed 1: Calculate the roll diameter based on the cumulative thickness 2: AI1 3: AI2 5: Pulse input (DIO1) 6: Communication (1000H)

0: Calculate the roll diameter based on the linear speed

This calculation method is independent of material thickness. The roll diameter is calculated based on the linear speed and running frequency in real time, so the error is not accumulated.

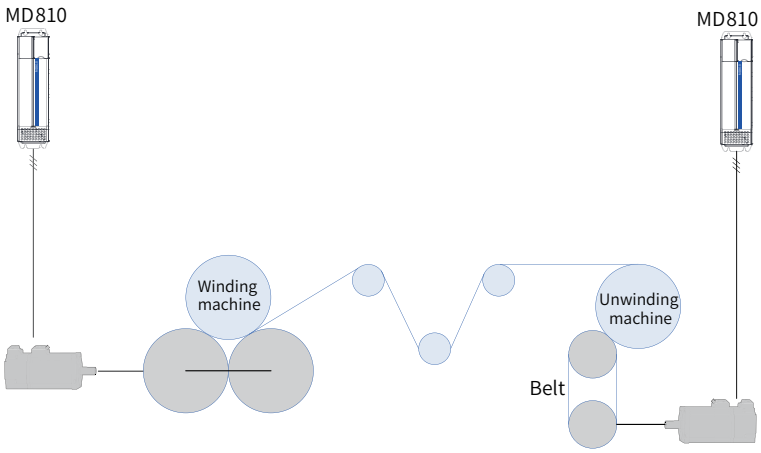
Requirements:

Linear speed: see “5.1.3 Linear Speed”.

Mechanical transmission ratio: B0-03

Note

- This calculation method is applicable to central winding/unwinding instead of surface winding/unwinding. The following figure describes typical surface winding/unwinding, where the AC drive shaft is not coaxial with the winding/winding shaft, so the roll diameter cannot be calculated based on the linear speed.



1: Calculate the roll diameter based on the cumulative thickness

This calculation method does not require linear speed. The roll diameter is calculated based on the cumulative material thickness and revolution counting signals. The calculation result is stable, but the error is accumulated.

Requirements:

Material thickness: B0-31 to B0-36

Revolution counting signal source: Function 61 (revolution counting signal) of the DI

Operation relationship: B0-29 (number of pulses per revolution) and B0-30 (number of revolutions per layer for wires)

2: AI1

3: AI2

5: Pulse input (DIO1)

6: Communication (1000H)

The roll diameter can be obtained by using methods 2 to 6. These methods can be used in scenarios where the roll diameter is directly measured by using a sensor or calculated outside the AC drive.

When the preceding methods are used, the maximum winding diameter (B0-08) must be set correctly according to the per unit relationship. If AI1 is used as the roll diameter setting channel, the roll diameter that corresponds to 100.0% of AI1 input is the maximum roll diameter (B0-08).

◆ Parameters related to the initial roll diameter

Parameter Code	Parameter Name	Default	Value Range	Description
B0-08	Maximum roll diameter	500.0 millimeter	0.1 mm to 6000.0 mm	Actual full roll diameter

In the tension control mode, this parameter provides the following functions:

1) Upper limit of roll diameter operation;
2) Calibration of roll diameter-related values. See parameters B0-07 and B0-10.

3) Optional unwinding roll diameter after resetting (see B0-10).

Parameter Code	Parameter Name	Default	Value Range	Description
B0-09	Empty roll diameter	100.0 millimeter	0.1 mm to 6000.0 mm	Actual empty roll diameter

In the tension control mode, this parameter provides the following functions:

1) Lower limit for roll diameter calculation

2) Optional winding roll diameter after resetting (see B0-10)

Parameter Code	Parameter Name	Default	Value Range	Description
B0-10	Initial Roll Diameter Source	0	0 to 4	0: Digital setting 1: AI1 2: AI2 4: Communication (1000H)

When the system is shut down due to reel replacement, running faults, or other reasons, the roll diameter often changes. To ensure accurate roll diameter during startup of the system, roll diameter must be reset by enabling the function 54 (roll diameter reset) of the DI.

This parameter is used to select the input channel of the initial roll diameter.

0: Digital setting

The source of the initial roll diameter is dependent on functions 55 and 56 of the DI (initial roll diameter selection terminal) and related to the winding mode.

For example,

B0-10 is set to 0, DI1is assigned with function 55, and DI2 is assigned with function 56. The following table describes the relationship between the initial roll diameter source and the DI.

DI2	DI1	Initial Roll Diameter Source
0	0	B0-09 (winding) or B0-08 (unwinding)
0	1	B0-11
1	0	B0-12
1	1	B0-13

By default, the source of the initial roll diameter is set to B0-08 or B0-09, depending on the winding mode.

1: AI1

2: AI2

4: Communication (1000H)

The initial roll diameter can be obtained by using calculation methods 1 to 4. When the preceding methods are used, the maximum winding diameter (B0-08) must be set correctly according to the per unit relationship.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-11	Initial roll diameter 1	100.0 mm	0.1 mm to 6000.0 mm	See B0-10.
B0-12	Initial roll diameter 2	100.0 mm	0.1 mm to 6000.0 mm	
B0-13	Initial roll diameter 3	100.0 mm	0.1 mm to 6000.0 mm	

Parameter Code	Parameter Name	Default	Value Range	Description
B0-14	Current roll diameter	---	0.1 mm to 6000.0 mm	This parameter shows the current roll diameter in real time.

The current roll diameter can be modified by editing this parameter, and the roll diameter calculation result will overwrite this parameter. This method can also be used to reset the roll diameter.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-18	Roll diameter reset during running	0 to 1	0	0: Disable 1: Enable

This parameter can be used to enable roll diameter reset during operation.

◆ Parameters for roll diameter calculation based on linear speed (roll diameter calculation is affected only when B0-07 is set to 0)

Parameter Code	Parameter Name	Default	Value Range	Description
B0-03	Mechanical transmission ratio	1.00	0.01 to 300.00	This parameter specifies the ratio of motor speed to reel speed. Set B0-03 based on the mechanical transmission structure.

When the linear speed is used to calculate the winding diameter (B0-07 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the roll diameter.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-06	Minimum linear speed for roll diameter calculation	20.0 m/min	0 m/min to 6500.0 m/min	This parameter takes effect only when B0-07 is set to 0.

When the linear speed is lower than the value of B0-06, the current roll diameter is remained. When the linear speed is higher than the value of B0-06, the roll diameter is calculated.

This parameter can be used to solve the problems that the running frequency is low or the

winding diameter calculation is incorrect during acceleration.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-15	Roll diameter filter time	5.00s	0.00s to 10.00s	This parameter takes effect only when B0-07 is set to 0.

You can set this parameter to filter the result of roll diameter operation and suppress the jitter of roll diameter.

The larger the parameter value, the smoother the winding diameter operation, and the longer the winding diameter change delay.

Rule: When the winding diameter changes linearly, the time that the calculated winding diameter lags behind the actual winding diameter is basically equal to the parameter value.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-16	Roll diameter change rate	0	0: Disable 0.1 mm/s to 1000.00 mm/s	This parameter takes effect only when B0-07 is set to 0.

You can set B0-16 to a non-zero value to limit the change of roll diameter per unit of time and prevent abnormal fast change. If the value is too small, the change of roll diameter will be excessively limited, which will affect the real-time operation of roll diameter. Set this parameter properly according to the actual situations.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-17	Roll diameter change direction limit	0	0 to 1	0: Disable 1: Decrease inhibited during winding, and increase inhibited during unwinding This parameter takes effect only when B0-07 is set to 0.

Set this parameter to limit the direction change of the roll diameter. Use it under the condition of setting B0-16 reasonably. Otherwise, if there is abnormal fluctuation of roll diameter, excessive deviation of winding diameter calculation result will be caused.

◆ Parameters for roll diameter calculation based on cumulative thickness (roll diameter calculation is affected only when B0-07 is set to 1)

Parameter Code	Parameter Name	Default	Value Range	Description
B0-29	Pulses per revolution	1	1 to 60000	This parameter specifies the number of pulses per revolution of the reel.
B0-30	Revolutions per layer	1	1 to 10000	This parameter specifies the number of revolutions for each layer of winded materials, generally used for wire rods. For wire rods, set B0-30 to 1.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-31	Maximum number of input channels	0	0 to 2	0: Digital setting 1: AI1 2: AI2

You can set B0-31 to select an input channel of material thickness.

0: Digital setting
When B0-31 is set to 0, the material thickness is affected by DI terminal functions 62 and 63 (the material thickness selection terminals).
Example:B0-31 = 0.DI1is set toDIFunction62DI2is set toDIFunction63: Material thickness:

DI2	DI1	Initial Roll Diameter Source
0	0	It is determined by B0-32.
0	1	It is determined by B0-33.
1	0	It is determined by B0-34.
1	1	It is determined by B0-35.

1: AI1
2: AI2
The initial roll diameter can be obtained by using calculation methods 1 to 3. When the preceding channels are used, the maximum material thickness (B0-36) must be set correctly based on the per-unit relationship.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-32	Material thickness 0	0.01 millimeter	0.00 mm to 100.00 mm	See B0-31.
B0-33	Material thickness 1	0.01 millimeter	0.00 mm to 100.00 mm	
B0-34	Material thickness 2	0.01 millimeter	0.00 mm to 100.00 mm	
B0-35	Material thickness 3	0.01 millimeter	0.00 mm to 100.00 mm	
B0-36	Maximum material thickness	1.00 mm	0.00 mm to 100.00 mm	

5.1.3 Linear Speed

In the closed-loop speed control mode, the winding synchronous frequency reference is calculated based on the linear speed. Linear speed is required in roll diameter calculation. Linear speed can also be used for pre-drive, inertia compensation, friction compensation, and other functions. Therefore, the linear speed is an important part in tension control.

Parameter Code	Parameter Name	Default	Value Range	Description	
B0-04	Linear speed input source	0	0 to 6	0: No input 1: AI1 2: AI2	4: Pulse reference 5: Communication 6: Communication

0: No output

1 to 6: If the linear speed is input through the preceding channels, the maximum linear speed (B0-05) must be set properly based on per-unit relationship.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-05	Maximum linear speed	1000.0 m/min	0.0 m/min to 6500.0 m/min	It is used to set the maximum linear speed.

It corresponds to the actual linear speed when 100.0% is input for channel 1 to 6 of D1-04. (It differs from the maximum linear speed required by production.)

When the linear speed is used to calculate the winding diameter (B0-07 = 0), the larger the parameter is, the larger the calculated winding diameter is, and vice versa. Referring to this rule, the parameter can be corrected according to the deviation between the calculated value and the actual value of the roll diameter.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-41	Source of constant linear speed	0	0 to 4	0: AI1 1: AI2 2: Reserved 3: Pulse reference 4: Communication (1000H) 5: Communication (731AH)

B0-41 is used to select the target linear speed source in the constant linear speed control mode. This parameter is also calibrated based on the maximum linear speed (B0-05).

5.1.4 Tension Reference

In the open-loop torque control mode (B0-00 = 1) or closed-loop torque control mode (B0-00 = 3), tension control is implemented by controlling the output torque. Therefore, set the target tension based on material characteristics and production requirements.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-00	Tension reference source	0	0 to 5	0: B1-01 1: AI1 2: AI2 3: Reserved 4: Pulse reference 5: Communication (1000H)

0: B1-01

1 to 5: Indicates the ratio (in percentage) of the target tension to the maximum tension. The maximum tension (B1-02) must be set properly based on the per-unit relationship.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-01	Tension digital setting	50 N	0 N to 65000 N	See value 0 of B1-00.

B1-02	Maximum tension	200 N	0 N to 65000 N	It is used to set the maximum tension, corresponding to the tension value when 100.0% is input for channels 1 to 5 of B1-00. When the actual tension does not meet requirements, corrections can be performed by editing this parameter without changing AI, pulse input signals, or curves.

5.1.5 PID Closed-Loop Adjustment

In the closed-loop speed control mode (B0-00 = 2) and closed-loop torque control mode (B0-00 = 3), PID closed-loop adjustment based on the open-loop reference is important to ensure control accuracy. Therefore, the parameters for PID closed-loop adjustment must be set properly.

When B0-00 is set to 2 or 3, set closed-loop control parameters in group FA, such as PID reference source, PID feedback source, PID direction, and PID proportional, and PID integral based on actual conditions.

Note

- If the tension control mode is used, the PID reference source is set through parameters in group B1.

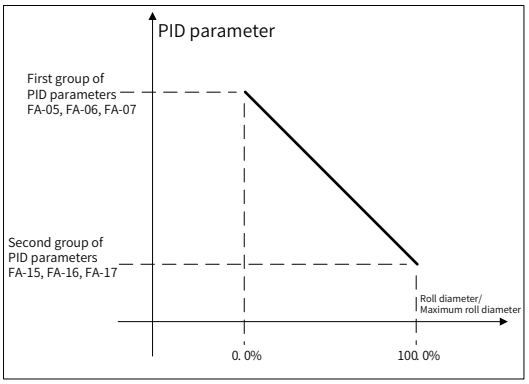
For descriptions of these parameters, see section of group FA. The following section only introduces settings which are different from common PID parameters.

The roll diameter-based PID parameter switchover function is added for the tension control mode.

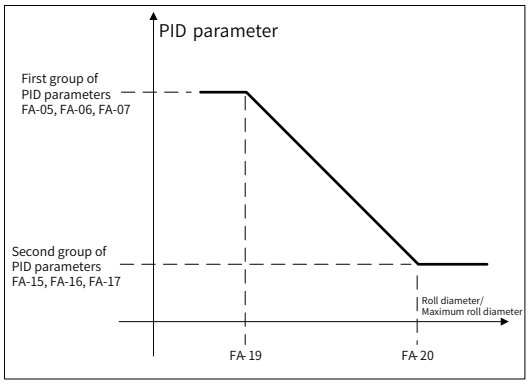
Parameter Code	Parameter Name	Default	Value Range	Description
FA-18	PID parameter switchover condition	0	6 to 7	6: Automatic adjustment mode 1 based on roll diameter 7: Automatic adjustment mode 2 based on roll diameter

6: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. For other situations, the PID parameters change linearly.

7: The first group of PID parameters is used at empty roll. The second group of PID parameters is used at full roll. If the roll changes between a specific range determined by FA-19 and FA-20, the PID parameters change linearly. See the illustration below.



6: Automatic adjustment 1 based on the roll diameter



7: Automatic adjustment 2 based on the roll diameter

5.1.6 Frequency and Torque Limit

In different modes, to implement special functions, such as runaway prevention, disconnection, closed-loop adjustment limit, and reverse tightening, limit the frequency and torque properly by setting related parameters.

◆ Parameter for frequency limit in the tension control mode

Parameter Code	Parameter Name	Default	Value Range	Description
B0-02	Unwinding reverse tightening selection	0	0: Disabled 0 m/min to 6500.0 m/min	It is used to set the unwinding action at material zero speed in the tension control mode.

When B0-02 is set to 0, the unwinding reel has no output and the material is not tightened at material zero speed.

When B0-02 is set to 0.1 m/min to 6500.0 m/min, the unwinding reel runs in the direction reverse to the set linear speed when running without material or with loose material. Under the condition of material zero speed, the output is maintained and the material is tightened.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-28	Winding frequency limit selection	0	0: Unlimited (can be set to be limited by the frequency upper limit) 1: Limited by B0-26 and B0-27	By default (B0-28 = 0), the upper limit of the winding frequency is not limited. To prevent material breaking and runaway, the left parameters can be set to limit the winding frequency upper limit.
B0-26	Winding frequency limit value	50.0%	0.0% to 100.0%	
B0-27	Winding frequency limit offset	5.00%	0.0% to 100.0%	

When B0-28 is set to 1, the winding frequency upper limit is obtained according to the following formula based on the synchronous frequency (the running frequency of the winder matching the current linear speed) and the maximum frequency (the running frequency of the winder matching the maximum linear speed):

Winding frequency upper limit = Synchronous frequency x (1 + B0-26) + Maximum frequency x B0-27

Parameter Code	Parameter Name	Default	Value Range	Description
B1-05	Frequency acceleration time in torque control	1.0s	0.0s to 6500.0s	Set B1-05 and B1-06 to change the slope of the frequency upper limit with time.
B1-06	Frequency deceleration time in torque control	1.0s	0.0s to 6500.0s	

In the tension control mode, the frequency upper limit affects the motor output. Generally, you do not need to set B1-05 and B1-06. In special cases, you can set them properly according to torque output requirements.

Example

Take the winding state as an example. To establish the tension at startup, set B1-05 to a value smaller than the acceleration time of the traction motor. To hold the tension during stop to avoid loose material accumulation, set B1-06 to a value larger than the deceleration time of the traction motor.

For similar purposes, you can set the parameters according to actual conditions or control the start or stop time sequence logic of different motors through the PLC.

◆ Parameter for adjustment limit in speed closed-loop mode

Parameter Code	Parameter Name	Default	Value Range	Description
B0-28	Limit selection in speed closed-loop mode	0	0 to 1	0: Limited by B0-26 and B0-27 1: Fixed to the frequency set by B0-26
B0-26	Limit value in speed closed-loop mode	50.0%	0.0% to 100.0%	
B0-27	Limit offset in speed closed-loop mode	5.00 Hz	0.0 Hz to 100.0 Hz	

To ensure the system stability, when the open loop references and closed loop adjustment are used, the closed loop adjustment amount should be limited to avoid system vibration. During speed closed-loop adjustment, based on the synchronization frequency (the running frequency that the rewinder matches the current linear speed) and the limit offset in the speed closed-loop mode, the closed-loop adjustment amount and the speed closed-loop limit offset can be limited.

B0-28= 0: The closed-loop adjusted output frequency can be limited based on the open-loop frequency and the maximum frequency.

B0-28= 1: The closed-loop adjustment is limited to a fixed frequency, which is determined by FA-32.

◆ Parameter for adjustment limit in torque closed-loop mode

Parameter Code	Parameter Name	Default	Value Range	Description

B1-16	Torque limit in tension closed-loop mode	50.0%	0.0% to 100.0%	It is used to limit the ratio (in percentage) of the adjustment amount in the torque closed-loop mode to the open-loop torque reference in the torque closed-loop control mode (B0-00 is set to 3).
B0-38	Main frequency and auxiliary frequency in closed-loop tension torque mode	1	0: Disable 1: Enable	

5.1.7 Inertia and Friction Compensation

This function is applicable only to the torque control mode. Set parameters in this section properly to optimize the tension control effect, improve the tension stability, and increase the system response speed.

These parameters can be set for the open-loop torque control mode (B0-00 = 1) and generally do not need to be set for the closed-loop torque control mode (B0-00 = 3).

◆ Running friction compensation parameters

When the motor runs stably, the output torque is used for material tension establishment and rotation friction. If the rotation friction cannot be ignored, the output torque needs compensation for friction.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-07	Friction force compensation coefficient	0.0%	0.0% to 50.0%	The actual friction force compensation equals F1-07 x motor rated torque.

In the tension control mode, the AC drive automatically sets the target torque according to the tension reference and roll diameter and decreases (unwinding) or increases (winding) the target torque according to B1-07. This can offset the effect of friction on material tension.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-17	Friction force compensation curve	0.0%	-50.0% to +50.0%	The actual friction force compensation correction value equals B1-17 x motor rated torque.

In most scenarios, friction may vary with running frequency and roll diameter. Using B1-17 may not achieve ideal friction compensation effect. In this case, use B1-17 and B1-18 together. For details, see B1-18.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-18	Friction force compensation curve	0	0 to 4	0: Running frequency 1: Linear speed 2: Multi-segment friction force compensation curve 1 3: Multi-segment friction force compensation curve 2 4: Roll diameter

Five friction compensation modes are available to meet the complex friction change rule.

0: Running frequency

In some scenarios, the friction changes with the system running frequency. When B1-18 is set to 0, the friction compensation value is determined using the following formula:

Friction compensation torque = B1-07 x (1 + Running frequency/Maximum frequency x B1-17)

1: Linear speed

This mode is similar to the mode when B1-18 is set to 0. The friction compensation correction is based on linear speed and the friction compensation value is determined using the following formula:

Friction compensation torque = B1-07 x (1 + Linear speed/Maximum linear speed x B1-17)

2: Multi-segment friction force compensation curve 1

In some scenarios, the friction does not change linearly with the running frequency. In this case, the multi-friction compensation curve can be used to implement the friction compensation correction. For details, see B1-19 to B1-24.

3: Multi-segment friction force compensation curve 2

Compared with multi-segment friction force compensation curve 1, multi-segment friction force compensation curve 2 is more flexible but more parameters need to be set. For details, see B1-19 to B1-30.

4: Roll diameter

This mode is similar to mode 0. The friction compensation is based on roll diameter and the friction compensation value is determined using the following formula:

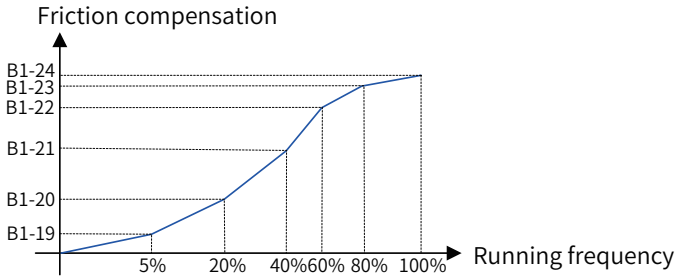
Friction compensation torque = B1-07 x (1 + Roll diameter/Maximum roll diameter x B1-17)

Parameter Code	Parameter Name	Default	Value Range	Description
B1-19	Multi-segment friction compensation torque 1	0.0%	0.0% to 50.0%	These parameters are used for multi-segment friction force compensation curves 1 and 2.
B1-20	Multi-segment friction compensation torque 2	0.0%	0.0% to 50.0%	
B1-21	Multi-segment friction compensation torque 3	0.0%	0.0% to 50.0%	
B1-22	Multi-segment friction compensation torque 4	0.0%	0.0% to 50.0%	
B1-23	Multi-segment friction compensation torque 5	0.0%	0.0% to 50.0%	
B1-24	Multi-segment friction compensation torque 6	0.0%	0.0% to 50.0%	
B1-25	Multi-segment friction compensation inflection point 1	0.00 Hz	0.00 Hz to maximum frequency	
B1-26	Multi-segment friction compensation inflection point 2	0.00 Hz	0.00 Hz to maximum frequency	
B1-27	Multi-segment friction compensation inflection point 3	0.00 Hz	0.00 Hz to maximum frequency	
B1-28	Multi-segment friction compensation inflection point 4	0.00 Hz	0.00 Hz to maximum frequency	
B1-29	Multi-segment friction compensation inflection point 5	0.00 Hz	0.00 Hz to maximum frequency	
B1-30	Multi-segment friction compensation inflection point 6	0.00 Hz	0.00 Hz to maximum frequency	

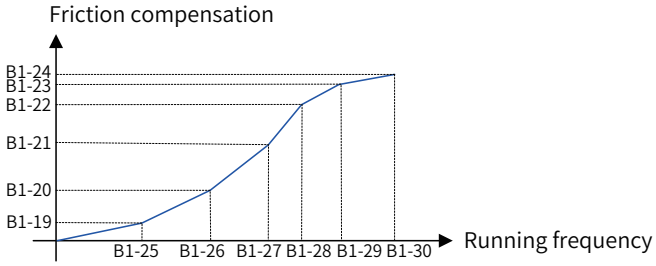
When B1-18 is set to 2, parameters B1-19 to B1-24 take effect. When B1-18 is set to 3, B1-19 to B1-30 take effect.

The change curves of friction compensation values are as shown in the following figures. You can set B1-18 based on actual conditions.

- When B1-18 is set to 2, friction compensation curve 1 is as follows.



- When B1-18 is set to 3, friction compensation curve 2 is as follows.



◆ Friction compensation parameters for startup

In some scenarios, the reel is subject to large startup friction, which makes system startup difficult. In this case, torque compensation can be provided during startup and canceled once the system runs properly to ensure constant tension.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-03	Zero-speed threshold	0.0%	0.0% to 20.0%	If the running frequency is lower than the value of this parameter, startup friction tension compensation will be carried out according to B1-04. If the running frequency is higher than the value of this parameter, startup friction tension compensation will not be carried out.
B1-04	Zero-speed tension rise	0.0%	0.0% to 100.0%	This parameter corresponds to the percentage of tension reference and must be set properly according to the range of allowable material tension. On the premise of ensuring startup, the parameter value must be as small as possible.

◆ Inertia compensation parameters

In the open-loop torque control mode, the output torque is used for material tension and rotation inertia of the system during acceleration or deceleration.

In any of the following cases, consider inertia compensation:

(1) Small material tension during acceleration of winding

(2) Large material tension during deceleration of winding

(3) Large material tension during acceleration of unwinding

(4) Small material tension during deceleration of unwinding

The inertia of a winding/unwinding system consists of mechanical inertia and material inertia. The parameter can be set according to the relationship between mechanical inertia and material inertia. If the material is heavy and the reel is light, only the parameters related to material inertia need to be set, and vice versa.

Accurate linear speed is required for inertia compensation.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-08	Mechanical flywheel inertia	0 N·m^2	0 N m^2 to 65535 N ··m^2	Set B1-08 based on the actual mechanical flywheel inertia.

For general cylindrical mechanical reels, the theoretical value of mechanical flywheel inertia can be obtained using the following formula:

$$GD_m^2 = \frac{\pi g}{8i^2}\gamma b\left(D^4 - D_0^4\right)$$

Where, g is the gravitational acceleration, γ is the density of machine materials, b is the length of the mechanical reel, D and D_0 are the outer diameter and inner diameter of the mechanical reel (0 for a solid reel) respectively, and i is the transmission ratio. The international units are applied.

The setting value can be adjusted according to the actual change of material tension during acceleration or deceleration.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-11	Material density	0 kg/m^3	0–65535 kg/m^3	Set these parameters based on the material property and set the mechanical transmission ratio (B0-03) correctly.
B1-12	Material width	0 millimeter	0-65535 mm	

The AC drive automatically calculates the flywheel inertia according to the material density, material width, reel diameter, and material roll diameter.

Parameter Code	Parameter Name	Default	Value Range	Description
B1-09	Acceleration inertia compensation gain	100.0%	0.0% to 200.0%	An inevitable deviation exists between the theoretical inertia and the actual inertia, so the inertia compensation effect may not be ideal even after the inertia parameters are set.
B1-10	Deceleration inertia compensation gain	100.0%	0.0% to 200.0%	

These parameters can be fine-tuned to optimize the control effect. Taking the winding acceleration as an example. If the material tension is low, increase the value of B1-09 to enhance the compensation effect. If the material tension is high, decrease the value of B1-09. The same

rule applies to winding deceleration.

This set of parameters can facilitate commissioning.

◆ Torque direction limit parameters

Parameter Code	Parameter Name	Default	Value Range	Description
B1-15	Torque direction limit	0	0: No limit 1: Reverse torque inhibited	This parameter takes effect only when B0-00 is set to 1 or 3.

After the friction and inertia compensation are added, the calculated torque is likely to be negative. The processing method can be set by this parameter when the torque is reversed. The torque direction is not limited by default. You can set this parameter to inhibit reverse direction.

5.1.8 Taper

In some scenarios, the tension should be reduced with the increase of the roll diameter to ensure smooth winding. For this purpose, set taper parameters properly. The parameters are valid only in the winding mode (B0-01 = 0).

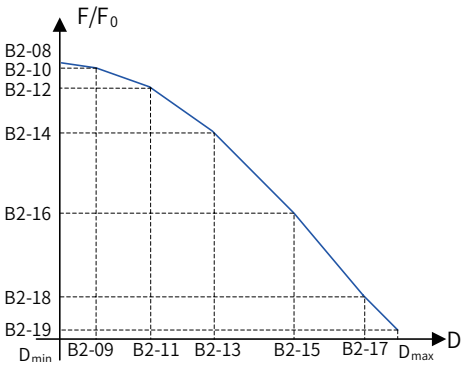
Parameter Code	Parameter Name	Default	Value Range	Description
B2-00	Taper curve selection	0	0: Curve taper 1: Multi-segment taper	It is used to set the generation mode of the taper curve.

0: Curve taper

The taper curve is generated based on the taper setting and the correction coefficient of taper compensation (B2-03). For details, see B2-03.

1: Multi-segment taper

You can draw the tension-roll broken line graph based on the winding process requirements. Up to five roll diameter inflection points are provided, and up to six segments of linear tension can be set. The related parameters are listed below.



Parameter Code	Parameter Name	Default	Parameter Code	Parameter Name	Default
B2-08	Minimum roll tension ratio	100% (default value)	B2-14	Tension ratio 3	80% (default value)

B2-09	Inflection point 1	150.0 millimeter	B2-15	Inflection point 4	300.0 millimeter
B2-10	Tension ratio 1	100.0%	B2-16	Tension ratio 4	70.0%
B2-11	Inflection point 2	200.0 millimeter	B2-17	Inflection point 5	400.0 millimeter
B2-12	Tension ratio 2	90.0%	B2-18	Tension ratio 5	50.0%
B2-13	Inflection point 3	250.0 millimeter	B2-19	Maximum roll tension ratio	30.0%

Parameter Code	Parameter Name	Default	Value Range	Description
B2-01	Tension taper source	0	0: B2-02 1: AI1 2: AI2	0: B2-02 1–3: Set by analog channels 1 to 2
B2-02	Taper digital setting	0.0%	0.0% to 100.0%	See value 0 of B2-01.
B2-03	Correction value of taper compensation	0 millimeter	0-10000 mm	It is used to set the correction value of taper compensation.

You can set the preceding parameters to set the curve taper based on the taper setting. The taper value can be determined by using the following formula (multiple modes are available and the following gives a typical example):

$$F = F_0 x\{1 - Kx\lfloor 1 - (D_0 + D_1)/(D + D_1)\rfloor\}$$

Where, F is the tension after taper is set; F_0 is the tension before taper is set, which is set through B1-00; K is the taper value set through B2-01; D_0 is the empty roll diameter set through B0-09; D is the current roll diameter set through B0-14; D_1 is the correction coefficient of taper compensation set through B2-03.

Parameter Code	Parameter Name	Default	Value Range	Description
B2-05	Setting channel of maximum external taper	0	0: B2-06 1: AI1 2: AI2	0: B2-06 1–2: Set by analog channels 1 to 2

In some cases, the material tension is determined by the external actuator. In this case, the external taper output function can be used to control the external executive parts to obtain the tension taper.

The maximum external taper value determines the maximum taper output value when the external taper output (function 18) is selected for FMP or AO (F5-06 to F5-08). The maximum taper output value refers to the corresponding output value when the roll is empty. B2-05 is used to set the channel of the maximum external taper.

Parameter Code	Parameter Name	Default	Value Range	Description
B2-06	Digital setting of maximum external taper	100.0%	0.0% to 100.0%	It defines the digital setting of the maximum external taper value. See value 0 of B2-05.

5.1.9 Pre-charge

The pre-charge function is applied to automatic reel replacement scenarios. To achieve shock-less roll change, ensure that the linear speed of the new roll matches that of the material when replacing a full roll with a new roll. For this purpose, enable function 57 (pre-charge) of the DI and set the pre-charge parameters properly.

Accurate linear speed and roll diameter are required for this function.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-19	Pre-charge frequency gain	0.0%	-100.0% to 100.0%	For pre-charge, the running frequency is automatically calculated based on the linear speed and roll diameter to ensure matching with the linear speed of the material.

For small deviation of linear speed, set B0-19 to increase or decrease the running frequency during pre-charge, ensuring accurate linear speed matching.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-20	Pre-charge torque limit source	0	0 to 1	0: F2-09 1: Torque in tension control mode

In the torque control tension mode, the target torque is automatically generated to meet the material tension demand. In the normal operation mode, the target torque can also be set according to F2-09. This parameter provides the preceding options for the source of the target torque in the pre-charge mode. You can set it as required.

0: The target torque is set by F2-09.

1: The target torque is set according to the open-loop torque in the tension control mode (for mode 1 and mode 3 only).

Parameter Code	Parameter Name	Default	Value Range	Description
B0-21	Pre-charge torque correction	0.0%	-100.0% to 100.0%	The parameter takes effect when B0-20 is set to 1 and is used to correct the tension control torque in the pre-charge mode.
B0-22	Pre-charge roll diameter calculation delay	0.0s	0.0s to 6500.0s	This parameter takes effect only when B0-07 is set to 0.

During roll diameter calculation based on the linear speed, set this parameter to delay the effective time of roll diameter calculation to avoid inaccurate or unstable roll diameter calculation within a short time after the pre-charge ends.

Parameter Code	Parameter Name	Default	Value Range	Description
B0-23	Pre-charge acceleration time	1.0s	0.0s to 6500.0s	These parameters are used to change the pre-charge frequency acceleration or deceleration time.
B0-24	Pre-charge deceleration time	1.0s	0.0s to 6500.0s	

Parameter Code	Parameter Name	Default	Value Range	Description
B0-25	Pre-charge roll diameter calculation function	0	0: Disable 1: Enable	This parameter takes effect only when B0-07 is set to 1.

When the roll diameter is calculated by thickness accumulation, the roll diameter increases/decreases with the number of revolutions of the reel. At this time, set this parameter to 1 to avoid the cumulative error caused by the failure of roll diameter calculation during pre-charge.

You can set this parameter as required.

5.1.10 I/O Functions

◆ DI functions

The DI function facilitates the implementation and operation of tension control. The DI provides a wide range of functions in conjunction with the setting of related parameters.

The DI function is set through F4-00 to F4-09. Flexible communication functions can be implemented through virtual DIs. The general terminal functions of the drive are not described here.

1) DI function 54: Roll diameter reset

Roll diameter reset during reel replacement is necessary for tension control. It ensures accurate roll diameter at the moment when the system is started after reel replacement, and also ensures normal system startup and proper material tension.

2) DI functions 55 and 56: Initial roll diameter selection terminals 1 and 2

These functions provide initial roll diameter switchover modes to meet different requirements for different reels or materials. For details of use, see B0-10.

3) DI function 57: Pre-charge input

When the terminal is activated, the AC drive is switched to the pre-charge speed control mode. After the roll is changed, deactivate this terminal to activate the tension function.

4) DI function 58: Switchover between winding and unwinding

Winding/unwinding switchover is performed without parameter change, greatly facilitating the operation. For details of use, see B0-01.

5) DI function 59: Roll diameter calculation stopped

When the terminal is activated, the roll diameter calculation is disabled.

6) DI function 60: Tension control forbidden

When the terminal is activated, the system exits the tension control mode and the AC drive restores general AC drive functions (the frequency source and torque source are enabled based on the general AC drive functions).

7) DI function 61: Revolution counting signal

When the roll diameter is calculated based on cumulative thickness, set this function for the DI to input revolution count signals from the terminal.

8) DI functions 62 and 63: Thickness selection terminals 1 and 2

These functions provide material thickness switchover modes to meet different requirements for materials with different thickness. For details of use, see B0-31.

◆ AO/Pulse output function

In addition to the AC drive, the PLC or actuators also affect the tension control function. The AC drive supports output of variables related to tension control, enriching means to realize the tension control function.

The AO/pulse output is set through F5-06 to F5-08. The general terminal functions of the drive are not described here.

1) Output function 18: External taper output

When the tension taper control is required and the material tension is determined by the external actuator, you can enable this function to output taper.

2) Output function 19: Roll diameter output

When the roll diameter is calculated in the AC drive and the calculation result needs to be output, you can enable this function to output the result.

3) Output function 20: Tension output

You can enable this function to output the tension reference of the AC drive. The actual valid tension after taper calculation is calibrated based on the maximum tension (B1-02).

5.1.11 Monitoring Parameters

The following table lists monitoring parameters.

Parameter Code	Parameter Name	Value Range	Minimum Unit	Communication Address
U1-00	Linear speed display	0.0 m/min to B0-05	0.1 m/min	7100H
U1-01	Roll diameter display	B0-09 to B0-08	0.1 millimeter	7101H
U1-02	Frequency calculated based on linear speed	0.00 Hz to maximum frequency	0.01 Hz	7102H
U1-03	Tension reference	0 N to B1-02	1 N	7103H
U1-04	Tension after taper	0 N to B1-02	1 N	7104H
U1-05	Target torque in tension control	0.0% to 200.0%	0.1%	7105H
U1-06	PID output	0.00 Hz to Limit value in closed-loop mode	0.01 Hz	7106H
U1-07	Acceleration rate	Larger than 0.0 m/min/s	0.1 m/min/s	7107H

For better control effect, conduct commissioning based on the measurements obtained using

a speed measuring device or tape and comparison between such measurements with related monitoring parameters.

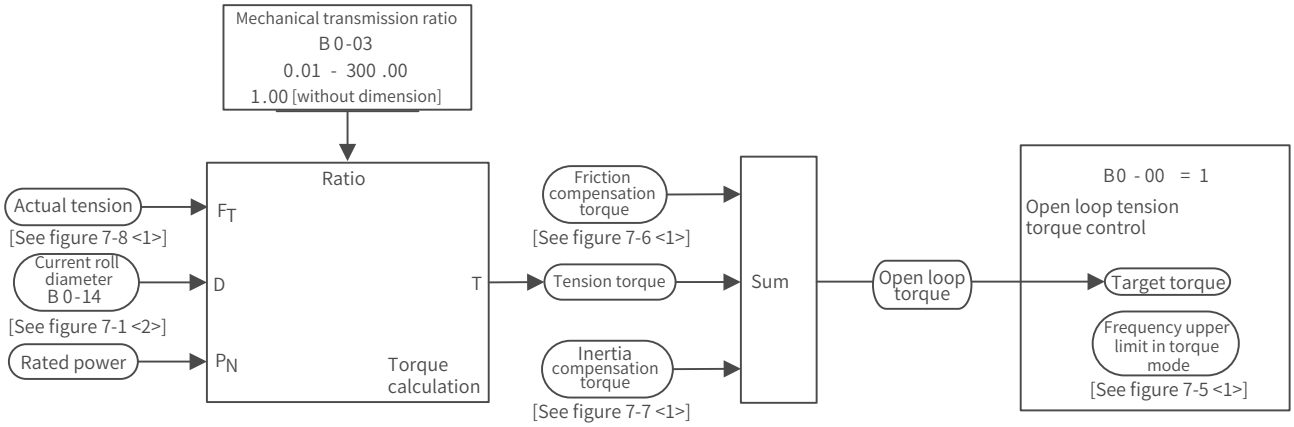
5.1.12 Function Diagram

◆ Function block diagram

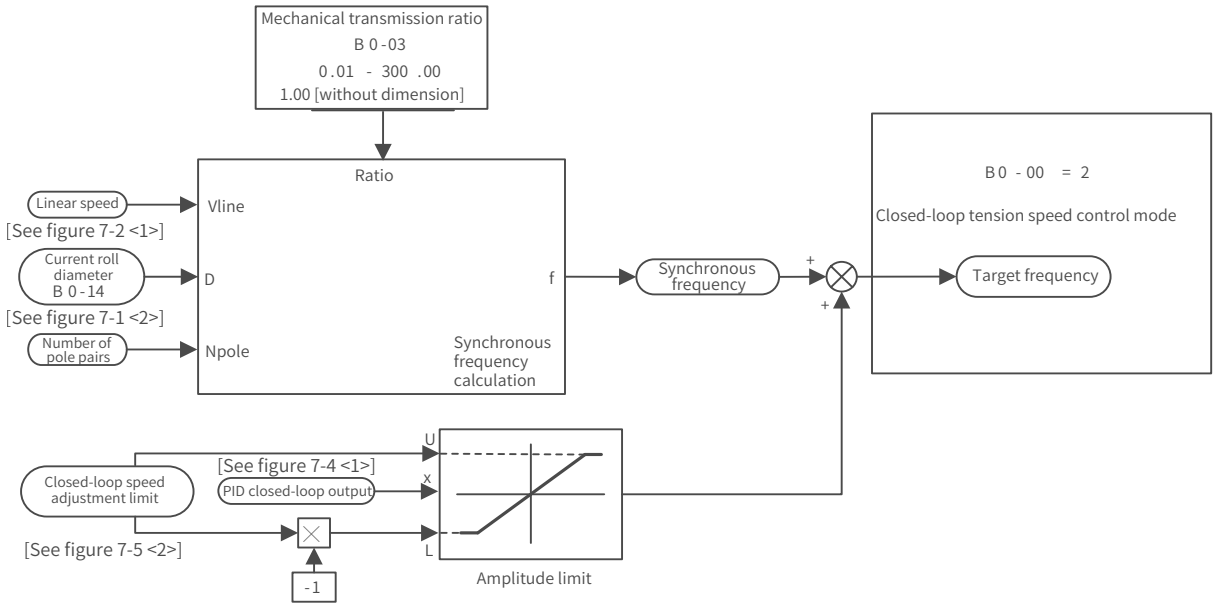
The torque and running frequency are controlled through the tension. Therefore, you can query the sub-function diagram and refer to the description of related parameters according to the data flow of the two key variables in the general block diagram to implement tension control.

The value of B0-00 determines the tension control mode. The product supports four tension control modes. The following figure shows the general block diagram.

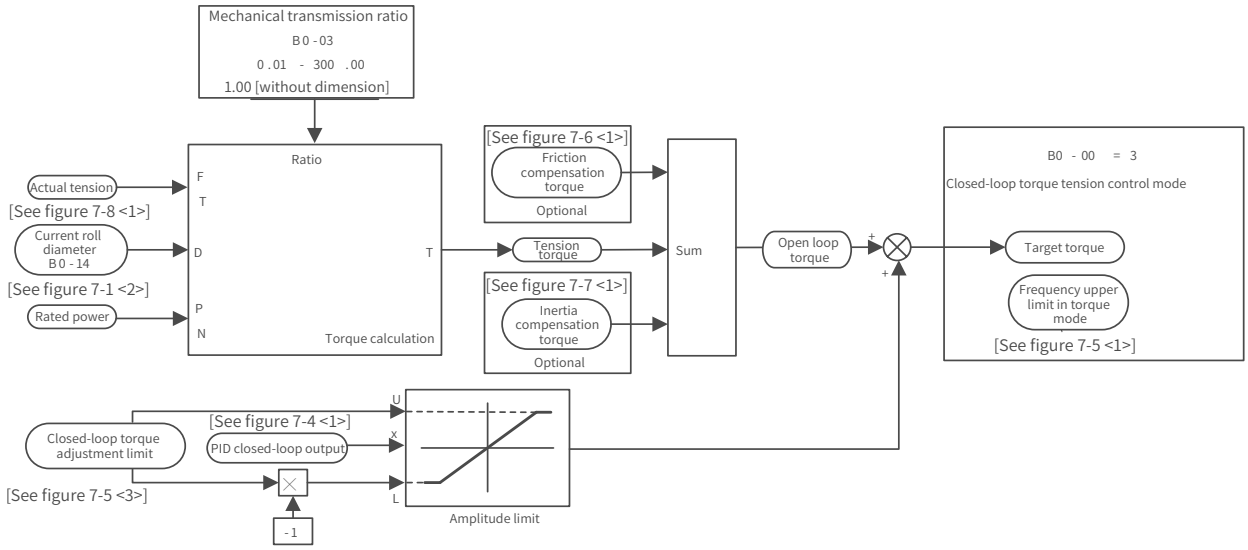
1) B0-00 = 1: Open-loop tension torque control mode



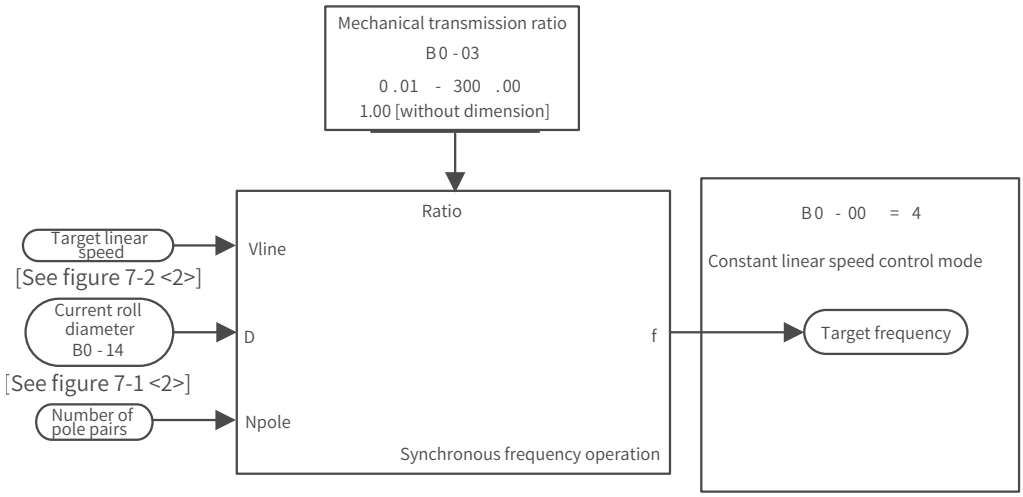
2) B0-00 = 2: Closed-loop tension speed control mode



3) B0-00 = 3: Closed-loop tension torque control mode



4) B0-00 = 4: Constant linear speed control mode



5) Additional functions: For details on the external taper and pre-charge output reference, see "Figure 5-8 Taper" and "Figure 5-9 Pre-charge".

◆ Sub-function block diagram

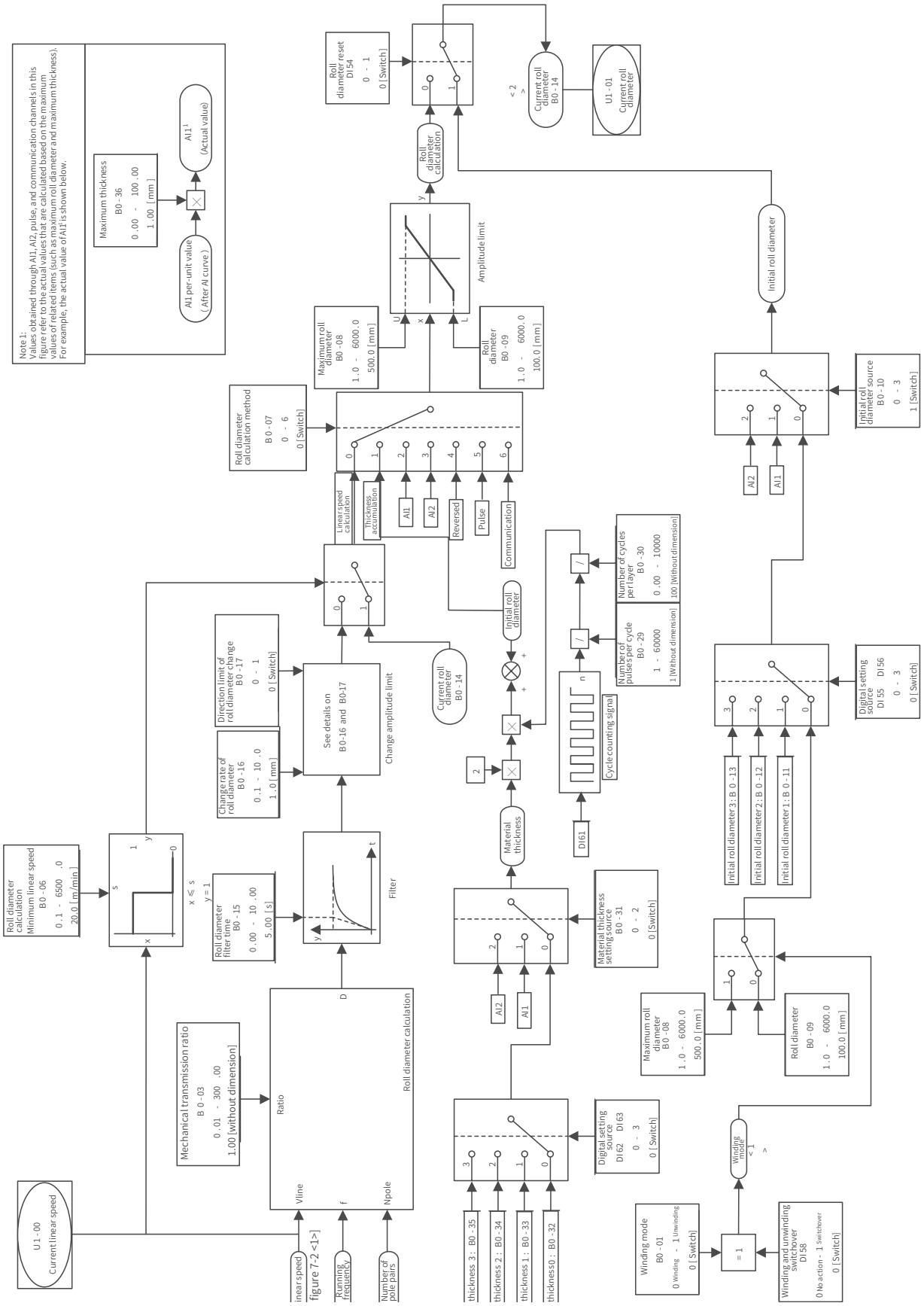


Figure 5-1 Roll diameter calculation

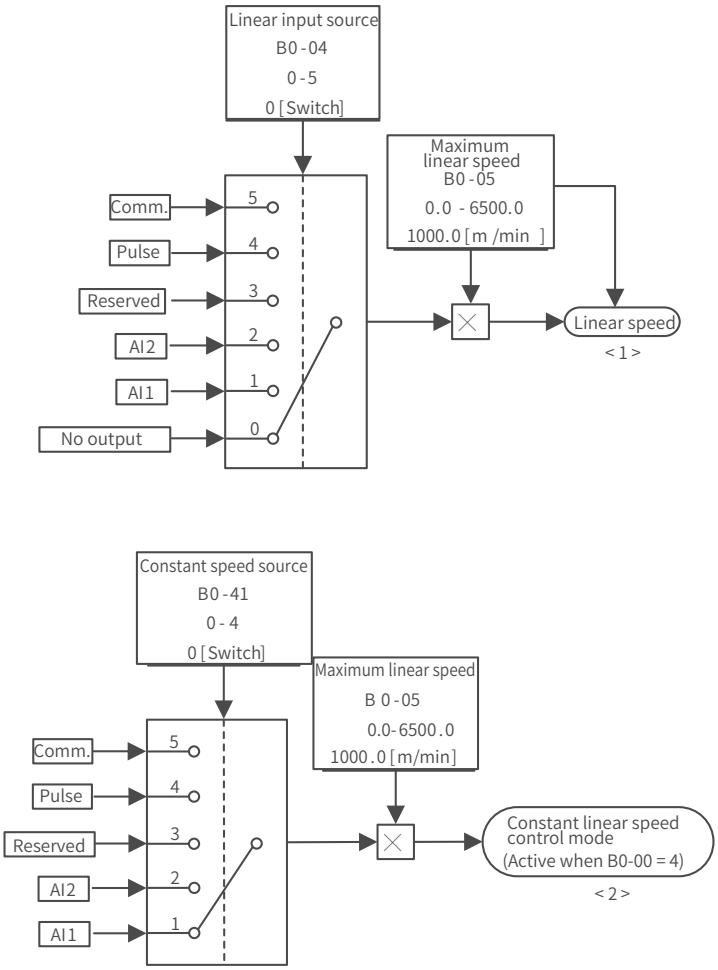


Figure 5-2 Linear speed

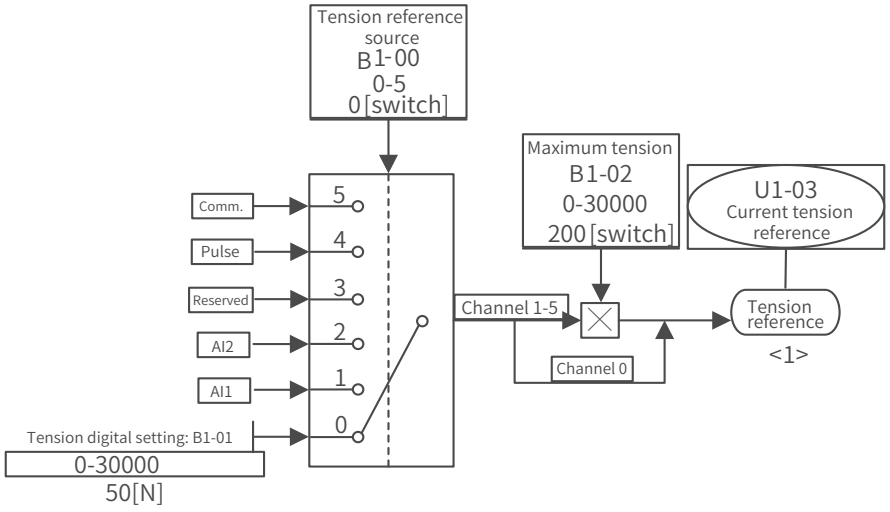


Figure 5-3 Tension setting

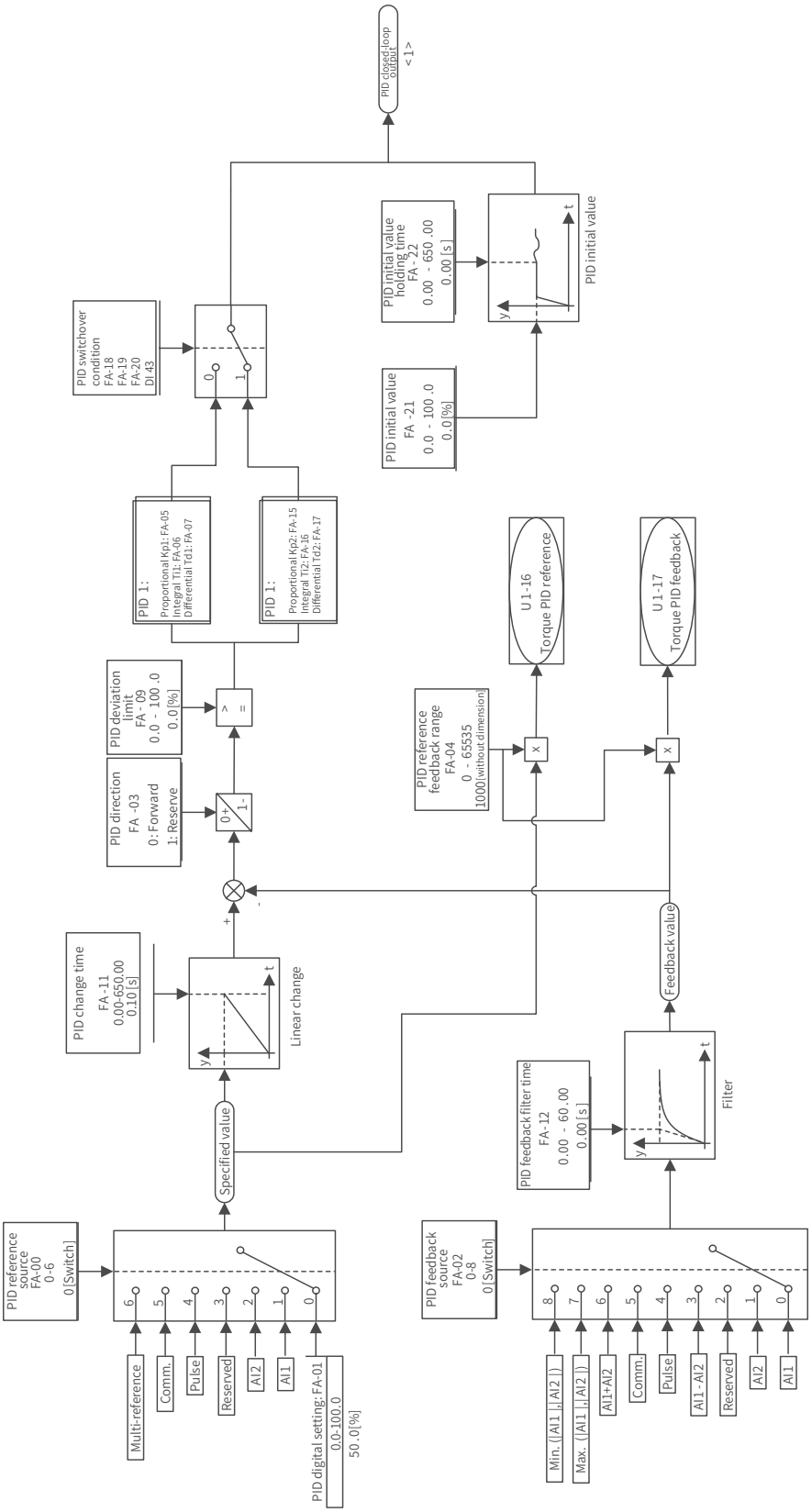


Figure 5-4 PID closed-loop adjustment

Note

- If the tension control mode is used, the PID reference source is set through parameters in group B1.

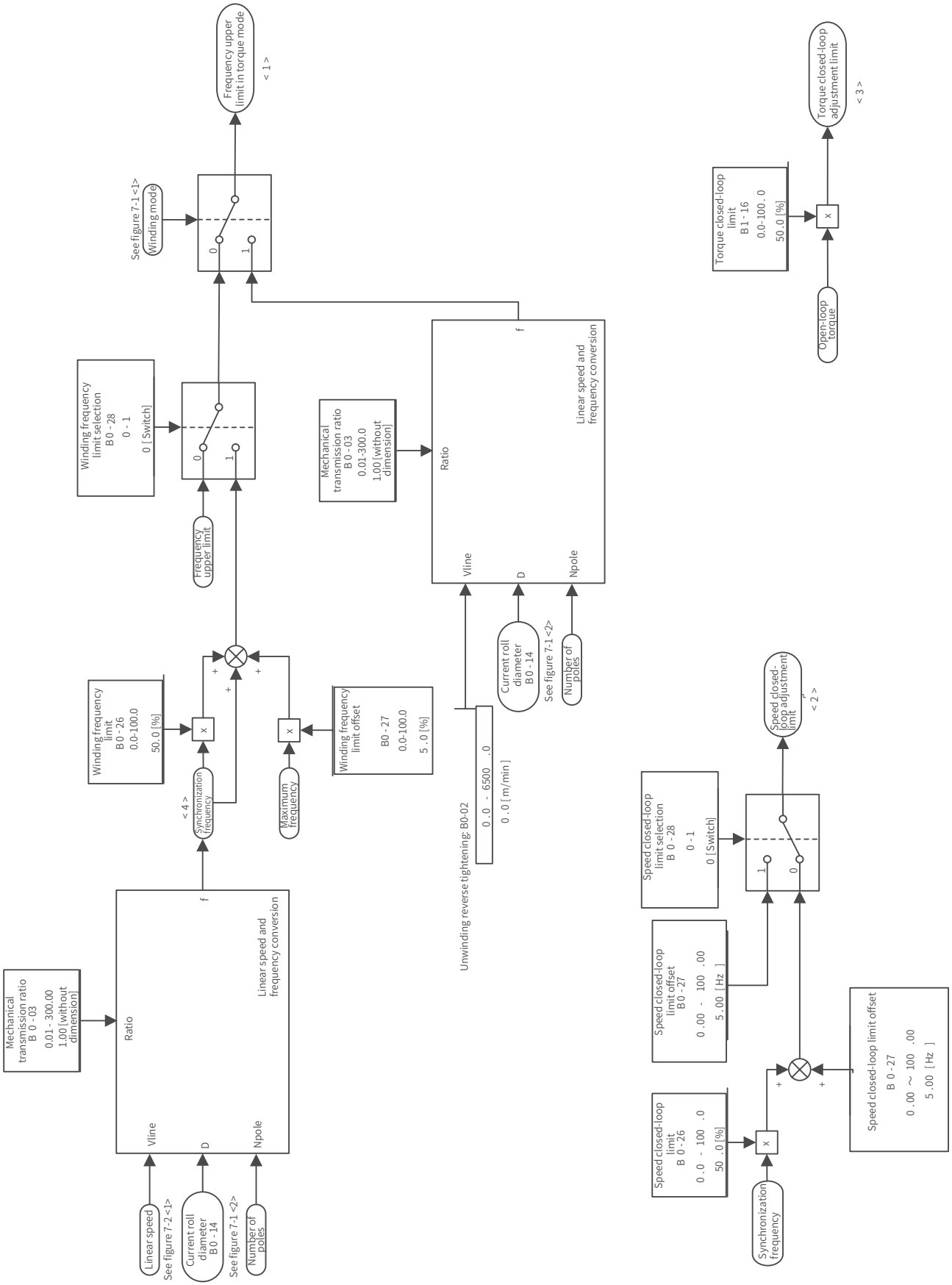


Figure 5-5 Frequency and torque limit

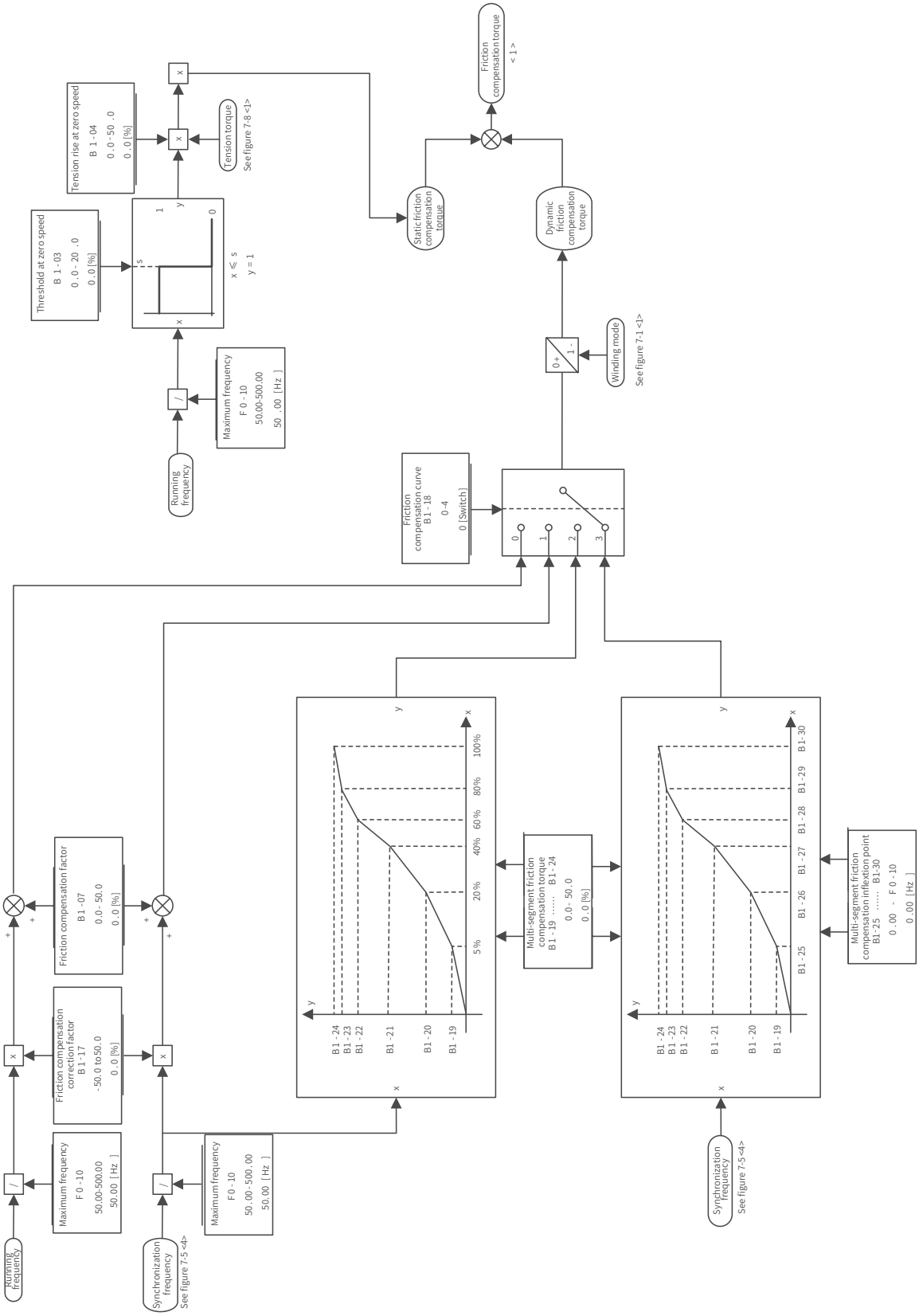


Figure 5-6 Friction compensation

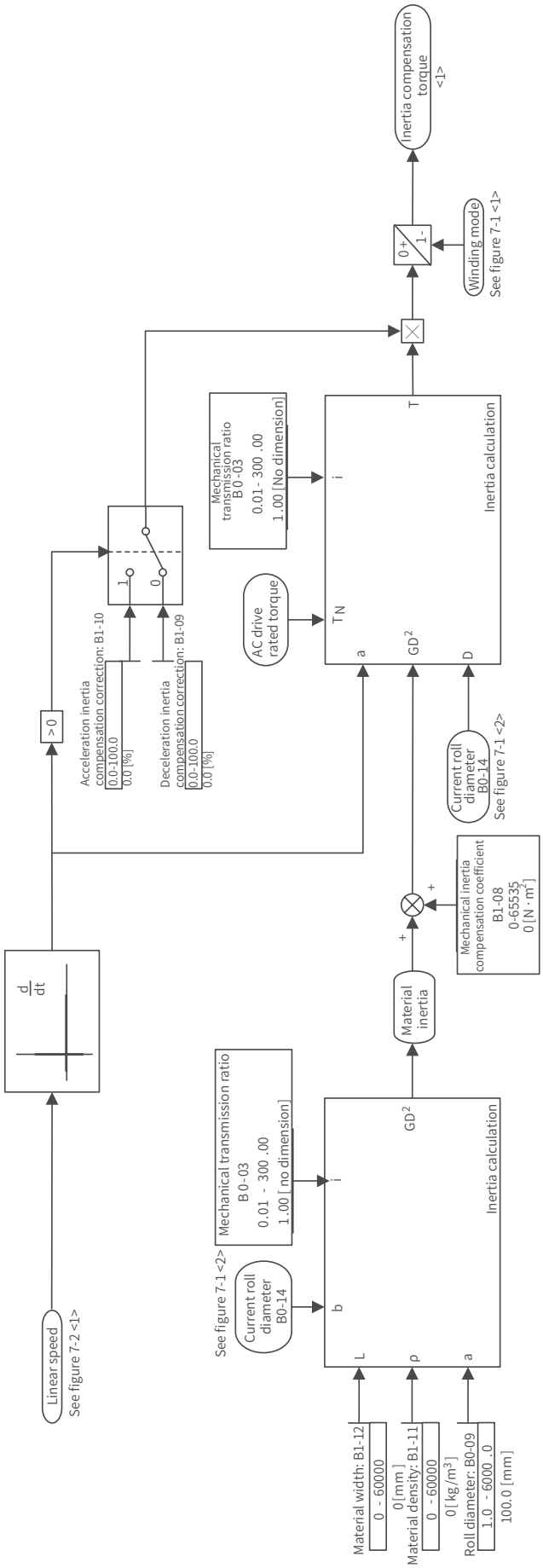


Figure 5-7 Inertia compensation

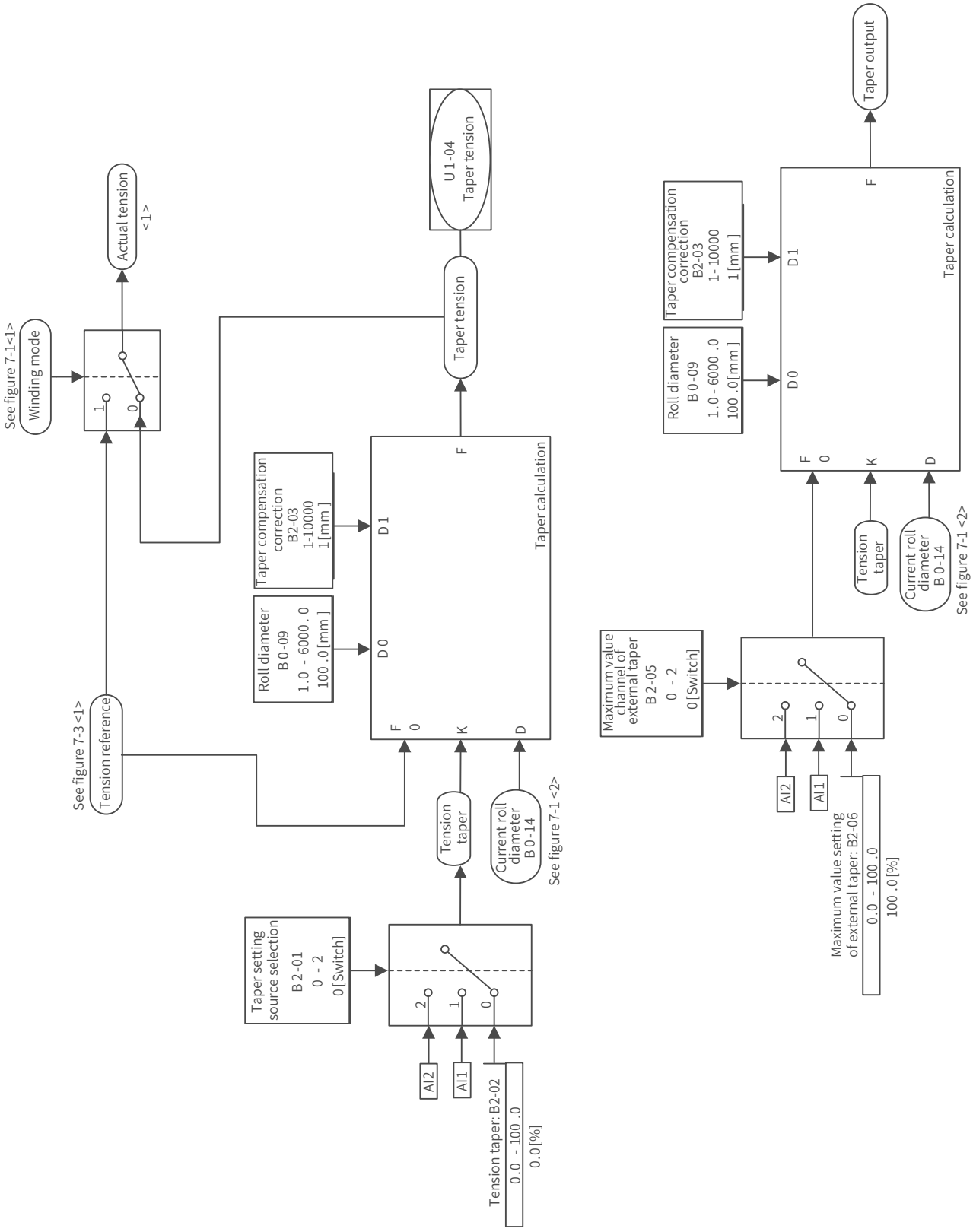


Figure 5-8 Taper

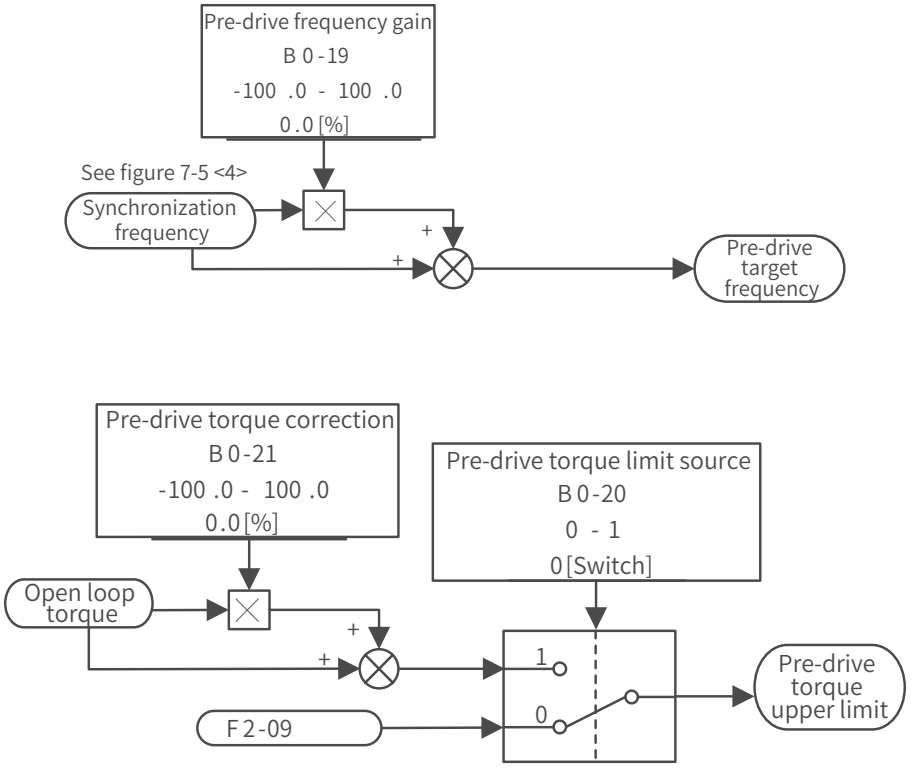


Figure 5-9 Pre-charge

5.2 Wobble Control

With the wobble function, the output frequency of the AC drive wobbles up and down around the frequency reference (F0-07). This function is applicable to industries such as textile and chemical fiber, and reciprocating motion, and winding/unwinding applications.

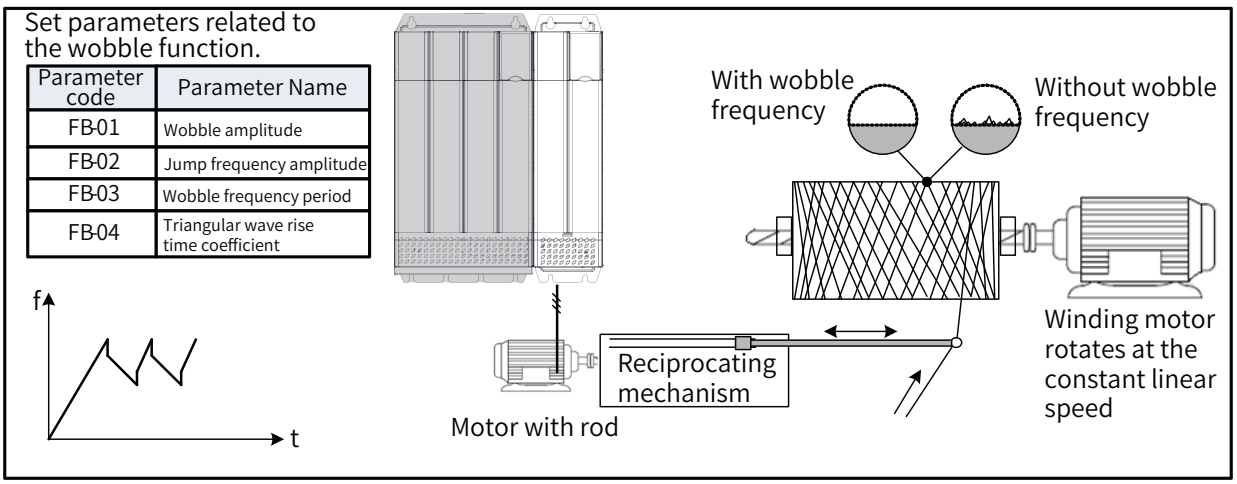


Figure 5-10 Application scenario of the wobble function

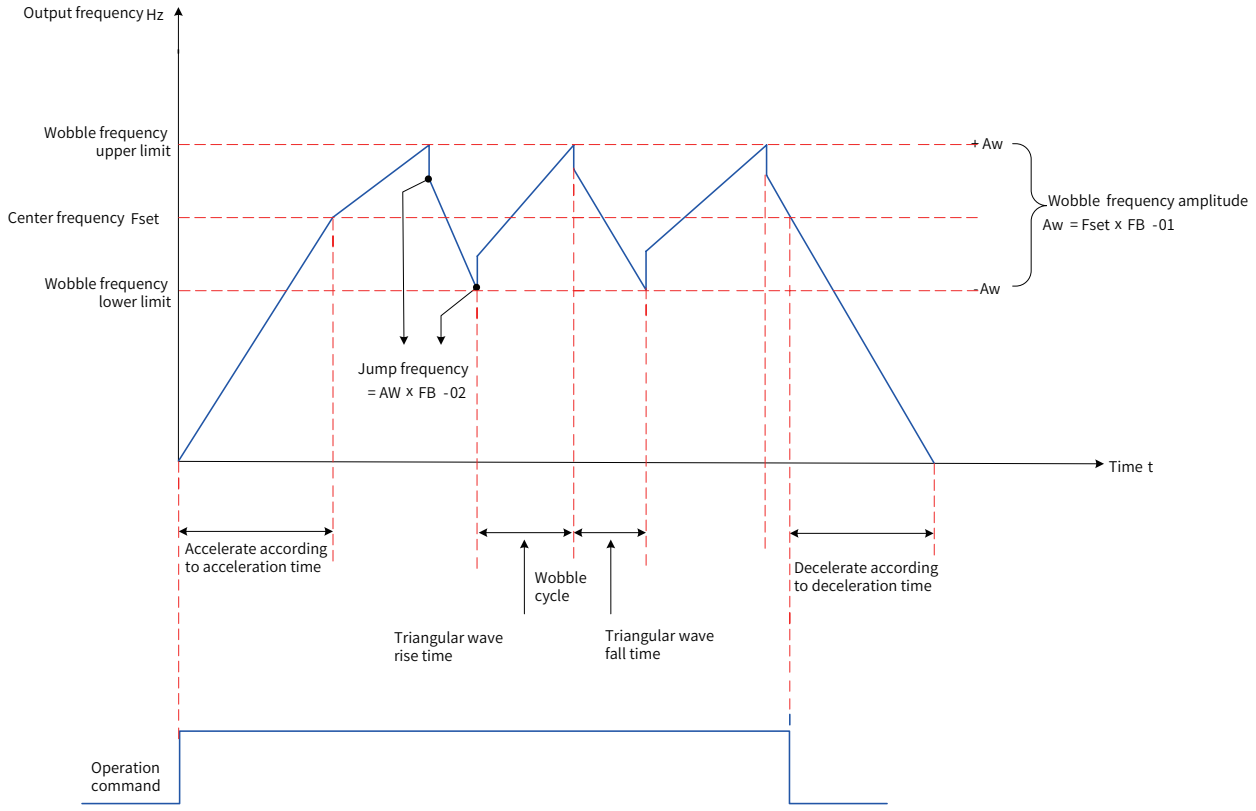


Figure 5-11 Working principle of the wobble function

Parameter Code	Parameter Name	Default	Value Range	Description
FB-00	Wobble setting mode	0	0: Relative to the center frequency	0: Relative to the center frequency (F0-07, frequency source superposition selection). This mode is a variable wobble system, in which the wobble changes with the center frequency.
			1: Relative to the maximum frequency	1: Relative to the maximum frequency (F0-10). This mode is a fixed wobble system, in which the wobble is fixed.
FB-01	Wobble amplitude	0.0%	0.0% to 100.0%	When FB-01 is set to 0, the wobble function is disabled.
FB-02	Jump frequency amplitude	0.0%	0.0% to 50.0%	This parameter defines the wobble amplitude and jump frequency amplitude. The wobble frequency is limited by the frequency upper limit and frequency lower limit.
FB-03	Wobble cycle	10.0s	0.1s to 3000.0s	This parameter defines the time of a complete wobble cycle.
FB-04	Wobble triangular wave rise time coefficient	50.0%	0.1% to 100.0%	This parameter indicates the percentage of triangular wave rising time to FB-03 (wobble cycle).

1) Wobble calculation

- When FB-00 is set to 0 (relative to the center frequency), the wobble is calculated according to the following formula:

Wobble (AW) = F0-07 (frequency source superposition selection) x FB-01 (wobble amplitude).

- When FB-00 is set to 1 (relative to the maximum frequency), the wobble is calculated according to the following formula:
  Wobble (AW) = F0-10 (maximum frequency) x FB-01 (wobble amplitude).

2) Jump frequency calculation

- During wobble, jump frequency = wobble frequency (AW) x FB-02 (jump frequency amplitude).
- When FB-00 is set to 0 (relative to the center frequency), the jump frequency is a variable.
- When FB-00 is set to 1 (relative to the maximum frequency), the jump frequency is a fixed value.

3) Calculation of the triangular wave rise/fall time

- Triangular wave rise time (unit: s) = FB-03 (wobble cycle) x FB-04 (triangular wave rise time coefficient)
- Triangular wave fall time (unit: s) = FB-03 (wobble cycle) x (1 – FB-04 (triangular wave rise time coefficient))

(Wobble cycle = Triangular wave rise time + Triangular wave fall time)

5.3 Fixed Length Control

The MD810 is equipped with the fixed length control function. The length pulses can be sampled only by DIO1. Therefore, you must allocate function 27 (Length count input) to DIO1.

Parameter Code	Parameter Name	Default	Value Range	Description
FB-05	Length reference	1000 m	0 m to 65535 m	-
FB-06	Actual length	0 m	0 m to 65535 m	The actual length is the monitored value. Actual length (FB-06) = Number of pulses sampled by terminal/Number of pulses per meter (FB-07)
FB-07	Number of pulses per meter	100.0	0.1 to 6553.5	-

In the following figure, the actual length is the monitored value.
Actual length (FB-06) = Number of pulses sampled by terminal/Number of pulses per meter (FB-07) When the actual length (FB-06) exceeds the length reference (FB-05), the relay or DO allocated with function 10 (Length reached) outputs an active signal. During fixed length control, length reset can be implemented by a multi-function DI with function 28 assigned. For details, see the following figure.

Parameter Code	Parameter Name	Value	Description
F4-04	DIO1 function selection	27	Length counting input
F4-00 to F4-09 (any one)	DI1 to DIO2 function selection (any one)	28	Length reset

F5-01 to F5-05 (any one)	Terminal output function selection (any one)	10	Length reached

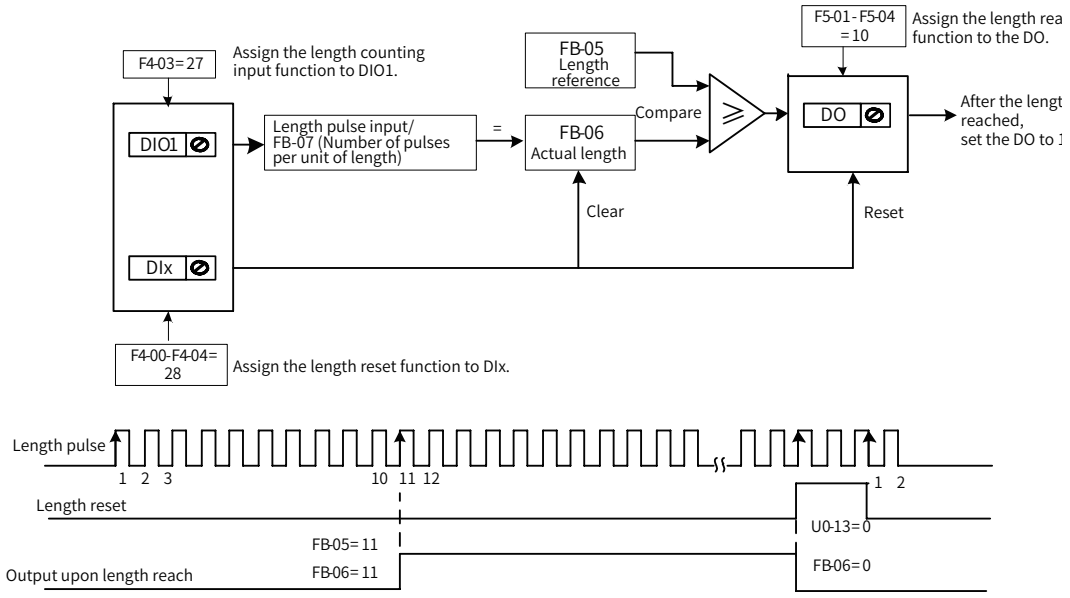


Figure 5-12 Fixed length control

Under the fixed length control mode, the length can be calculated only through the number of pulses because the direction cannot be identified.

When the T/A-T/B signal output by the relay with the length reach function allocated is fed to the stop input terminal of the AC drive, the AC drive stops automatically.

5.4 Counting

The DI allocated with function 25 (counter input) is used to collect the count value (when the pulse frequency is high, the DIO1 must be used).

Parameter Code	Parameter Name	Default	Value Range	Description
FB-08	Count value reference	1000	1 to 65535	-
FB-09	Designated count value	1000	1 to 65535	FB-09 must not be greater than FB-08.

In the following figure, the DI allocated with function 25 (counter input) is used to collect the count value. When the count value reaches the value of FB-08, the DO outputs an active signal indicating that the count value reference has reached. When the count value reaches FB-09, the DO outputs an active signal indicating that the designated count value has reached.

Parameter Code	Parameter Name	Value	Description
F4-00 to F4-04 (any one)	DI1 to DIO2 function selection (any one)	25	Counter input
F4-00 to F4-04 (any one)	DI1 to DIO2 function selection (any one)	26	Counting reset
F5-01 to F5-04 (any one)	Terminal output function selection (any one)	8	Counting value reference reached

F5-01 to F5-04 (any one)	Terminal output function selection (any one)	9	Designated counting value reached

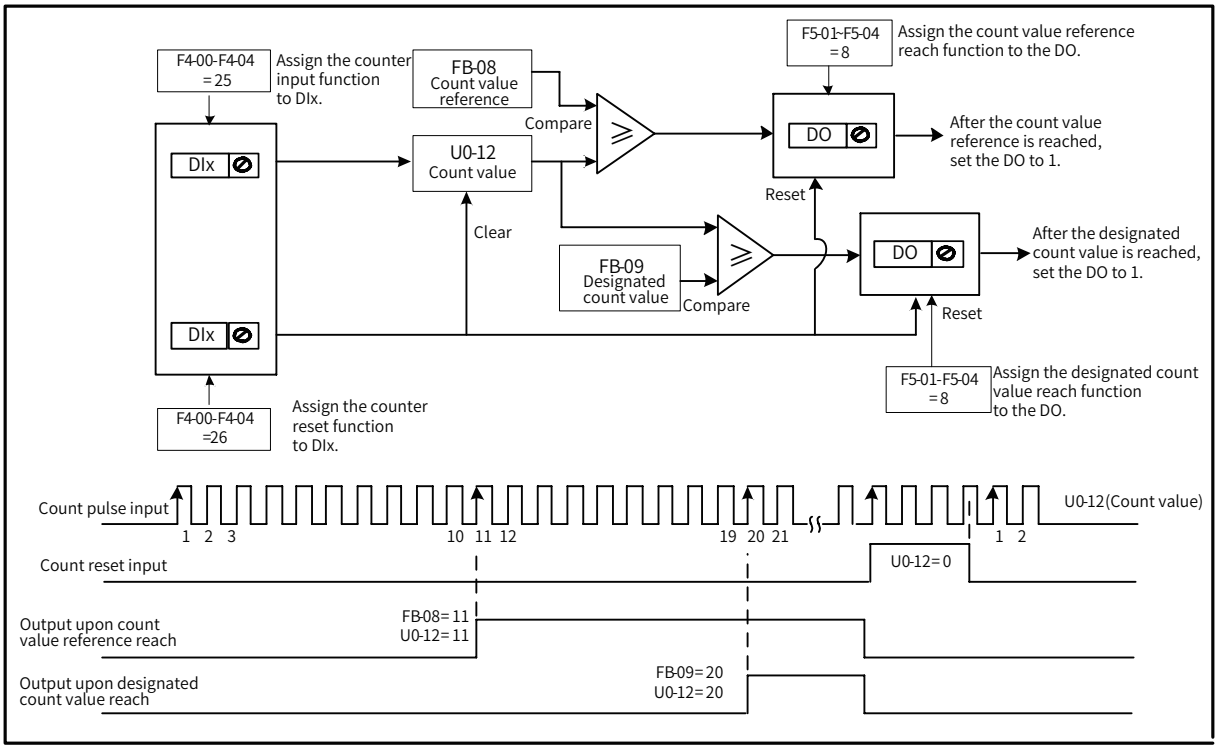


Figure 5-13 Counting function

DIO1 must be used when the pulse frequency is high.

One DO terminal can be assigned with either the "count value reference reach" function or the "designated count value reach" function.

The counter keeps counting when the AC drive is running or stops until the count value reference is reached.

The count value is retentive at a power failure.

When the count value reach signal output by the DO is fed to the AC drive stop input terminal, the AC drive stops automatically.

5.5 PID Adjustment Methods

This section describes general rules for PID parameter adjustment, which can be used as reference for adjusting process closed-loop control PID parameters (FA-05 to FA-07, and FA-15 to FA-17) and speed loop PI parameters (F2-00 to F2-04).

1) In the case of slow response, increase Kp.

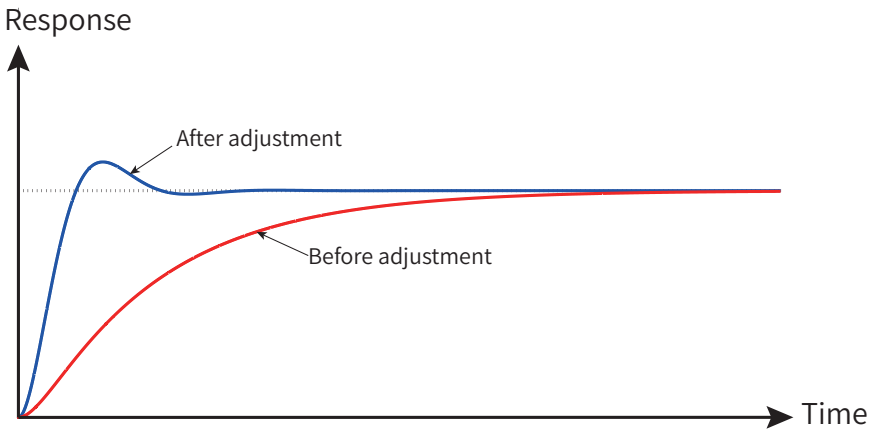


Figure 5-14 Response-time trend after increasing Kp

2) In the case of frequent oscillation, reduce Kp.

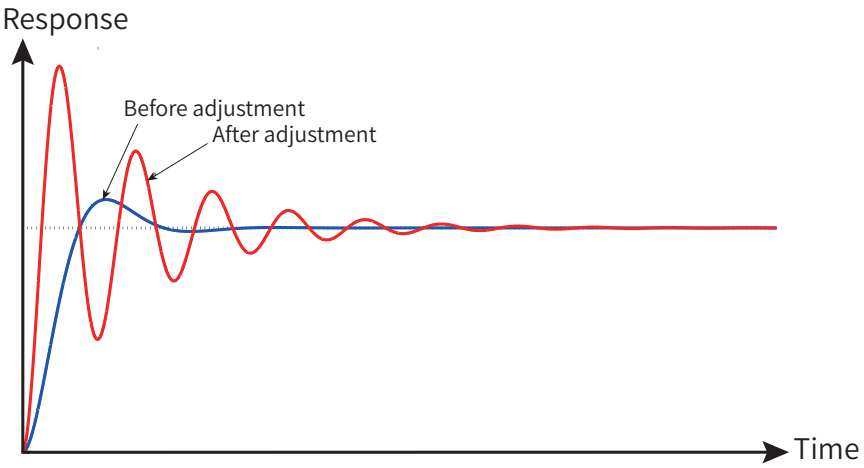


Figure 5-15 Response-time trend after decreasing Kp

3) In the case of large overshoot and slow fluctuation, increase Ti.

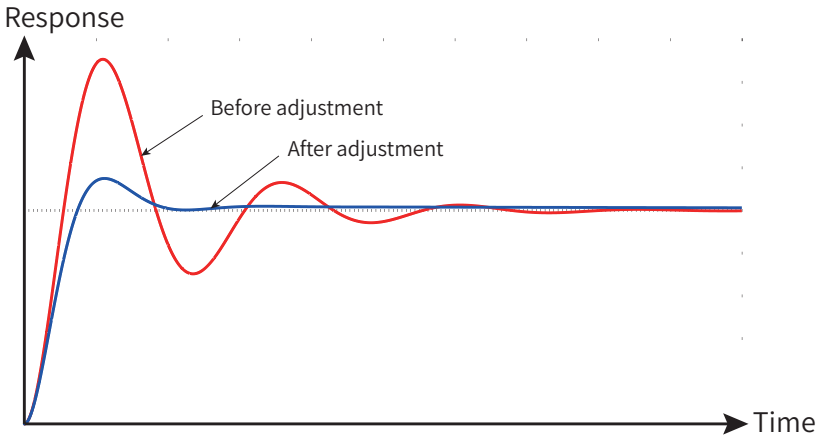


Figure 5-16 Response-time trend after increasing Ti

4) In the case of large static difference and slow response at load fluctuation, increase Kp or decrease Ti.

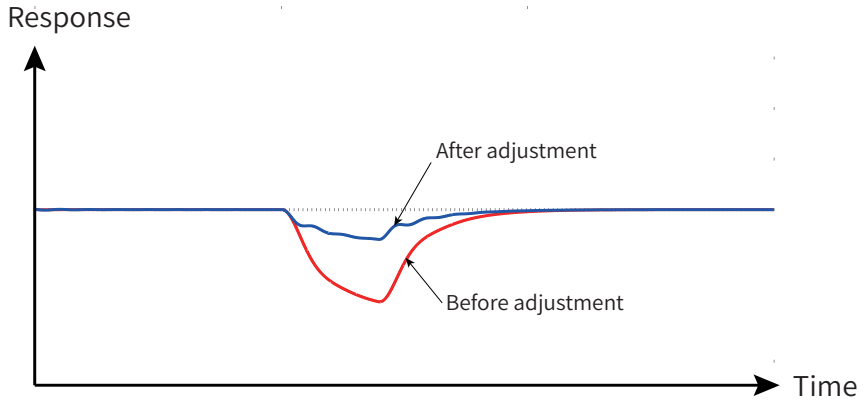


Figure 5-17 Response-time trend after increasing Kp at load fluctuation

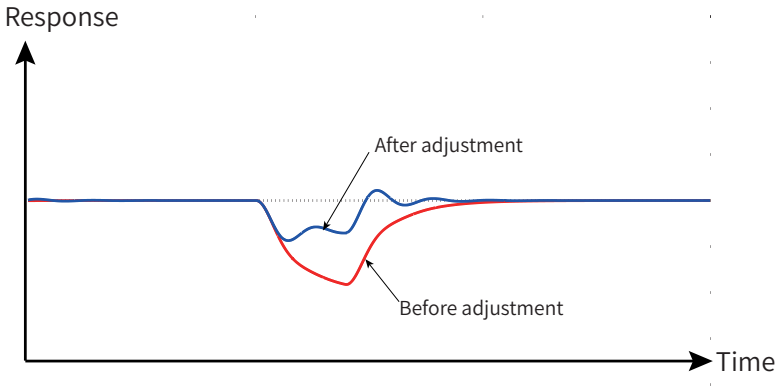


Figure 5-18 Response-time trend after decreasing Ti at load fluctuation

Note

- The above two methods can meet requirements of the same steady-state error. Generally, increasing Kp will have less impact on the stability of the system.

5) If the derivative time Td is set properly, the system stability can be improved. Note that if the derivative time Td is too long, interference and vibration may be caused.

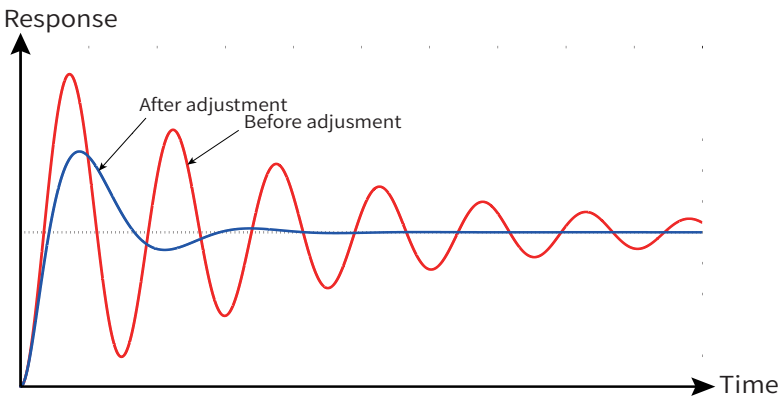


Figure 5-19 Response-time trend after setting the Td

5.6 Synchronization Control

This section mainly introduces the synchronous control components integrated in the AC drive. Typical applications and scenarios for each synchronous control function and related parameters will be described below.

The dedicated CAN for synchronous control provides dedicated communication links for the synchronous control function. Before using the synchronous control function, perform networking for the drive through the CAN2 interface.

Currently, four synchronization control modes are available for meeting different process requirements.

- Speed synchronization
- Position synchronization
- Load distribution
- Droop control

When performing synchronous control networking, ensure that the node used to connect the dedicated CAN network for synchronous control has different bus communication addresses.

Parameter Code	Parameter Name	Default	Value Range	Description
A8-00	Local address	1	1 to 124	It is used to set the station number of the synchronous control network node.

The baud rate of the dedicated CAN bus for synchronous control is fixed to 1 Mbps and cannot be modified.

Network timeout time can be set for the slave nodes. If a slave detects network communication timeout, the AC drive reports a bus fault E16.15. For scenarios where slight interference exists on the network and frequent stop upon communication faults is not allowed, set the timeout time to 0 (cancel) or increase the timeout time.

Parameter Code	Parameter Name	Default	Value Range	Description
A8-02	Synchronous control communication times out. Communication timeout period	1.0s	0.0s to 10.0s	Slave valid When this parameter is set to 0, the fault detection is canceled.

The slave start/stop can be controlled by separate command setting modes (DI or external communication) or the slave can be configured to follow the start/stop command of the master to simplify wiring or reduce external communication load.

Parameter Code	Parameter Name	Default	Value Range	Description

A8-14	Slave configuration parameter	1	0: The slave does not follow the master to start/ stop. 1: The slave follows the master to start/ stop.	It is valid for the slave for speed and position synchronization.
A8-54	Slave configuration parameter	1	0: The slave does not follow the master to start/ stop. 1: The slave follows the master to start/ stop.	It is valid for the slave for load distribution.
A8-74	Slave configuration parameter	1	0: The slave does not follow the master to start/ stop. 1: The slave follows the master to start/ stop.	It is valid for the slave for droop control.

Set other parameters in group A8 according to the selected synchronization mode. The parameters in group A8 for different synchronization modes are described as follows:

- Parameters for speed/position synchronous control: A8-10 to A8-43
- Parameters for load distribution: A8-50 to A8-63
- Parameters for droop control: A8-70 to A8-81

5.6.1 Speed/Position Synchronization

The mechanical devices or processes contain multiple nodes with mechanical or process connections, which requires the running speed of different nodes to keep certain ratio. In this case, speed synchronization applies.

The following figure shows a typical application. The speed ratio between the transmission nodes is configured to fix the linear speed ratio, realizing tension control of flexible materials (tension determined by the node speed difference at the two ends of the material) between the transmission nodes.

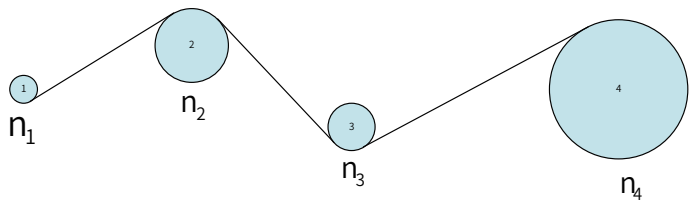


Figure 5-20 Typical application of speed synchronization

In the speed synchronization mode, position deviation will be accumulated. Therefore, for scenarios where the slave is required to follow the position of the master strictly, use position synchronization. The following figure shows a typical position control application. The lifting and lowering positions of the master and slave must be synchronous to ensure stable move-

ment of the load.

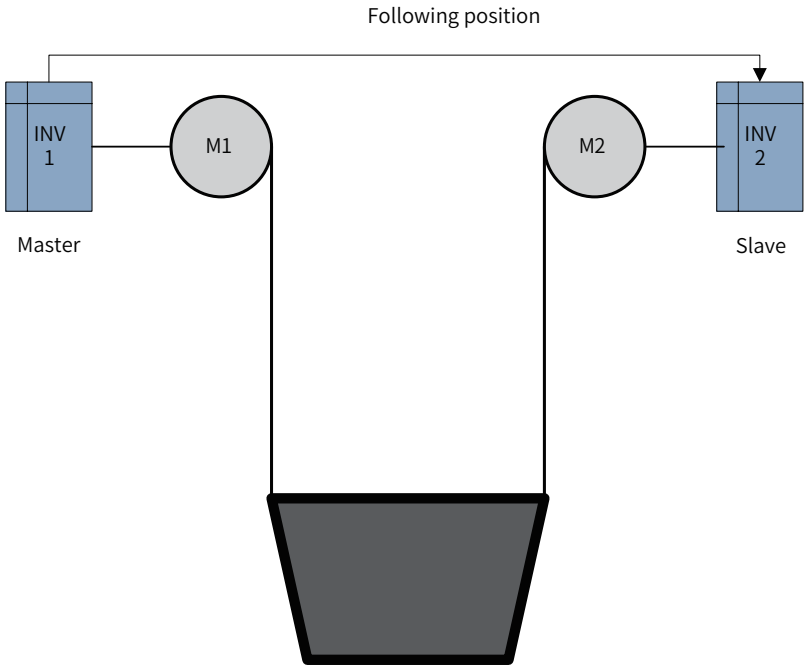


Figure 5-21 Typical application of position synchronization

Do not use speed synchronization and position synchronization for the transmission structure with only rigid connections. Otherwise, the drive direction may be reverse, causing overload or mechanical damage.

Two or more synchronous nodes may exist on a synchronous control network. You can set the following parameters to enable flexible master and slave configuration and synchronization settings.

Parameter Code	Parameter Name	Default	Value Range	Description
A8-10	Speed synchronization Master/Slave selection in droop control	0	0 to 3	0: Disable (speed and position synchronization disabled) 1: Master 2: Slave 3: Intermediate node
A8-11	Synchronization mode selection	0	0 to 1	0: Speed synchronization 1: Position synchronization
A8-12	Follow master station number	1	1 to 124	It is valid for the slave.

Example

1) Configuration solution 1: On the network, only one speed/position synchronization master is set and other nodes synchronize the speed or position of the master, as shown in the following figure.

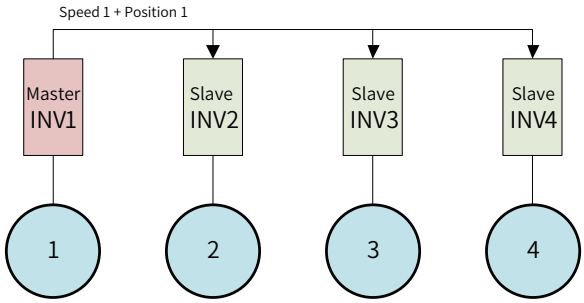


Figure 5-22 Single master mode

2) Configuration solution 2: On the network, the next level node follows the previous level node. That is, one master, several intermediate nodes, and one slave are set on the network, as shown in the following figure.

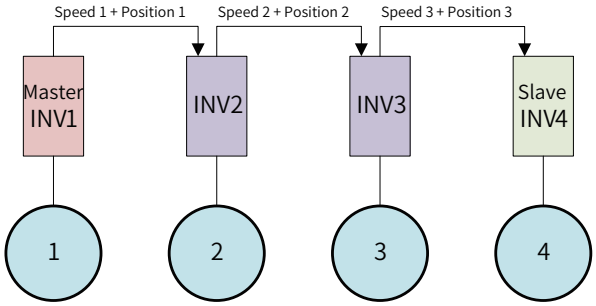


Figure 5-23 Serial connection mode

5.6.2 Load Distribution

Load distribution is applicable for scenarios where multiple motors drive the same motor or process, which requires speed synchronization and load balance between the motors. Generally, rigid connection is applied between the motors and speed synchronization between motors can be ensured through the mechanical structure. The AC drive ensures that the torque of all motors is synchronous, that is, the load is distributed among the motors.

The tension roller is a typical application of load distribution, as shown in the following figure.

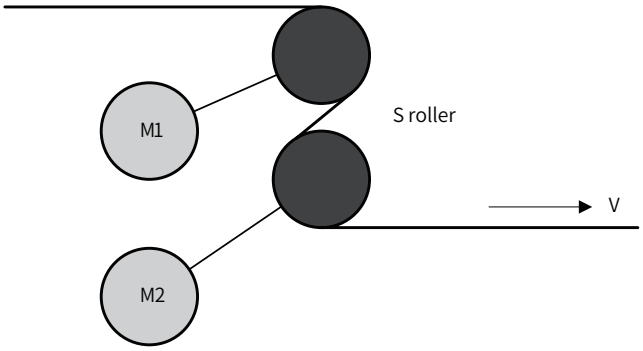


Figure 5-24 Typical application of load distribution

The tension roller is mainly used in the strip production line to control the strip speed in certain process segments. The strip tension and speed can be controlled easily by increasing the friction force between the strip and roller bed surfaces. Each of the two roller beds is controlled by one motor separately. Speed and torque must be synchronized between the two

motors.

In the load distribution mode, the master transfers the torque and speed to the slave simultaneously. This ensures speed and torque synchronization during normal operation and limits the slave motor speed to prevent runaway upon stall when slip occurs.

Different torque distribution can be enabled by setting the following parameters for the slave. The slave speed limit can be set flexibly to realize slave speed control under abnormal conditions.

Parameter Code	Parameter Name	Default	Value Range	Description
A8-57	Frequency gain	1.00	-10.00 to 10.00	Gain and offset percentage of the frequency and torque
A8-58	Frequency offset	0.00%	-100.00% to 100.00%	
A8-59	Torque gain	1.00	-10.00 to 10.00	
A8-60	Torque offset	0.00%	-100.00% to 100.00%	

5.6.3 Droop Control

In some flexible connection systems, such as belt drive or applications where slip occurs easily, the speed synchronization between motors cannot be ensured by mechanical connections, and load unbalance occurs due to machining accuracy or friction force difference. In this case, droop control can be used to ensure load balance between motors.

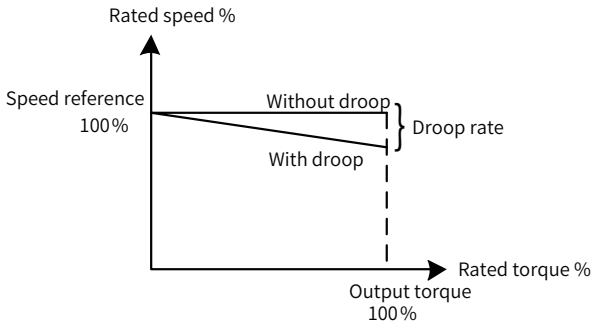


Figure 5-25 Droop control principle

Parameter Code	Parameter Name	Default	Value Range	Description
A8-77	Droop ratio	5.00%	0.00% to 15.00%	Under the same load torque, when the value of this parameter is increased, the reduction value of the set frequency is increased.

The typical application of the droop control is to transfer objects on the roller bed. Multiple roller beds are placed in one row, each roller or several rollers are driven by one motor and the row of roller beds are driven by multiple motors with the same speed. Objects are transferred through the friction force between the objects and roller beds, which requires load balance on each roller bed.

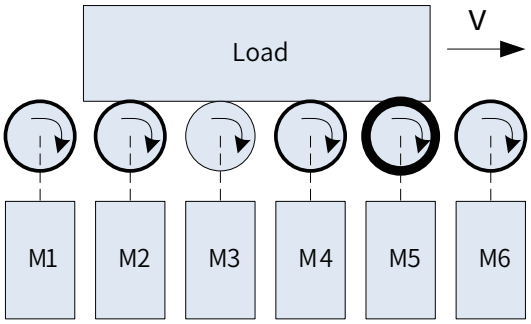


Figure 5-26 Typical application of droop control

In the droop control mode, the original set frequency is given by the master and the slave follows the set frequency of the master. The master and slave adjust the frequency based on their own droop rate to realize load distribution. Besides, in scenarios where only one motor is used for control or where the dedicated CAN network for synchronous control is unavailable, droop control of a single motor can be enabled by using the self-droop function.

Parameter Code	Parameter Name	Default	Value Range	Description
A8-70	Droop control Master/Slave selection in droop control	0	0 to 3	0: Disable (droop control function disabled) 1: Master 2: Slave 3: Self-droop

5.6.4 Combination of Synchronous Control Modes

The preceding sections describe the applicable scenarios and typical applications of each synchronous control mode. In some scenarios with complicated process control, multiple types of synchronous control may be required at the same time. In this case, several synchronous control modes can be flexibly combined through parameter settings.

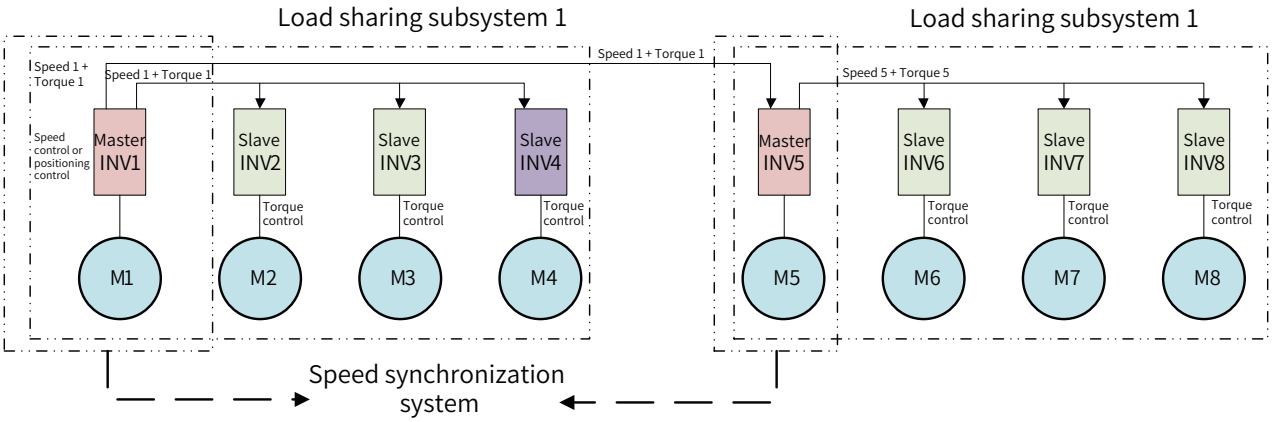


Figure 5-27 Combination example of synchronous control modes

The preceding example is for reference.

- According the process requirements, INV1 runs at the set frequency and works with INV5 as a speed following system. It is set as the speed synchronization master. INV1 is also configured as the master of load distribution subsystem 2. Load distribution is enabled between

INV2 to INV4 according to the torque sent by INV1.

- INV5 works as the slave of INV1 in the speed synchronization system and the master in load distribution subsystem 2. It works with INV6 to INV8 to realize load distribution among the other four nodes.

If more than one master is configured on the network, the values of A8-52 and A8-72 must be different (note the synchronization mode of the slaves).

Parameter Code	Parameter Name	Default	Value Range	Description
A8-12	Synchronize master station number (valid for slave)	1	1 to 124	It is valid for the slave for speed and position synchronization.
A8-52	Follow master station number	1	1 to 124	It is valid for the slave for load distribution.
A8-72	Follow master station number	1	1 to 124	It is valid for the slave for droop control.

When multiple synchronization modes are combined, one node can be set as the master of multiple synchronization modes or as the master of one mode and slave of another mode at the same time. However, one node cannot be set as the slave of two or mode synchronization modes. Otherwise, the AC drive reports the synchronous control parameter setting error (E46.01).

6 Troubleshooting

6.1. Safety Precautions

General Safety Instructions
DANGER ◆ Never wire the drive with power on, and keep all circuit breakers in the OFF state. Failure to comply will result in electric shock.
WARNING ◆ Ground the drive according to local regulations. Failure to comply can result in the risk of electric shock or fire. ◆ Do not remove the drive housing or touch internal circuits when the drive is energized. Failure to comply can result in electric shock. ◆ Troubleshooting must be performed by professionals. The drive must be inspected, maintained, and repaired by professionals. Failure to comply can result in the risk of electric shock or fire. ◆ When installing the drive into an enclosed cabinet or chassis, use a cooling fan or air conditioner to keep the temperature of the inlet air below 50°C . Failure to comply can result in overtemperature or fire. ◆ Tighten all screws with specified tightening torque. Failure to comply may result in electric shock or fire. ◆ Ensure that the input voltage of the AC drive is within the rated voltage on the nameplate. Failure to comply may result in electric shock or fire. ◆ Keep combustible and explosive materials away from the drive.
CAUTION ◆ Cover the upper part of the drive with a piece of paper or cloth during installation. This is to prevent unwanted objects such as metal chippings, oil, and water from entering the drive. Foreign objects entering the drive may cause fault of the drive. ◆ Remove the paper or cloth after installation is done. Failure to comply may degrade ventilation and result in overtemperature of the drive. ◆ Follow proper electrostatic discharge (ESD) measures when operating the drive. Failure to comply will result in damage to the internal circuits due to static electricity.

6.2 Troubleshooting During Trial Run of the Drive Unit

1) SVC mode (default: F0-01= 0)

In this mode, the drive controls the motor speed and torque without an encoder for speed feedback. Auto-tuning on motor parameters is required to obtain the motor parameters.

Fault	Solution
Overload or overcurrent during motor start	● Set motor parameters F1-01 to F1-05 according to the motor nameplate. ● Perform auto-tuning on the motor parameters (F1-37 = 03) or dynamic complete auto-tuning on the motor parameters (F1-37 = 02) if possible. ● Reduce the value of F2-10 (torque upper limit) to keep it within 120% to 150%.

Fault	Solution
Slow response in torque/speed control mode and great motor speed fluctuation at the frequency below 5 Hz	● To shorten the response time in the speed control mode (A0-00 = 00), 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. If vibration occurs, decrease the values of F2-00 and F2-01. ● To shorten the response time in the torque control mode (A0-00 = 01), if the drive cannot be started, the static friction force of the mechanical device may be too large or the torque reference may be too low. In this case, increase the torque reference. ● To shorten the response time in the torque control mode (A0-00 = 01), if the motor speed of the winding device fluctuates violently, the tension of the winding material may fluctuate during winding. In this case, enable the speed fluctuation suppression function.
Slow in torque/speed control mode and great motor speed fluctuation at the frequency above 5 Hz	● To shorten the response time in the torque or speed control mode, 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 shorten the response time in the torque control mode (A0-00 = 01), if the drive cannot be started, the static friction force of the mechanical device may be too large or the torque reference may be too low. In this case, increase the torque reference. ● To shorten the response time in the torque control mode (A0-00 = 01), if the motor speed of the winding device fluctuates violently, the tension of the winding material may fluctuate during winding. In this case, enable the speed fluctuation suppression function.
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	● If the motor speed fluctuates, increase the value of F2-07 (speed filter time in closed-loop vector control) or A9-05 (speed filter time in open-loop vector control) by the step value of 0.001s. ● Increase the speed loop ratio.
Excessive 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	● Check whether the torque upper limit is set to a low value. If yes, increase the value of F2-10 (Torque upper limit) in the speed control mode or increase the torque reference in the torque control mode.

2) 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.

Fault	Solution
Overload or overcurrent fault detected during startup	● Set the encoder pulses per revolution, encoder type, and encoder direction correctly.
Overload or overcurrent 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. Perform dynamic complete auto-tuning on motor parameters if possible.

Fault	Solution
Slow torque/speed response and motor oscillation occur at a frequency below 5 Hz.	● To shorten the response time in the speed control mode (A0-00 = 00), 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. If vibration occurs, decrease the values of F2-00 and F2-01. ● To shorten the response time in the torque control mode (A0-00 = 01), if the drive cannot be started, the static friction force of the mechanical device may be too large or the torque reference may be too low. In this case, increase the torque reference. ● To shorten the response time in the torque control mode (A0-00 = 01), if the motor speed of the winding device fluctuates violently, the tension of the winding material may fluctuate during winding. In this case, enable the speed fluctuation suppression function.
Slow torque/speed response and motor oscillation occur at a frequency above 5 Hz.	● To shorten the response time in the torque or speed control mode, 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 shorten the response time in the torque control mode (A0-00 = 01), if the drive cannot be started, the static friction force of the mechanical device may be too large or the torque reference may be too low. In this case, increase the torque reference. ● To shorten the response time in the torque control mode (A0-00 = 01), if the motor speed of the winding device fluctuates violently, the tension of the winding material may fluctuate during winding. In this case, enable the speed fluctuation suppression function.
Obvious speed fluctuation	● Increase the value of F2-07 (speed filter time) by the step value of 0.001s when motor speed fluctuates abnormally. ● Increase the speed loop ratio and shorten the speed loop integral time.
Excessive motor noise	● Increase the value of F0-15 (Carrier frequency) by the step value of 1.0 kHz gradually. Note that the increase of carrier frequency will increase the leakage current of the motor.
Insufficient motor torque	● Check whether the torque upper limit is too low. If yes, increase the value of F2-10 (torque upper limit) in the speed control mode or the value of the torque reference in the torque control mode.

3) V/f control mode (F0-01 = 2)

This mode is applicable to scenarios without an encoder for speed feedback. You only need to set motor parameters according to the motor nameplate. Auto-tuning is not required.

The set rated motor current will affect motor overload protection.

Fault	Solution
Motor oscillation during running	● Increase the value of F3-11 (V/f oscillation suppression gain) by the step value of 10. The permissible maximum value is 100.
Overcurrent during high-power startup	● Decrease the value of F3-01 (Torque boost) by the step value of 0.5%. Increase the value of F0-17 (Acceleration time).
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%, or set F3-01 (Torque boost) to 0.0%.

Fault	Solution
Excessive motor noise	● Increase the value of F0-15 (Carrier frequency) by the step value of 1.0 kHz. Note that the increase of carrier frequency will increase the leakage current of the motor.
Overvoltage during deceleration or when heavy load is suddenly removed	● Set F3-23 (V/f 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%.

6.3 Fault Display and Solution

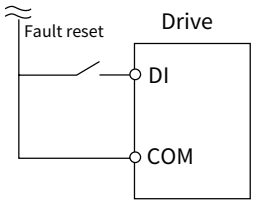
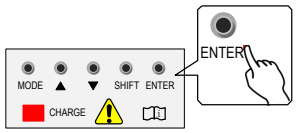
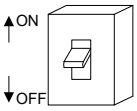
The drive may encounter faults and alarms. The priority of faults is higher than that of alarms.

1. Example of fault display:

2. Example of alarm display:

When a fault occurs during running, the AC drive stops output immediately, the fault indicator flashes red, and the contact of the fault relay acts. For details about the faults and solutions, see the following table. The following information is only for reference. Do not repair or modify the drive by yourself. If the fault cannot be eliminated, contact the agent or Inovance for technical support.

Stage	Solution	Remarks
Upon occurrence of the fault	Check the keypad for detailed information of the recent three faults, such as the fault type and the time, frequency, current, bus voltage, DI/DO state, cumulative power-on time, cumulative running time, IGBT temperature, and fault subcode upon occurrence of the faults.	View the record through F9-14 and F9-46. ...
Before fault reset	Before fault reset, find the fault cause and clear the fault according to the fault type displayed on the keypad.	Troubleshoot the fault according to section 6.4.

Stage	Solution	Remarks
Fault reset	(1) Allocate function 9 (fault reset) to the DI by setting any of F4-00 to F4-04 to 9.	
	(2) Press the **ENTER** key on the keypad in any mode.	
	(3) Power off and then power on the drive, so that the drive is reset automatically. 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.	

6.4 Fault List and Solution

6.4.1 Fault List for the Power Supply Unit

Fault Name	Fault Code	Cause	Solution
The grid voltage is abnormal.	E12.01	Phase R loss occurs on input three-phase voltage.	Check whether the three-phase power supply is normal. Check the input cables for wire breakage. Check whether input cable terminals are properly connected. Check the hardware voltage detection circuit.
	E12.02	Phase S loss occurs on input three-phase voltage.	Check whether the three-phase power supply is normal. Check the input cables for wire breakage. Check whether input cable terminals are properly connected. Check the hardware voltage detection circuit.
	E12.03	Phase T loss occurs on input three-phase voltage.	Check whether the three-phase power supply is normal. Check the input cables for wire breakage. Check whether input cable terminals are properly connected. Check the hardware voltage detection circuit.
	E12.04	The power grid input voltage exceeds the rated value.	Adjust the three-phase voltage to a normal range.
	E12.05	The input three-phase voltage is unbalanced.	Check whether the three-phase power supply is normal. Check whether the hardware voltage detection circuit is normal.
	E12.06	The input cable is disconnected.	Check whether the three-phase input terminal is connected to the power grid.
Drive over-temperature	E14.00	The ambient temperature is too high.	Lower down the ambient temperature.
		The air duct is blocked.	Clean the air duct.
		The fan is damaged.	Replace the fan.
		The thermistor is damaged.	Contact the agent or Inovance.
		The module is damaged.	Contact the agent or Inovance.
Comm. fault	E16.01	Modbus communication timeout	Ensure that the RS-485 cable is connected properly. Ensure that the RS-485 cable is free from interference. Ensure that the value of Fd-04 for the power supply unit is greater than the PLC communication cycle.
	E16.11	CANopen communication timeout	Ensure that the CAN communication cable is connected properly. Check parameters FD-15 to FD-17 to confirm the interference and eliminate the interference. Ensure that heartbeat messages are transmitted and the device is normal.
	E16.12	The PDO mapping configured for CANopen is inconsistent with the actual communication mapping.	Check whether the PDO mapping of group FE/AF is consistent with the PDO and ensure that the PDO is configured correctly. Check whether the mapping relationship configured on the master station conforms to the EDS file specification of the MD810.
	E16.13	Abnormality occurs when the drive unit receives interactive data from the power supply unit.	Check whether the power supply unit is in operation. Check whether the communication cable between the power supply unit and the drive unit is connected. Check whether the termination resistor is properly connected. Check whether Fd-12 (CAN baud rate) is correctly set. Note: You can set related parameters to shield fault E16.13. For the G2xx models, set FF-12. For the G3xx and G4xx models, set FD-28.

Fault Name	Fault Code	Cause	Solution
Comm. fault	E16.14	Abnormality occurs when the drive unit receives interactive data from the power supply unit.	The power supply unit is faulty. Eliminate the fault.
	E16.21	CANlink heartbeat message timeout	Check and ensure that the CANlink communication cable is correctly connected. Check the values of Fd-15 to Fd-17 and confirm interference.
	E16.22	CANlink station number conflict	Modify the repeated CAN station numbers by using Fd-13.
	E16.31	PROFIBUS DP communication times out (dedicated for PROFIBUS DP-to-CANopen bridge mode)	Check whether the PROFIBUS DP communication cable is connected properly.
	E16.34	An offline CAN slave is detected during configuration of the PROFIBUS DP-to-CANopen bridge.	Check whether the value of "The number of devices" for the PLC matches the actual quantity of stations. Check whether the station numbers of slaves are correctly set.
Comm. fault	E16.35	Parameters for configuring PROFIBUS DP-to-CANopen bridge are set improperly.	Check whether the value of "NO.n" for the PLC is consistent with that of AF-66/67 for the drive according to the PLC diagnostic message.
	E16.41	PROFIBUS DP communication times out.	Check whether the PROFIBUS DP communication cable is correctly connected.
	E16.42	Parameters for configuring PROFIBUS DP-to-CANopen bridge are set improperly.	Check whether the value of "NO. 1" for the PLC is consistent with that of AF-66/67 for the drive.
Comm. fault	E16.71	PROFINET communication times out.	Check the Ethernet wiring. Increase the PROFINET timeout time.
	E16.72	CANopen slave communication times out.	Check the wiring. Check whether the termination resistor is configured correctly.
	E16.74	The configured CANopen slave is lost.	Modify the AC drive station number or modify the PLC configuration to ensure consistent configuration.
	E16.75	CANopen mapping data does not match.	Check the process data mapping of parameter configuration. Ensure that the data length of the PLC configuration is consistent with the process data length of the corresponding slave.
	E16.76	The process data of the power supply unit does not match the configuration.	Check the process data mapping of parameter configuration. Ensure that the data length of the PLC configuration is consistent with the process data length of the power supply unit.
	E16.77	Internal serial port communication fault	Set FD-10 to 5 and power on again. If the fault persists, contact the agent or Inovance.
	E16.78	Internal SPI communication fault	Set FD-10 to 5 and power on again. If the fault persists, contact the agent or Inovance.

Fault Name	Fault Code	Cause	Solution
EEPROM reading/writing fault	E21.01	An error occurs during parameter writing.	If the EEROM chip is damaged, contact the manufacturer for replacement.
	E21.02	An error occurs during parameter reading.	If the EEROM chip is damaged, contact the manufacturer for replacement.
	E21.03	An error occurs during parameter reading and writing.	If the EEROM chip is damaged, contact the manufacturer for replacement.
	E21.04	The number of parameters to be written exceeds the limit.	Reduce the number of parameters to be written in a short period of time.
Braking unit fault	E61.01	The braking unit is shoot-through.	Check whether the braking resistor is short-circuited. Check whether the braking transistor is shoot-through.
	E61.02	The braking unit encounters overcurrent.	Check whether the resistance and power of the braking resistor are too small. Check for interference. Check whether an error occurs during hardware circuit detection.
	E61.03	The braking unit is overloaded.	Check whether the resistance and power of the braking resistor are too small.
	E61.04	The braking unit overheats.	Lower down the ambient temperature. Check whether the cooling fan runs properly. Clean the air duct. Check whether the temperature sensor is damaged. If yes, contact the agent or Inovance.

6.4.2 Fault List of the Drive Unit (Non-G53X Models)

Note

- This section applies only to drive units other than MD810-50M4TXXXG53X.

Fault Name	Fault Code	Cause	Solution
Hardware fault	E01.01	The current sampling circuit of the drive is faulty.	Check whether the main circuit is powered on. Check whether the Hall sensor or current sampling circuit is damaged. If yes, contact Inovance for technical support.
	E01.02	The driver board and power supply are faulty.	Contact the agent or Inovance.
		The contactor is faulty.	Contact the agent or Inovance.
		The lightning protection board is abnormal.	Contact the agent or Inovance.
	E01.05	The product model and hardware do not match.	Check whether the set product model is correct.
	E01.06	The product hardware does not support STO.	Check whether the unit does not feature the STO function, and contact the manufacturer if so.
Overcurrent during acceleration	E02.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check the motor or contactor for short circuit.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The acceleration time is too short under abrupt acceleration conditions.	Increase the acceleration time (F0-17).
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 160%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The manual torque boost value or V/f curve is improper.	Adjust the manual torque boost value or V/f curve.
		The motor is started while rotating.	Select the flying start mode or start the drive after the motor stops.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.

Fault Name	Fault Code	Cause	Solution
Over-current during deceleration	E03.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check whether the motor is short-circuited or disconnected.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The deceleration time is too short under abrupt deceleration conditions.	Increase the deceleration time (F0-18).
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 150%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.
Over-current during operation at constant speed	E04.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check whether the motor is short-circuited or disconnected.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 150%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The power rating of the AC drive is too low.	In the stable operation state, if the operating current exceeds the rated current of the motor or the rated output current of the drive, select an AC drive with a higher power rating.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.

Fault Name	Fault Code	Cause	Solution
Overvoltage during acceleration	E05.00	The input grid voltage is too large.	Adjust the voltage until it is within the normal range.
		External force drives the motor during acceleration.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
		The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (overvoltage stall suppression gain) is too small. Change it to a value between 30 to 50.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
		The acceleration time is too short.	Increase the acceleration time.
Overvoltage during deceleration	E06.00	The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (overvoltage stall suppression frequency gain) is too small. Change it to a value between 30 and 50.
		External force drives the motor during deceleration.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
		The deceleration time is too short.	Increase the deceleration time.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
Overvoltage during operation at a constant speed	E07.00	The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (Overvoltage suppression frequency gain) is too small. Change it to a value between 30 and 50.
		External force drives the motor during running.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
Pre-charge resistor overload	E08.00	The pre-charge resistor is overloaded.	Contact the agent or Inovance.

Fault Name	Fault Code	Cause	Solution
Under-voltage	E09.00	An instantaneous power failure occurs.	Enable the power dip ride through function (F9-59).
		The input voltage of the AC drive is beyond the specified range.	Adjust the voltage to a value within the normal range.
		The bus voltage is abnormal.	Contact the agent or Inovance.
		The power supply unit, the driver board of the drive unit, or the control board of the drive unit is faulty.	Contact the agent or Inovance.
Drive overload	E10.00	The load is too heavy or the motor is stalled.	Reduce the load and check the motor and mechanical conditions.
		The power rating of the AC drive is too low.	Replace the AC drive with one of higher power rating.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The control mode is V/f control.	The torque boost (F3-01) is set to an excessively high value. Decrease the value of F3-01 by the step value of 1.0% every time or set it to 0 (automatic torque boost).
Motor overload	E11.00	F9-01 (motor overload protection gain) is set improperly.	Set F9-01 properly. Increasing the value of F9-01 prolongs the motor overload time.
		The load is too heavy or the motor is stalled.	Reduce the load and check the motor and mechanical conditions.
Input phase loss	E12.00	The input side of the power supply unit is not connected to the power grid.	Connect the input side of the power supply unit to the power grid.
Output phase loss occurs.	E13.00	The motor is faulty.	Check whether the motor is disconnected.
		The cable connecting the drive and the motor is faulty.	Eliminate external faults.
		The three-phase outputs of the AC drive are unbalanced during motor running.	Check whether the motor three-phase winding is normal and eliminate the fault.
		The driver board or the IGBT module is faulty.	Contact the agent or Inovance.
Drive over-temperature	E14.00	The ambient temperature is too high.	Lower down the ambient temperature.
		The air duct is blocked.	Clean the air duct.
		The fan is damaged.	Replace the fan.
		The thermistor is damaged.	Contact the agent or Inovance.
		The module is damaged.	Contact the agent or Inovance.

Fault Name	Fault Code	Cause	Solution
The external device is faulty.	E15.01	An external fault signal is input through the multi-functional DI (NO).	Eliminate external faults and ensure that restart (F8-18) is allowed under the mechanical condition for reset.
		An external fault signal is input through the virtual I/O terminal (NO).	Check that the virtual I/O parameters in group A1 are set correctly and reset the operation.
	E15.02	An external fault signal is input through the multi-functional DI (NC).	Eliminate external faults and ensure that restart (F8-18) is allowed under the mechanical condition for reset.
		An external fault signal is input through the virtual I/O terminal (NC).	Check that the virtual I/O parameters in group A1 are set correctly and reset the operation.

Fault Name	Fault Code	Cause	Solution
Comm. fault	E16.01	Modbus communication timeout	Check whether the RS-485 communication cable is correctly connected. Check whether the value of Fd-04 and the PLC communication cycle are proper.
	E16.11	CANopen communication times out.	Check whether the CAN communication cable is correctly connected. Check the values of Fd-15 to Fd-17 and confirm interference.
	E16.12	The PDO mapping configured for CANopen is inconsistent with the actual communication mapping.	Check the PDO mapping in group AF.
	E16.13	Data exchange from the power supply unit to the drive unit times out.	Check whether the power supply unit is in operation.
			Check whether the communication cable between the power supply unit and the drive unit is connected.
			Check whether the termination resistor is properly connected.
			Check whether Fd-12 (CAN baud rate) is correctly set.
Comm. fault	E16.14	Abnormality occurs when the drive unit receives interactive data from the power supply unit.	The power supply unit is faulty. Eliminate the fault.
	E16.15	Synchronous control communication times out.	Check parameters in group A8 to see whether the master station and slave station numbers are correct, and check whether the CAN2 cable is connected properly.
	E16.21	CANlink heartbeat message timeout	Check whether the CAN communication cable is correctly connected. Check the values of Fd-15 to Fd-17 and confirm interference.
	E16.22	CANlink station number conflict	Modify the repeated CAN station numbers by using Fd-13.
	E16.31	PROFIBUS DP communication times out (dedicated for PROFIBUS DP-to-CANopen bridge mode).	Check that the PROFIBUS DP communication cable is correctly connected.
Comm. fault	E16.34	An offline CAN slave is detected during configuration of the PROFIBUS DP-to-CANopen bridge.	Check whether the value of "The number of devices" for the PLC matches the actual quantity of stations.
	E16.35	Parameters for configuring the PROFIBUS DP-to-CANopen bridge are set incorrectly.	Check whether the station numbers of the slaves are correctly set.
	E16.41	The value of "NO. n" for the PLC is inconsistent with that of AF-66/67 for the drive.	Check whether the value of "NO.n" for the PLC is consistent with that of AF-66/67 for the drive according to the PLC diagnostic message.
	E16.42	The DP communication cable is disconnected.	Check whether the DP communication cable is correctly connected.

Fault Name	Fault Code	Cause	Solution
Contactor fault	E17.05	The external pre-charge unit is not connected or fails.	Check whether the external pre-charge unit is required. If not, restore the tens place of F9-49 to the default value, which is 5.
Current detection fault	E18.00	Current sampling zero drift too large	The model is set improperly. Contact the agent or Inovance for technical support.
Motor auto-tuning fault	E19.02	Auto-tuning on the magnetic pole position angle of the synchronous motor fails.	Check whether the motor is connected or output phase loss occurs.
	E19.06	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated current of the motor (F1-03) is set according to the motor nameplate.
	E19.07	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated frequency of the motor (F1-04) is set according to the motor nameplate.
	E19.08	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated speed of the motor (F1-05) is set according to the motor nameplate.
	E19.09	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	Check whether the motor is connected or output phase loss occurs. Check that the motor is connected properly.
	E19.10	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	Check whether the motor is connected or output phase loss occurs. Check that the motor is connected properly.
	E19.23	Auto-tuning on the pole position of the synchronous motor encounters a fault.	Check that the rated current of the motor (F1-03) is set according to the motor nameplate. Decrease the value of F2-29 (Synchronous motor initial angle detection current).
	E19.24	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	The AC drive power rating is too low. Select an AC drive with a proper power rating according to the motor power.

Fault Name	Fault Code	Cause	Solution
Encoder fault	E20.00	The encoder cable is disconnected.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.01	The encoder is faulty.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.02	The encoder cable is disconnected.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.03	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.04	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.

Fault Name	Fault Code	Cause	Solution
Encoder fault	E20.06	The encoder is faulty during with-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.07	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.08	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the setting of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.09	The encoder is faulty during auto-tuning of the synchronous motor.	Check whether the encoder signal Z is normal and whether the PG card is connected properly.
	E20.10	The synchronous motor encoder is faulty.	Check whether the encoder signal Z is normal and whether the PG card is connected properly.
	E20.11	The encoder is faulty during no-load auto-tuning of the asynchronous motor in the FVC mode.	Check that the encoder is correctly connected. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution).
	E20.13	The hardware part of the resolver is disconnected.	Check the encoder cable connection.
	E20.17	The wiring of the 23-bit encoder is faulty.	Check the encoder wiring.
EEPROM reading/writing fault	E21.01	An error occurs during parameter writing.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.02	An error occurs during parameter reading.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.03	An error occurs during parameter reading and writing.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.04	The number of parameters to be written exceeds the limit.	Reduce the number of parameters to be written in a short period of time.

Fault Name	Fault Code	Cause	Solution
Motor auto-tuning warning	E22.00	The stator resistance obtained through auto-tuning exceeds the allowed range.	The rated motor voltage and current are set incorrectly. Set F1-02 (rated motor voltage) and F1-03 (rated motor current) correctly according to the motor nameplate.
	E22.01	The rotor resistance of the asynchronous motor obtained from auto-tuning exceeds the allowed range.	Check that auto-tuning is performed after the motor stops.
	E22.02	The auto-tuned no-load current and mutual inductance of the asynchronous motor exceed the allowed range. If this fault is reported, the AC drive calculates the mutual inductance and no-load current based on known motor parameters. The calculated values may be different from optimal values.	Set the motor parameters in group F1 correctly according to the motor nameplate. Before auto-tuning, check that the motor is not connected to any load.
	E22.03	The back EMF of the synchronous motor obtained through auto-tuning exceeds the allowed range.	Set F1-02 (Rated motor voltage) according to the motor nameplate. Before auto-tuning, check that the motor is not connected to any load.
	E22.04	The inertia auto-tuning is abnormal.	Check that the rated current of the motor (F1-03) is set according to the motor nameplate.
Output short-circuited to ground	E23.00	The motor is short-circuited to the ground.	Replace the cable or motor.
Output inter-phase short circuit	E24.00	Inter-phase short circuit occurs on the motor.	Check whether inter-phase short circuit occurs on any two of the output phases U/V/W.

Fault Name	Fault Code	Cause	Solution
Power supply unit fault	E25.00	The power supply unit is faulty.	1. Eliminate the power supply unit faults, such as input phase loss and overtemperature. 2. Check the I/O terminal configuration of the power supply unit. If any one of the following functions is selected, a fault is reported when there is no feedback signal. In this case, check the terminal configuration of the power supply unit. a: Running enabling b: Incoming circuit breaker feedback c: Auxiliary circuit breaker feedback d: Leakage protection switch feedback If any one of the following functions is selected and the terminal is active, a fault is reported: a: Drive unit running forbidden 7: Coast-to-stop for drive unit 8: Stop according to preset mode for drive unit
Cumulative operating time reach	E26.00	The cumulative running duration reaches the setpoint.	Clear the record by parameter initialization.
User-defined fault 1	E27.00	1. The signal of user-defined fault 1 is input through the multi-functional DI. 2. The signal of user-defined fault 1 is input through the virtual I/O.	Reset the operation.
User-defined fault 2	E28.00	The signal of user-defined fault 2 is input through the multi-functional DI. The signal of user-defined fault 2 is input through the virtual I/O terminal.	Reset the operation.
Cumulative power-on time reach	E29.00	The cumulative power-on duration reaches the setpoint.	Clear the record by parameter initialization.
Load loss	E30.00	The operating current of the drive is lower than the value of F9-64.	1. Check whether the load is disconnected. 2. Check whether the values of F9-64 and F9-65 meet actual operating conditions.
PID feedback loss during operation	E31.00	The PID feedback is lower than the value of FA-26.	Check the PID feedback signal or set FA-26 properly.
Excessive speed deviation	E42.00	Encoder parameters are set improperly.	Set the encoder parameters correctly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		The speed deviation exceeds the threshold set by F9-69 and F9-70.	Set the detection parameters properly based on actual conditions.

Fault Name	Fault Code	Cause	Solution
Motor overspeed	E43.00	Encoder parameters are set improperly.	Set the encoder parameters correctly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		The speed deviation exceeds the threshold set by F9-69 and F9-70.	Set the detection parameters properly based on actual conditions.
Motor temperature fault	E45.00	The cable of the temperature sensor becomes loose.	Check the connection of the temperature sensor and eliminate the fault.
		Motor overtemperature	Increase the carrier frequency or take other measures to cool the motor.
		The value of F9-57 (Motor over-temperature protection threshold) is too small.	Increase the motor overheat protection threshold (90°C to 100°C for normal motors).
Incorrect settings of synchronous control parameters	E46.01	More than two slave types are set.	Check whether A8-10, A8-50, and A8-70 are all set to "Slave".
STO fault	E47.00	The STO terminal is faulty.	1. Check whether the STO function (F8-54) is enabled. 2. If the STO function is enabled, check whether the terminals STO1 and STO2 of the drive unit input 24 V power supply.
Excessive pulse deviation in position synchronization mode	E55.00	In the position synchronization mode, the pulse deviation is too large. The main reason is that the slave cannot follow the master pulse. If the pulse deviation value between the master and the slave is larger than the value of A8-32 for the duration set by A8-33, excessive pulse deviation occurs.	Set A9-32 and A8-33.
Braking unit fault	E61.01	The braking unit is shoot-through.	Check that the braking transistor is normal. Check whether an external braking resistor is installed.
	E61.02	The braking unit encounters overcurrent.	Check whether the braking resistance is large enough. Check whether the bus voltage is too high.
	E61.03	The braking unit is overloaded.	Check whether the braking resistance is large enough. Check whether the bus voltage is too high.
	E61.04	The braking transistor overheats.	Check whether the bus voltage is too high. Check whether the ambient temperature is too high. Check whether the air duct is blocked. Check whether the fan works normally. Check whether the thermistor works normally. Check that the braking transistor is normal.

Fault Name	Fault Code	Cause	Solution
SSI encoder status abnormal	E66.00	The SSI encoder status is abnormal.	Check whether the SSI encoder is damaged.
Fan fault	E80.00	The fan is faulty.	Check whether the fan of the drive unit is connected correctly. Check whether the fan of the drive unit rotates normally.

6.4.3 Fault List of the Drive Unit (G53X Models)

Note

- This section applies only to MD810-50M4TXXXG53X drive units.

Fault Name	Fault Code	Cause	Solution
Hardware fault	E01.01	The current sampling circuit of the drive is faulty.	Check whether the main circuit is powered on. Check whether the Hall sensor or current sampling circuit is damaged. If yes, contact Inovance for technical support.
	E01.02	The driver board and power supply are faulty.	Contact the agent or Inovance.
		The contactor is faulty.	Contact the agent or Inovance.
		The lightning protection board is abnormal.	Contact the agent or Inovance.
	E01.05	The product model and hardware do not match.	Check whether the product model is correct.
	E01.06	The product hardware does not support STO.	Check whether the drive model support the STO function. If the model does not support the STO function, contact Inovance.

Fault Name	Fault Code	Cause	Solution
Over-current during acceleration	E02.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check the motor or contactor for short circuit.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The acceleration time is too short under abrupt acceleration conditions.	Increase the acceleration time (F0-17).
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 160%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The manual torque boost value or V/f curve is improper.	Adjust the manual torque boost value or V/f curve.
		The motor is started while rotating.	Select the flying start mode or start the drive after the motor stops.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.

Fault Name	Fault Code	Cause	Solution
Over-current during deceleration	E03.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check whether the motor is short-circuited or disconnected.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The deceleration time is too short under abrupt deceleration conditions.	Increase the deceleration time (F0-18).
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 150%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.
Over-current during operation at constant speed	E04.00	A grounding fault or short circuit exists in the output circuit of the AC drive.	Check whether the motor is short-circuited or disconnected.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The overcurrent stall suppression parameters are set improperly.	Ensure that the overcurrent stall suppression function (F3-19) is enabled. The value of F3-18 (Overcurrent stall action current) is too large. Change it to a value between 120% and 150%. The value of F3-20 (Overcurrent stall suppression gain) is too small. Change it to a value between 20 and 40.
		The power rating of the AC drive is too low.	In the stable operation state, if the operating current exceeds the rated current of the motor or the rated output current of the drive, select an AC drive with a higher power rating.
		The drive suffers external interference.	Check if the current upon the fault reaches the overcurrent threshold (F3–18) in the fault log. If not, the fault may be caused by external interference. In this case, remove the external interference to clear the fault. If no external interference source is found, the driver board or Hall device may be faulty. Contact the manufacturer to replace them.

Fault Name	Fault Code	Cause	Solution
Overvoltage during acceleration	E05.00	The input grid voltage is too large.	Adjust the voltage until it is within the normal range.
		External force drives the motor during acceleration.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
		The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (overvoltage stall suppression frequency gain) is too small. Change it to a value between 30 and 50.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
		The acceleration time is too short.	Increase the acceleration time.
Overvoltage during deceleration	E06.00	The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (overvoltage stall suppression gain) is too small. Change it to a value between 30 to 50.
		External force drives the motor during deceleration.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
		The deceleration time is too short.	Increase the deceleration time.
		The braking unit or braking resistor is not installed.	Install the braking unit and braking resistor.
Overvoltage during operation at a constant speed	E07.00	The overvoltage suppression parameters are set improperly.	Ensure that the overvoltage stall suppression function (F3-23) is enabled. The value of F3-22 (overvoltage stall action voltage) is too large. Change it to a value between 770 V and 700 V. The value of F3-24 (overvoltage stall suppression gain) is too small. Change it to a value between 30 to 50.
		External force drives the motor during running.	Remove the external force or install a braking resistor. The maximum rise frequency during overvoltage stall suppression (F3-26) is too low. Adjust it to a value between 5 Hz and 15 Hz when external force is applied.
Pre-charge resistor overload	E08.00	The pre-charge resistor is overloaded.	Contact the agent or Inovance.

Fault Name	Fault Code	Cause	Solution
Undervoltage	E09.00	An instantaneous power failure occurs.	Enable the power dip ride through function (F9-59).
		The input voltage of the AC drive is beyond the specified range.	Adjust the voltage to a value within the normal range.
		The bus voltage is abnormal.	Contact the agent or Inovance.
		The power supply unit, the driver board of the drive unit, or the control board of the drive unit is faulty.	Contact the agent or Inovance.
Drive overload	E10.00	The load is too heavy or the motor is stalled.	Reduce the load and check the motor and mechanical conditions.
		The power rating of the AC drive is too low.	Replace the AC drive with one of higher power rating.
		The control mode is FVC or SVC but parameter auto-tuning is not performed.	Set the motor parameters according to the motor nameplate and perform auto-tuning on motor parameters.
		The control mode is V/f control.	The torque boost (F3-01) is set to an excessively high value. Decrease the value of F3-01 by the step value of 1.0% every time or set it to 0 (automatic torque boost).
Motor overload	E11.00	F9-01 (motor overload protection gain) is set improperly.	Set F9-01 (motor overload protection gain) properly. The motor overload time is prolonged if you increase the value of F9-01.
		The load is too heavy or the motor is stalled.	Reduce the load and check the motor and mechanical conditions.
Input phase loss	E12.00	The input side of the power supply unit is not connected to the power grid.	Connect the input side of the power supply unit to the power grid.
Output phase loss	E13.00	The motor is faulty.	Check whether the motor is disconnected.
		The cable connecting the drive and the motor is faulty.	Eliminate external faults.
		The three-phase outputs of the AC drive are unbalanced during motor running.	Check whether the motor three-phase winding is normal and eliminate the fault.
		The driver board or the IGBT module is faulty.	Contact the agent or Inovance.
Drive over-temperature	E14.00	The ambient temperature is too high.	Lower down the ambient temperature.
		The air duct is blocked.	Clean the air duct.
		The fan is damaged.	Replace the fan.
		The thermistor is damaged.	Contact the agent or Inovance.
		The module is damaged.	Contact the agent or Inovance.
The external device is faulty.	E15.01	An external fault signal is input through the multi-functional DI (NO).	Eliminate external faults and ensure that restart (F8-18) is allowed under the mechanical condition for reset.
		An external fault signal is input using the virtual I/O terminal (NO).	Check that the virtual I/O parameters in group A1 are set correctly and reset the operation.
	E15.02	An external fault signal is input through the multi-functional DI (NC).	Eliminate external faults and ensure that restart (F8-18) is allowed under the mechanical condition for reset.
		An external fault signal is input through the virtual I/O terminal (NC).	Check that the virtual I/O parameters in group A1 are set correctly and reset the operation.

Fault Name	Fault Code	Cause	Solution
Comm. fault	E16.01	Modbus communication timeout	Check whether the RS-485 communication cable is correctly connected. Check whether the value of Fd-04 and the PLC communication cycle are proper.
	E16.11	CANopen communication times out.	Check whether the CAN communication cable is correctly connected. Check the values of Fd-15 to Fd-17 and confirm interference.
	E16.12	The PDO mapping configured for CANopen is inconsistent with the actual communication mapping.	Check the PDO mapping in group AF.
	E16.13	Data exchange from the power supply unit to the drive unit times out.	Check whether the power supply unit is in operation.
			Check whether the communication cable between the power supply unit and the drive unit is connected.
			Check whether the termination resistor is properly connected.
			Check whether Fd-12 (CAN baud rate) is correctly set.
Comm. fault	E16.14	Abnormality occurs when the drive unit receives interactive data from the power supply unit.	The power supply unit is faulty. Eliminate the fault.
	E16.15	Synchronous control communication times out.	Check parameters in group A8 to see whether the master station and slave station numbers are correct, and check whether the CAN2 cable is connected properly.
	E16.21	CANlink heartbeat message timeout	Check whether the CAN communication cable is correctly connected. Check the values of Fd-15 to Fd-17 and confirm interference.
	E16.22	CANlink station number conflict	Modify the repeated CAN station numbers by using Fd-13.
	E16.31	PROFIBUS DP communication times out (dedicated for PROFIBUS DP-to-CANopen bridge mode).	Check that the PROFIBUS DP communication cable is correctly connected.
Contactor fault	E16.34	An offline CAN slave is detected during configuration of the PROFIBUS DP-to-CANopen bridge.	Check whether the value of "The number of devices" for the PLC matches the actual quantity of stations.
	E16.35	Parameters for configuring the PROFIBUS DP-to-CANopen bridge are set incorrectly.	Check whether the station numbers of the slaves are correctly set.
	E16.41	The value of "NO. n" for the PLC is inconsistent with that of AF-66/67 for the drive.	Check whether the value of "NO.n" for the PLC is consistent with that of AF-66/67 for the drive according to the PLC diagnostic message.
	E16.42	The DP communication cable is disconnected.	Check whether the DP communication cable is correctly connected.
	E16.51	The EtherCAT communication cable is disconnected.	Check whether the EtherCAT communication cable is correctly connected.
	E17.05	The external pre-charge unit is not connected or fails.	Check whether the external pre-charge unit is required. If not, restore the tens place of F9-49 to the default value, which is 5.
Current detection fault	E18.00	Current sampling zero drift too large	The model is set improperly. Contact the agent or Inovance for technical support.

Fault Name	Fault Code	Cause	Solution
Motor auto-tuning fault	E19.02	Auto-tuning on the magnetic pole position angle of the synchronous motor fails.	Check whether the motor is connected or output phase loss occurs.
	E19.04	Auto-tuning on the magnetic pole position angle of the synchronous motor fails.	Check whether the motor is connected or output phase loss occurs.
	E19.05	Auto-tuning on the magnetic pole initial position angle of the synchronous motor fails.	Increase the value of F2-29 (Synchronous motor initial angle detection current).
	E19.06	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated current of the motor (F1-03) is set according to the motor nameplate.
Motor auto-tuning fault	E19.07	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated frequency of the motor (F1-04) is set according to the motor nameplate.
	E19.08	Stator resistance auto-tuning fault	Ensure that the motor is connected. Check that the rated speed of the motor (F1-05) is set according to the motor nameplate.
	E19.09	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	Check whether the motor is connected or output phase loss occurs. Check that the motor is connected properly.
	E19.10	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	Check whether the motor is connected or output phase loss occurs. Check that the motor is connected properly.
	E19.11	The inertia auto-tuning is abnormal.	Check that the rated current of the motor (F1-03) is set according to the motor nameplate. Increase the value of F2-43 (Inertia auto-tuning and dynamic speed reference).
Motor auto-tuning fault	E19.12	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.13	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.14	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.15	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.16	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.17	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
Motor auto-tuning fault	E19.18	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.19	The auto-tuning times out.	Check whether the motor is connected or output phase loss occurs. Check that the load is disconnected from the motor.
	E19.20	Auto-tuning of the no-load zero position angle for the synchronous motor times out.	Check the Z feedback signal.
	E19.22	The auto-tuning times out.	Check the Z feedback signal.
	E19.23	Auto-tuning on the pole position of the synchronous motor encounters a fault.	Check that the rated current of the motor (F1-03) is set according to the motor nameplate. Decrease the value of F2-29 (Synchronous motor initial angle detection current).
	E19.24	Auto-tuning on the transient leakage inductance of the asynchronous motor encounters a fault.	The AC drive power rating is too low. Select an AC drive with a proper power rating according to the motor power.

Fault Name	Fault Code	Cause	Solution
Encoder fault	E20.00	The encoder cable is disconnected.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.01	The encoder is faulty.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.02	The encoder cable is disconnected.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.03	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
Encoder fault	E20.04	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.06	The encoder is faulty during with-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.07	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.08	The encoder is faulty during no-load auto-tuning of the synchronous motor.	Rectify the disconnection fault. The PG cable is wired improperly. Ensure the power supply of the PG cable is connected properly. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution). AB signal cables are connected improperly.
	E20.09	The encoder is faulty during auto-tuning of the synchronous motor.	Check whether the encoder signal Z is normal and whether the PG card is connected properly.
	E20.10	The synchronous motor encoder is faulty.	Check whether the encoder signal Z is normal and whether the PG card is connected properly.
	E20.11	The encoder is faulty during no-load auto-tuning of the asynchronous motor in the FVC mode.	Check that the encoder is correctly connected. Check whether the actual encoder pulses per revolution matches the value of F1-27 (Encoder pulses per revolution).

Fault Name	Fault Code	Cause	Solution
Encoder fault	E20.12	Deviation between the encoder feedback speed and the speed estimated in SVC mode is too large.	Check whether the encoder is disconnected. Check whether motor parameters are set properly. Check whether motor auto-tuning is performed.
	E20.13	The hardware part of the resolver is disconnected.	Check the encoder cable connection.
	E20.17	The wiring of the 23-bit encoder is faulty.	Check the encoder wiring.
EEPROM reading/ writing fault	E21.01	An error occurs during parameter writing.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.02	An error occurs during parameter reading.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.03	An error occurs during parameter reading and writing.	The EEPROM chip is damaged. Contact the manufacturer to replace the control board.
	E21.04	The number of parameters to be written exceeds the limit.	Reduce the number of parameters to be written in a short period of time.
Motor auto-tuning warning	E22.00	The stator resistance obtained through auto-tuning exceeds the allowed range.	The rated motor voltage and current are set incorrectly. Set F1-02 (rated motor voltage) and F1-03 (rated motor current) correctly according to the motor nameplate.
	E22.01	The rotor resistance of the asynchronous motor obtained from auto-tuning exceeds the allowed range.	Check that auto-tuning is performed after the motor stops.
	E22.02	The auto-tuned no-load current and mutual inductance of the asynchronous motor exceed the allowed range. If this fault is reported, the AC drive calculates the mutual inductance and no-load current based on known motor parameters. The calculated values may be different from optimal values.	Set the motor parameters in group F1 correctly according to the motor nameplate. Before auto-tuning, check that the motor is not connected to any load.
	E22.03	The back EMF of the synchronous motor obtained through auto-tuning exceeds the allowed range.	Set F1-02 (Rated motor voltage) according to the motor nameplate. Before auto-tuning, check that the motor is not connected to any load.
	E22.04	The inertia auto-tuning is abnormal.	Check that the rated current of the motor (F1-03) is set according to the motor nameplate.
Output short-circuited to ground	E23.00	The motor is short-circuited to the ground.	Replace the cable or motor.

Fault Name	Fault Code	Cause	Solution
Output inter-phase short circuit	E24.00	Inter-phase short circuit occurs on the motor.	Check whether inter-phase short circuit occurs on any two of the output phases U/V/W.
Power supply unit fault	E25.00	The power supply unit is faulty.	1. Eliminate the power supply unit faults, such as input phase loss and overtemperature. 2. Check the I/O terminal configuration of the power supply unit. If any one of the following functions is selected, a fault is reported when there is no feedback signal. In this case, check the terminal configuration of the power supply unit. a: Running enabling b: Incoming circuit breaker feedback c: Auxiliary circuit breaker feedback d: Leakage protection switch feedback If any one of the following functions is selected and the terminal is active, a fault is reported: a: Drive unit running forbidden 7: Coast-to-stop for drive unit 8: Stop according to preset mode for drive unit
Cumulative operating time reach	E26.00	The cumulative running duration reaches the setpoint.	Clear the record by parameter initialization.
User-defined fault 1	E27.00	1. The signal of user-defined fault 1 is input through the multi-functional DI. 2. The signal of user-defined fault 1 is input through the virtual I/O terminal.	Reset the operation.
User-defined fault 2	E28.00	The signal of user-defined fault 2 is input through the multi-functional DI. The signal of user-defined fault 2 is input through the virtual I/O terminal.	Reset the operation.
Cumulative power-on time reach	E29.00	The cumulative power-on duration reaches the setpoint.	Clear the record by parameter initialization.
Load loss	E30.00	The operation current of the drive is lower than the value of F9-64.	1. Check whether the load is disconnected. 2. Check whether the values of F9-64 and F9-65 meet actual operating conditions.
PID feedback loss during operation	E31.00	The PID feedback is lower than the value of FA-26.	Check the PID feedback signal or set FA-26 properly.

Fault Name	Fault Code	Cause	Solution
Pulse-by-pulse current limit fault	E40.00	1. The load is too heavy or locked-rotor occurs on the motor. 2. The power rating of the AC drive model is excessively low.	1. Reduce the load and check the motor and mechanical conditions. 2. Select an AC drive of a higher power rating.
Excessive speed deviation	E42.00	Encoder parameters are set improperly.	Set the encoder parameters correctly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		The speed deviation exceeds the threshold set by F9-69 and F9-70.	Set the detection parameters properly based on actual conditions.
Motor overspeed	E43.00	Encoder parameters are set improperly.	Set the encoder parameters correctly.
		Motor auto-tuning is not performed.	Perform motor auto-tuning.
		The speed deviation exceeds the threshold set by F9-69 and F9-70.	Set the detection parameters properly based on actual conditions.
Motor temperature fault	E45.00	The cable of the temperature sensor becomes loose.	Check the connection of the temperature sensor and eliminate the fault.
		Motor overtemperature	Increase the carrier frequency or take other measures to cool the motor.
		The value of F9-57 (Motor over-temperature protection threshold) is too small.	Increase the motor overheat protection threshold (90°C to 100°C for normal motors).
Incorrect settings of synchronous control parameters	E46.01	More than two slave types are set.	Check whether A8-10, A8-50, and A8-70 are all set to "Slave".
STO fault	E47.00	The STO terminal is faulty.	1. Check whether the STO function (F8-54) is enabled. 2. If the STO function is enabled, check whether the terminals STO1 and STO2 of the drive unit input 24 V power supply.
Home loss	E54.01	The home cannot be searched for a long time. B4-18 is used to set the maximum time for home searching.	Check whether the home switch is damaged, whether the home switch is loose, or whether B4-18 is set to a small value.
Excessive home position deviation	E54.02	The deviation between the two adjacent home signals of the ABZ encoder is too large. B4-19 is used to set the allowable deviation of the home.	Check whether the home switch is damaged, whether the home switch is loose, or whether B4-19 is set to a small value.

Fault Name	Fault Code	Cause	Solution
Large number of home loss times during home correction	E54.03	The home correction value is too large during home correction. B4-67 is used to set the home loss threshold during home correction	Check whether the home switch is damaged, whether the home switch is loose, or whether B4-67 is set to a small value.
Excessive pulse deviation in position synchronization mode	E55.00	In the position synchronization mode, the pulse deviation is too large. The main reason is that the slave cannot follow the master pulse. If the pulse deviation value between the master and the slave is larger than the value of A8-32 for the duration set by A8-33, excessive pulse deviation occurs.	Set A9-32 and A8-33.
Hard limit exceeded in the forward direction	E58.01	The forward limit switch (80#DI) is triggered.	Check whether the mechanical structure exceeds the limit and whether the positive and negative logic of the DI is set correctly.
Hard limit exceeded in the reverse direction	E58.02	The reverse limit switch (81#DI) is triggered.	Check whether the mechanical structure exceeds the limit and whether the positive and negative logic of the DI is set correctly.
Soft limit exceeded in the forward direction	E58.03	The current position exceeds the position set by the soft limit in the forward direction (B4-63/64).	Check whether the mechanical structure exceeds the limit, whether the encoder sampling value has burrs, and whether the value set by soft limit in the forward direction (B4-63/64) is too low.
Soft limit exceeded in the reverse direction	E58.04	The current position is smaller than the position set by the soft limit in the reverse direction (B4-65/66).	Check whether the mechanical structure exceeds the limit, whether the encoder sampling value has burrs, and whether the value set by soft limit in the reverse direction (B4-63/64) is too low.
Braking unit fault	E61.01	The braking unit is shoot-through.	Check that the braking transistor is normal. Check whether an external braking resistor is installed.
	E61.02	The braking unit encounters overcurrent.	Check whether the braking resistance is large enough. Check whether the bus voltage is too high.
	E61.03	The braking unit is overloaded.	Check whether the braking resistance is large enough. Check whether the bus voltage is too high.
	E61.04	The braking transistor overheats.	Check whether the bus voltage is too high. Check whether the ambient temperature is too high. Check whether the air duct is blocked. Check whether the fan works normally. Check whether the thermistor works normally. Check that the braking transistor is normal.
SSI encoder status abnormal	E66.00	The SSI encoder status is abnormal.	Check whether the SSI encoder is damaged.
SSI encoder disconnection	E66.01	The SSI encoder is disconnected.	Check whether the SSI encoder cable is connected properly.

Fault Name	Fault Code	Cause	Solution
SSI encoder light blocked	E66.02	The SSI encoder light is blocked.	Check whether the SSI encoder light is blocked.
Excessive speed deviation between the ABZ encoder and the SSI encoder	E66.03	The speed deviation between the ABZ encoder and the SSI encoder is too large (ABZ encoder variation (U2-98) - SSI encoder variation (U2-18) > threshold of excessive position deviation (B4-94, in the unit of ABZ encoder)) and lasts for 40 ms.	1. Check whether ABZ encoder and SSI encoder parameters in group F1 are set properly. 2. Check whether the ABZ encoder and SSI encoder are installed properly. 3. Check whether the SSI encoder light is blocked. 4. Check whether the value of B4-94 (threshold of excessive position deviation) is too low.
Fan fault	E80.00	The fan is faulty.	Check whether the fan of the drive unit is connected correctly. Check whether the fan of the drive unit rotates normally.

6.5 Common Faults and Solutions

No.	Fault	Possible Cause	Solution
1	There is no display upon power-on.	There is no voltage input or the input voltage is too low.	Check the input power supply.
		The switched-mode power supply on the driver board of the drive is faulty.	Replace the power supply board and drive, or contact the manufacturer.
		The control board or the operation panel is faulty.	Contact the agent or Inovance.
		The power supply unit is damaged.	
2	The operating panel keeps displaying "HC" upon power-on.	Related components on the control board are damaged.	Contact the agent or Inovance.
		The motor or the motor cable is short circuited to the ground.	
		The Hall device is faulty.	
		The mains voltage is too low.	
3	"E23.00" is displayed upon power-on.	The motor or the output cable is short circuited to the ground.	Check the insulation status of the motor and the output cable with a megger.
		The drive is damaged.	Contact the agent or Inovance.
4	The display is normal upon power-on, but "HC" is displayed and the drive stops immediately after startup.	The cooling 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	E14.00 (module overtemperature) is reported frequently.	The carrier frequency is set too high.	Decrease the value of F0-15 (Carrier frequency).
		The cooling fan is damaged, or the air duct is blocked.	Replace the cooling fan and clean the air duct.
		Components (thermocouple or others) inside the drive are damaged.	Contact the agent or Inovance.

No.	Fault	Possible Cause	Solution
6	The motor does not rotate when the drive is running.	The cable between the drive and the motor is abnormal.	Confirm that the drive and motor are properly connected.
		Drive parameters are set improperly (motor parameters).	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 under heavy-load start.
		The driver board is faulty.	Contact the agent or Inovance.
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 +24 V becomes loose.	Secure the jumper between OP and +24V.
		The control board is faulty.	Contact the agent or Inovance.
8	The motor speed cannot be increased in the FVC mode.	Encoder fault	Replace the encoder disk and double check the cable connection.
		The PG card is faulty.	Contact the agent or Inovance.
		The driver board is faulty.	
9	The drive reports overcurrent and overvoltage frequently.	The motor parameters are set incorrectly.	Reset motor parameters or perform motor auto-tuning.
		The acceleration/deceleration time is improper.	Set acceleration/deceleration time properly.
		The load fluctuates.	Contact the agent or Inovance.
11	The motor coasts to stop or the brake fails during deceleration or deceleration to stop.	The encoder cable is disconnected or overvoltage stall protection applies.	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 protection function by setting F3-23 to 0.

Display for the drive unit with two axes:

- When A1 axis is displayed on the keypad and becomes faulty, the keypad displays the corresponding fault code. If A1 axis is normal but A2 axis is faulty, the keypad displays , indicating that A2 axis is faulty. You can troubleshoot the fault according to the display. After the fault is cleared, the prompt of A1 axis also disappears.
- Similarly, if A2 axis is displayed on the keypad and A1 axis becomes faulty, the keypad displays .
- If both A1 and A2 axes are faulty, the fault code of the current axis is displayed directly.

Fault Name	Display	Possible Cause	Solution
A1 axis fault		A1 axis is faulty.	Check the fault code and handle the fault based on the fault code.

A2 axis fault indication		A2 axis is faulty.	Check the fault code and handle the fault based on the fault code.

7. Maintenance and Inspection

General Safety Instructions
DANGER ◆ Never perform wiring with power on. Failure to comply can result in electric shock. ◆ Before inspection, disconnect all the power supplies and wait for at least 10 minutes as residual voltage still exists in the internal DC capacitor of the drive. After the power indicator is off, wait for the power-on interval designated on the drive before next power-on. ◆ After the AC drive is powered on, do not modify wiring, disconnect cables, remove optional cards, or replace the cooling fan to prevent electric shock. ◆ Ensure that the motor grounding terminal is grounded. Failure to comply may result in electric shock when touching the motor housing. ◆ Only qualified professionals can repair or maintain the product. ◆ Installation, wiring, commissioning, maintenance, inspection, and parts replacement can only be performed by electricians that familiar with installation, commissioning, and maintenance.
WARNING ◆ Do not run the product with the housing removed. ◆ 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. ◆ Tighten all terminal screws based on specified tightening torque. ◆ Ensure that the input voltage is within permissible range. Incorrect input voltage of main circuit may result in operation error. ◆ Keep combustibles far away from the drive or mount the drive on incombustible surfaces.
CAUTION ◆ Replace the cooling fan in correct ways as specified in this guide. Ensure the correct air outlet direction of the fan. Failure to comply will degrade the cooling performance. ◆ Do not connect or disconnect the motor when the product is running. Failure to comply will result in electric shock and damage to the product. ◆ Use shielded cables for control circuit wiring. ◆ Meanwhile, ground the shield at one end to prevent product malfunction. ◆ Do not modify the drive circuit. Failure to comply can damage the drive. ◆ Connect the output terminals of the product and the wiring terminals of the motor correctly. ◆ If you need to change the motor rotating direction, exchange the sequence of any two phases among the U, V, and W phases. ◆ Do not operate on a damaged drive. This is to prevent further damage to other devices connected to the drive.

7.1 Routine Inspection

The ambient temperature, humidity, dust, and vibration will cause aging of components in the product, which may cause potential faults or shorten the product life. Therefore, it is essential to carry out routine maintenance on the product. The maintenance interval must be shortened in the following cases:
High ambient temperature
Frequent startup and stop
Fluctuation on the AC power supply or the load

Check the following items daily to ensure that the product functions properly. It is recommended to make a copy of this checklist and sign the "Checked" column after each inspection.

Item	Content	Solution	Checked
Motor	Check whether unusual vibration or noise exists.	◆ Check whether the mechanical connection is normal. ◆ Check whether phase loss occurs on the motor. ◆ Check whether motor screws are tightened.	
Fan	Check whether the fans of the drive and the motor work properly.	◆ Check whether the fan of the drive works properly. ◆ Check whether the fan of the motor works properly. ◆ Check whether the air duct is blocked. ◆ Check whether the ambient temperature is within the permissible range.	
Installation environment	Check whether the cabinet and cable ducts are normal.	◆ Check whether the insulation of drive I/O cables is intact. ◆ Check for the mounting bracket vibration. ◆ Check whether copper busbars and wiring terminals become loose or get corroded.	
Load	Check whether the operating current of the drive exceeds the rated current of the drive and the motor for a certain period.	◆ Check whether the motor parameters are set correctly. ◆ Check whether the motor is overloaded. ◆ Check whether the mechanical vibration is severe (normal condition: < 0.6 g).	
Input voltage	Check whether the power supply voltage between the main circuit and control circuit is normal.	◆ Check whether the input voltage is within the permissible range. ◆ Check whether a heavy load is being started around the drive.	

7.2 Periodic Inspection

7.2.1 Periodic Check Items

Perform regular inspection on items that are difficult to check during operation. Clean the dust especially metal dust on the surface of the drive to prevent the dust from falling into the drive. Clean the greasy dirt on the cooling fan of the drive.

DANGER	◆ Do not perform inspection while the power is on. Failure to comply will result in an electric shock. ◆ Before inspection, disconnect all the power supplies and wait for at least 10 minutes to avoid risks caused by the residual voltage in the capacitor of the drive.

Item	Content	Solution	Checked
Power supply unit	Check for wastes, dirt and dust on the surface of the power supply unit, and capacitor leakage.	◆ Check whether the cabinet of the power supply unit or the drive unit is powered off. ◆ Use a vacuum cleaner to suck up waste and dust to prevent direct contact with the components. ◆ Wipe greasy dirt gently with soft cloth immersed in neutral detergent. ◆ Contact Inovance for electrolytic capacitor replacement in case of capacitor leakage.	
Cable	Check whether power cables and the connectors are discolored. Check whether the insulation is aged or cracked.	◆ Replace the cracked cable. ◆ Replace the damaged terminals.	
Peripherals of the electromagnetic contactor	Check whether the contactor closes loosely or generates unexpected noise during closing. Check whether short circuit, water seepage, swelling, or cracking occurs on any peripheral device.	◆ Replace the abnormal components.	
Air duct	Check whether the air duct and heatsink are blocked. Check whether the fan is damaged.	◆ Clean the air duct. ◆ Replace the fan.	
Control circuit	Check for components with poor contact. Check whether terminal screws are connected securely. Check whether the insulation of the control circuit cable is intact without cracking.	◆ Clean up the surface of control circuit cables and terminals. ◆ Replace the damaged or corroded control cables.	

7.2.2 Insulation Test on the Main Circuit

Before measuring the insulation resistance with a megger (500 VDC megger recommended), disconnect the main circuit from the drive. Do not use the insulation resistance meter to test the insulation of the control circuit. See the following figure. Do not perform the high voltage (> 500 V) test because it has been done before delivery.

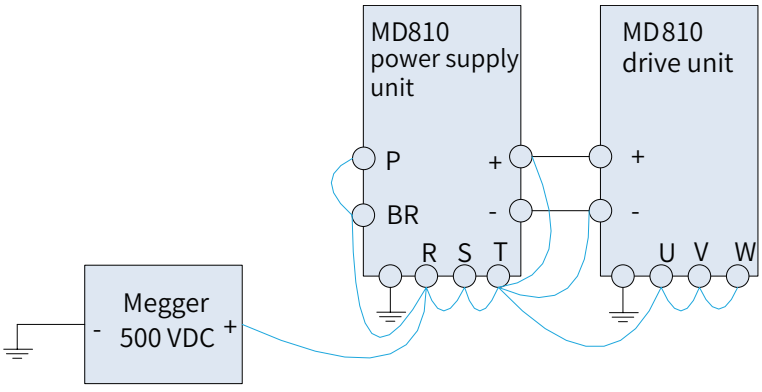


Figure 7-1 Main circuit insulation test

The measured insulation resistance must be greater than 5 MΩ.

Before test, remove the voltage dependent resistor (VDR) screw of the power supply unit, as shown in the following position.

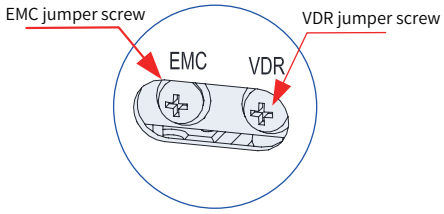


Figure 7-2 VDR and EMC grounding jumper positions

Note

- For details on VDR and EMC grounding jumper positions, see the Md810 Series AC Drive (Multi-drive System) Hardware Guide.

7.3 Replacing Fans

The fan is easy to wear and the general service time is equal to or longer than five years[Note].

Note: The service life indicates the time when the fan is used in the following conditions. You can determine when to replace the fan according to the actual operating time.

1) Ambient temperature: 40° C
2) Load rate: 80%
3) Operating rate: 24 hours per day

1) Possible causes of damage: bearing wear and blade aging
2) Diagnosis: cracks on the blade, abnormal vibration noise upon startup, and abnormal running of fan blades
3) Replacement:

   Push down the snap-fit joint of the fan cover and pull the fan out.

   After replacing the fan, ensure the fan blows the air upwards.

Note

- Before replacing the fan of the vertical power supply unit and vertical drive unit, power off the equipment.

7.3.1 Quantity of Fans

Table 7-1 Quantity of fans for the power supply unit

Power Supply Unit Model	Number of Bus Capacitor Fans			
	40 x 40 x 28 (mm)	80 x 80 x 25 (mm)	80 x 80 x 32 (mm)	80 x 80 x 38 (mm)
MD810-20M4T22GXXX	1	-	-	-
MD810-20M4T45GXXX	-	1	-	-
MD810-20M4T110GXXX	-	-	2	-
MD810-20M4T160GXXX(W)	-	-	-	3
MD810-20M4T355GXXX	-	-	-	3

Table 7-2 Quantity of fans for the drive unit

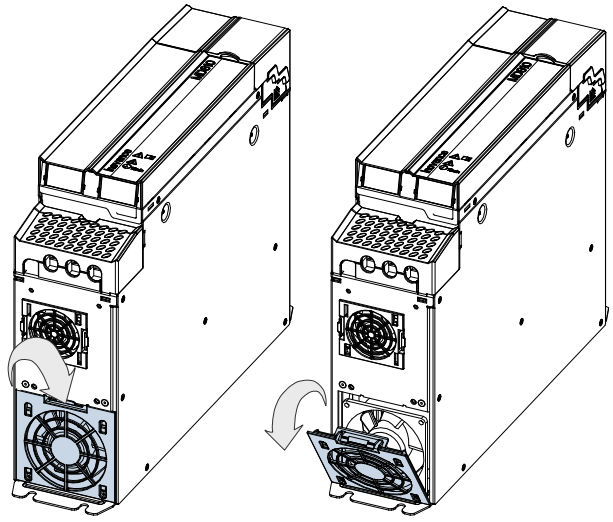
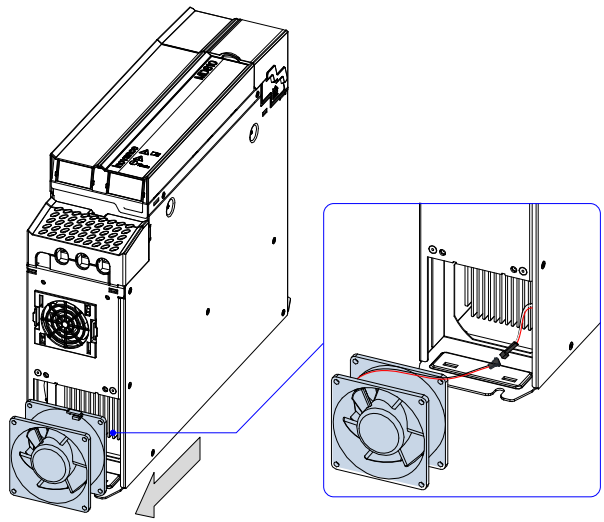
Drive Unit Model	Number of Fans						
	40 x 40 x 28 (mm)	50 x 50 x 15 (mm)	80 x 80 x 25 (mm)	80 x 80 x 32 (mm)	80 x 80 x 38 (mm)	120 x 120 x 38 (mm)	172 x 150 x 51 (mm)
MD810-50M4T1.5GXXX	1	-	-	-	-	-	-
MD810-50M4T2.2GXXX	1	-	-	-	-	-	-
MD810-50M4T3.7GXXX	1	-	-	-	-	-	-
MD810-50M4T5.5GXXX	1	-	-	-	-	-	-
MD810-50M4T7.5GXXX	1	-	-	-	-	-	-
MD810-50M4T11GXXX	-	-	1	-	-	-	-
MD810-50M4T15GXXX	-	-	1	-	-	-	-
MD810-50M4T18.5GXXX	-	-	-	1	-	-	-
MD810-50M4T22GXXX	-	1	-	1	-	-	-
MD810-50M4T30GXXX	-	1	-	1	-	-	-
MD810-50M4T37GXXX	-	1	-	-	1	-	-
MD810-50M4T45GXXX	-	-	-	2	-	-	-
MD810-50M4T55GXXX	-	-	-	-	2	-	-
MD810-50M4T75GXXX	-	-	-	-	2	-	-
MD810-50M4T90GXXX	-	-	-	3	-	-	-
MD810-50M4T110GXXX	-	-	-	-	3	-	-
MD810-50M4T132GXXX	-	-	-	-	3	-	-
MD810-50M4T160GXXX	-	-	-	-	3	-	-
MD810-50M4T200GXXXH	-	-	-	-	-	3	-
MD810-50M4T250GXXXH	-	-	-	-	-	3	-
MD810-50M4T315GXXXH	-	-	-	-	-	-	3
MD810-50M4T355GXXXH	-	-	-	-	-	-	3
MD810-50M4TD1.5GXXX	1	-	-	-	-	-	-
MD810-50M4TD2.2GXXX	1	-	-	-	-	-	-
MD810-50M4TD3.7GXXX	1	-	-	-	-	-	-
MD810-50M4TD5.5GXXX	1	-	-	-	-	-	-

Drive Unit Model	Number of Fans						
	40 x 40 x 28 (mm)	50 x 50 x 15 (mm)	80 x 80 x 25 (mm)	80 x 80 x 32 (mm)	80 x 80 x 38 (mm)	120 x 120 x 38 (mm)	172 x 150 x 51 (mm)
MD810-50M4TD7.5GXXX	-	-	1	-	-	-	-
MD810-50M4TD11GXXX	-	-	1	-	-	-	-
MD810-50M4TD15GXXX	-	-	1	-	-	-	-
MD810-50M4TD18.5GXXX	-	-	-	-	1	-	-

7.3.2 Removing and Installing Fans

1) Removing and installing the fan of the power supply unit

◆ Removing the fan (80 mm x 80 mm) of the unit with the same height

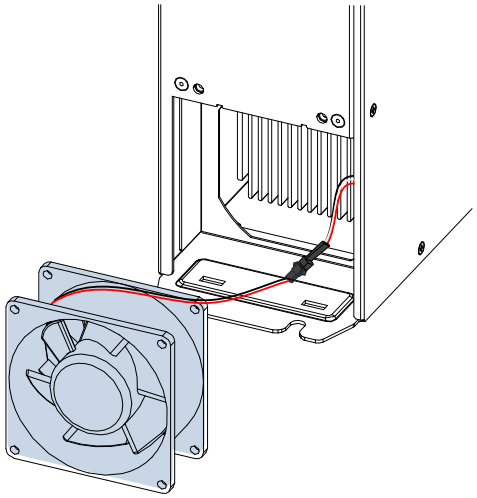
Removing the fan	
1. Press the snap-fit joint of the fan cover and remove the fan cover.	2. Pull the fan outward and disconnect the power cable plug from the socket.
	

◆ Installing the fan (80 x 80 mm) of the unit with the same height

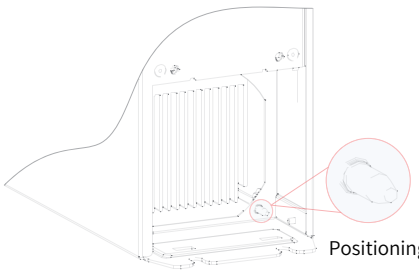
Installing the fan

1. Install the fan in a reverse order of removal. Ensure that the direction of the fan is correct.

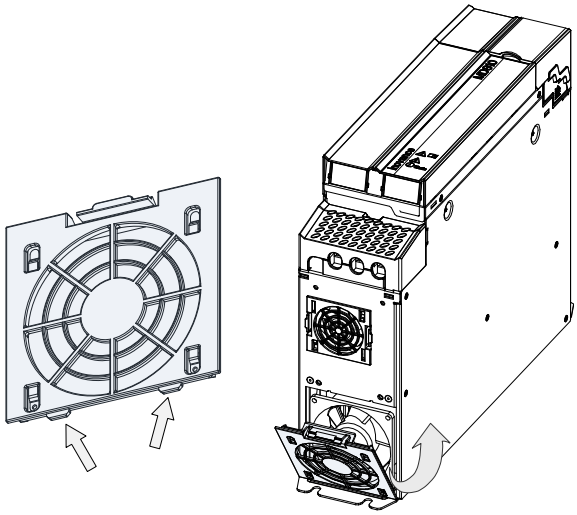
- Plug the power cable plug into the socket.



- Install the fan into the drive unit with the fixing holes at the bottom of the fan aligned with the positioning pins on the unit.

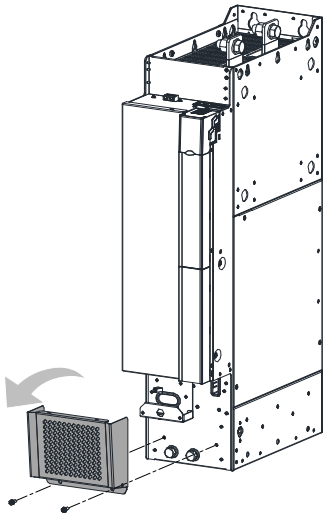
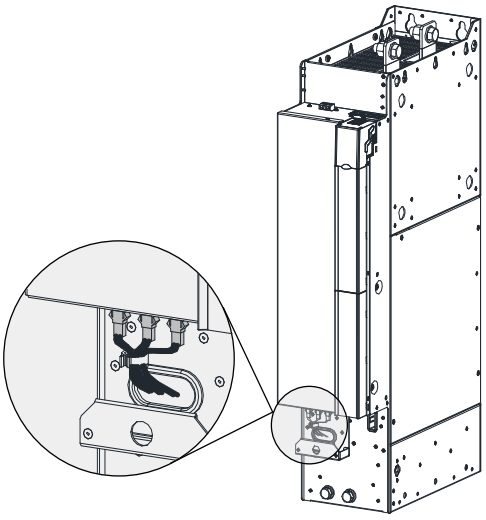
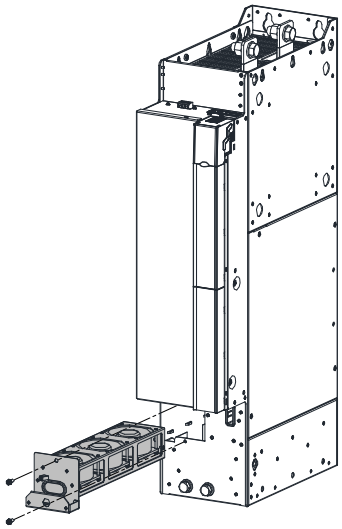
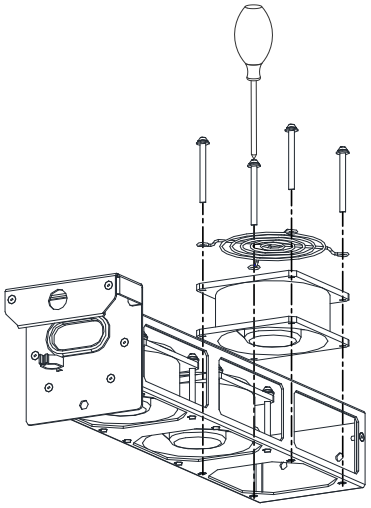


2. Insert the two snap-fit joints into the groove and press down to fix the snap-fit joints.

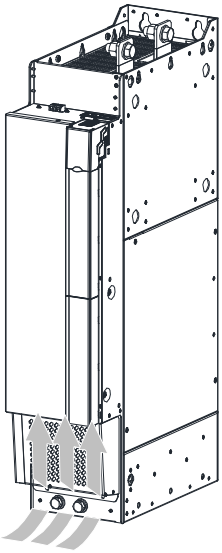


3. After replacement is completed, check that the air flow direction is upright.

◆ Removing the fan of the vertical tower unit

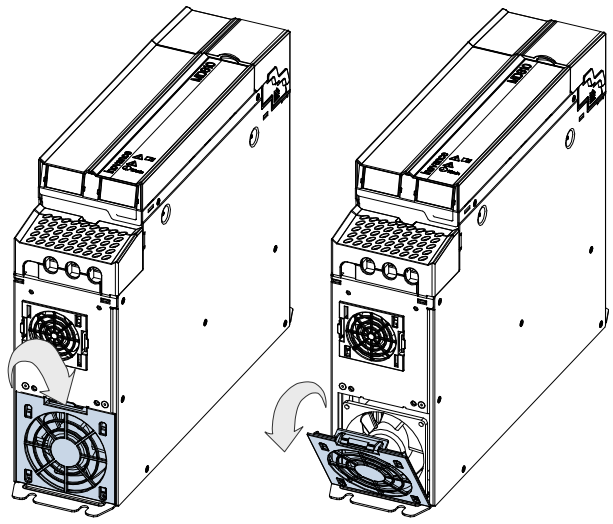
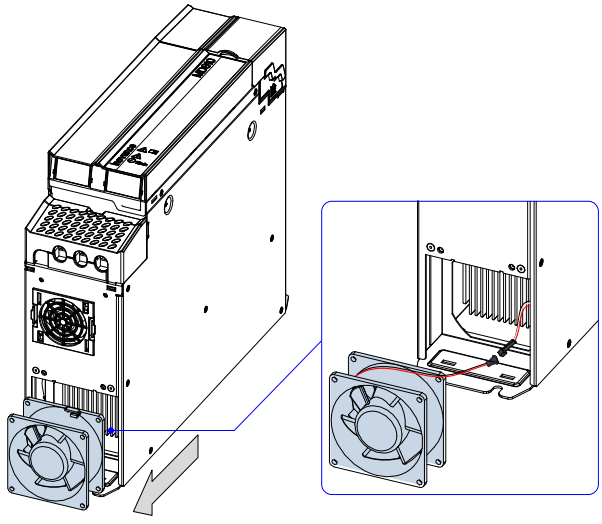
<table>
<tr><th colspan="2">Removing the fan</th></tr>
<tr><td>1. Remove the six fixing screws on the cover. Then, hold the cover with both hands and lift it up in the direction indicated by the arrow to remove the cover.
  </td><td>2. Disconnect the fan power cable connector from the power supply unit. Each fan has a power cable connector.
  </td></tr>
<tr><td>3. Remove two screws from the fan box and draw the fan box out in the direction of arrow.
  </td><td>3. Turn the fan box upside down and remove the four screws on each fan.
  </td></tr>
</table>

◆ Installing the fan of the vertical tower unit

Installing the fan
① Install the fan in a reverse order of removal. Ensure that the direction of the fan is correct. ② Align the fan box with the mounting rail and push it into the unit. ③ Connect the fan power cable connector first and then fix the fan box. After replacing the fan, ensure the fan blows the air upwards. 

2) Removing and installing the fan of the drive unit

◆ Removing the fan (80 mm x 80 mm) of the unit with the same height

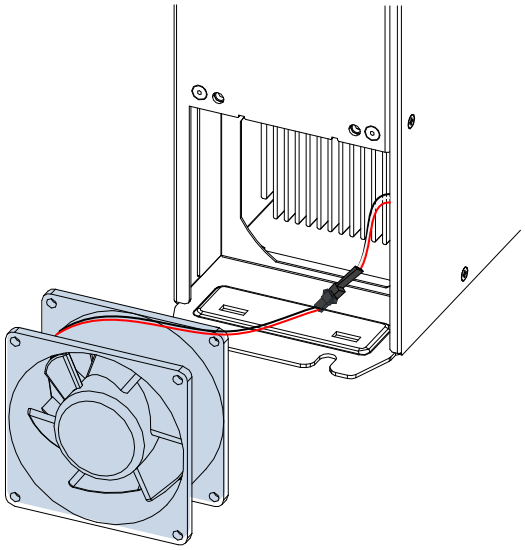
Removing the fan	
1. Press the snap-fit joint of the fan cover and remove the fan cover. 	2. Pull the fan outward and disconnect the power cable plug from the socket. 

◆ Installing the fan (80 x 80 mm) of the unit with the same height

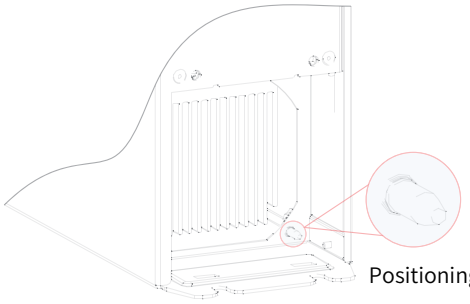
Installing the fan

1. Install the fan in a reverse order of removal. Ensure that the direction of the fan is correct.

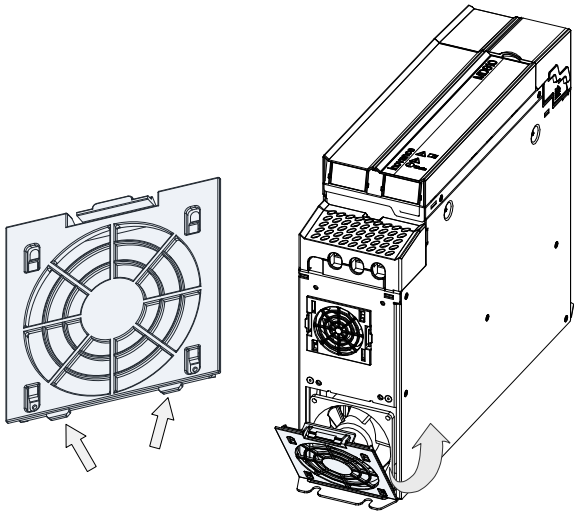
- Plug the power cable plug into the socket.



- Install the fan into the drive unit with the fixing holes at the bottom of the fan aligned with the positioning pins on the unit.

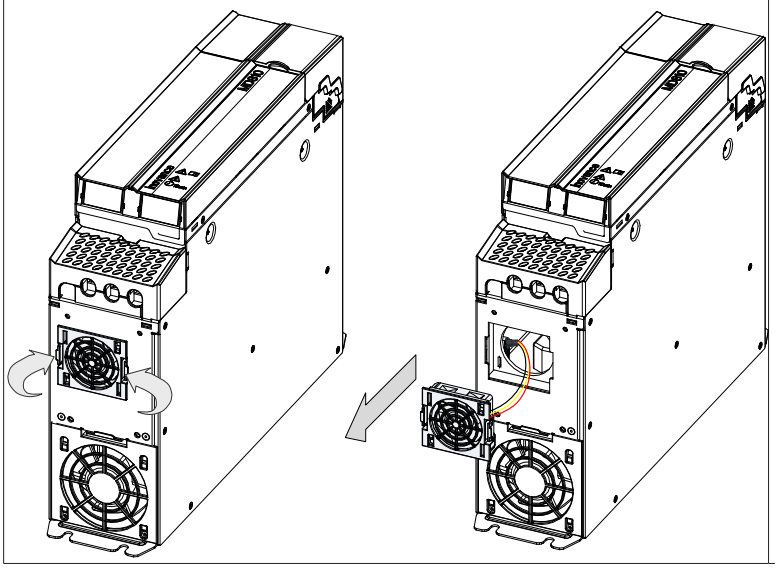
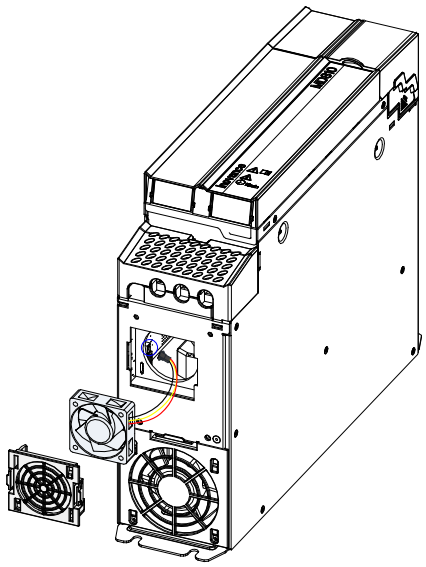


2. Insert the two snap-fit joints into the groove and press down to fix the snap-fit joints.

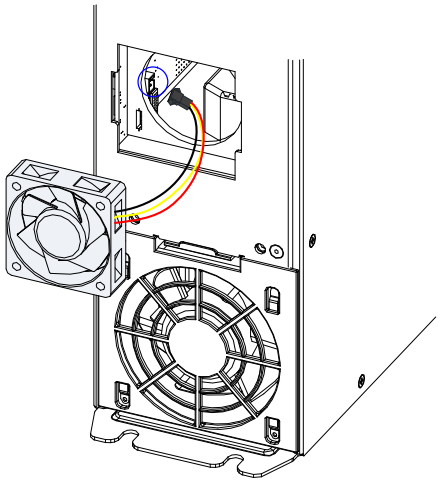


3. After replacement is completed, check that the air flow direction is upright.

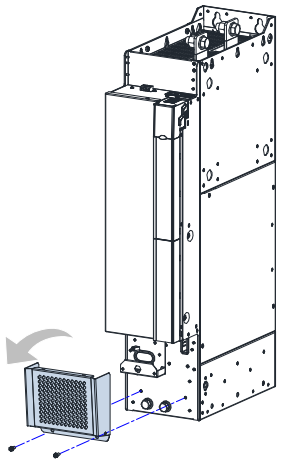
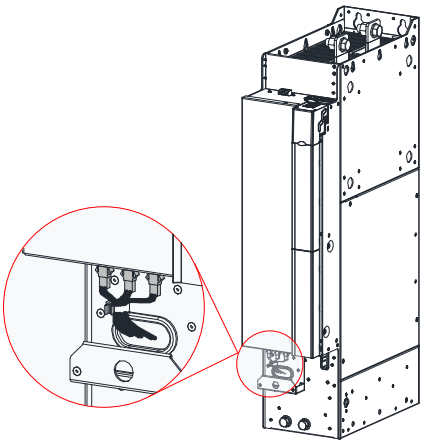
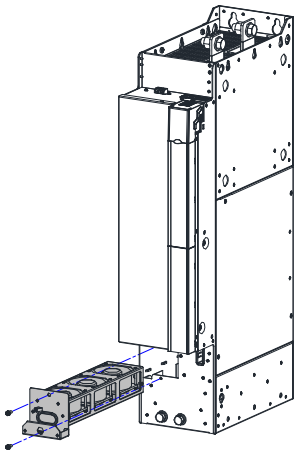
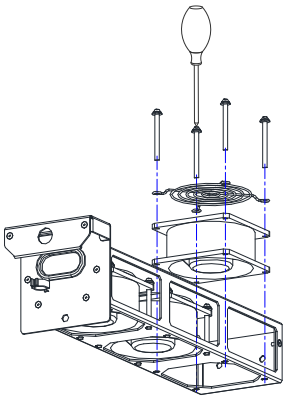
◆ Removing and installing the fan (50 x 40 mm, 50 x 50 mm) of the booksize unit

Removing the fan	
1. Press the snap-fit joint at both sides of the fan cover and remove the fan cover and the fan.	2. Detach the fan cover from the fan upwards and disconnect the power cable plug from the socket.
	

◆ Installing the fan (50 x 40 mm, 50 x 50 mm) of the booksize unit

Installing the fan
1. Install the fan in the reverse order of removal. Ensure that the direction of the fan is correct.
● Plug the power cable plug into the socket.

● Install the fan into the fan cover, place the assembly into the unit, and install the snap-fit joints at both sides of the fan into the groove.
● After replacing the fan, ensure the fan blows the air upwards.

◆ Removing the fan of the vertical tower unit (180-mm width)

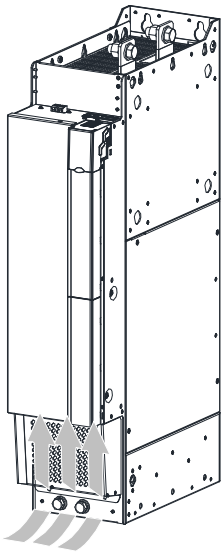
Removing the fan	
1. Remove the six fixing screws on the cover. Then, hold the cover with both hands and lift it up in the direction indicated by the arrow to remove the cover. 	2. Disconnect the fan power cable connector from the power supply unit. Each fan has a power cable connector. 
3. Remove two screws from the fan box and draw the fan box out in the direction of arrow. 	4. Turn the fan box upside down and remove the four screws on each fan. 

◆ Installing the fan of the vertical tower unit (180-mm width)

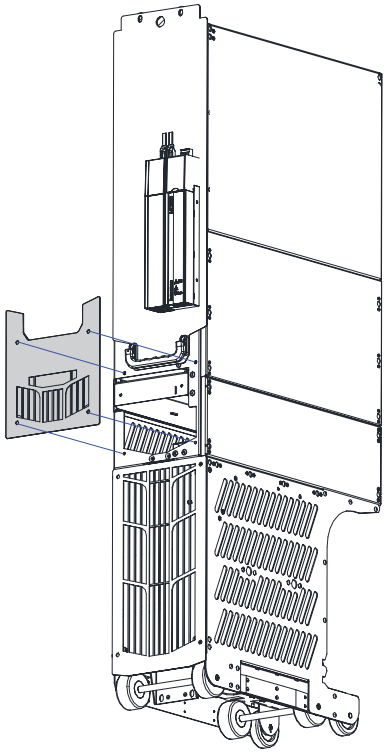
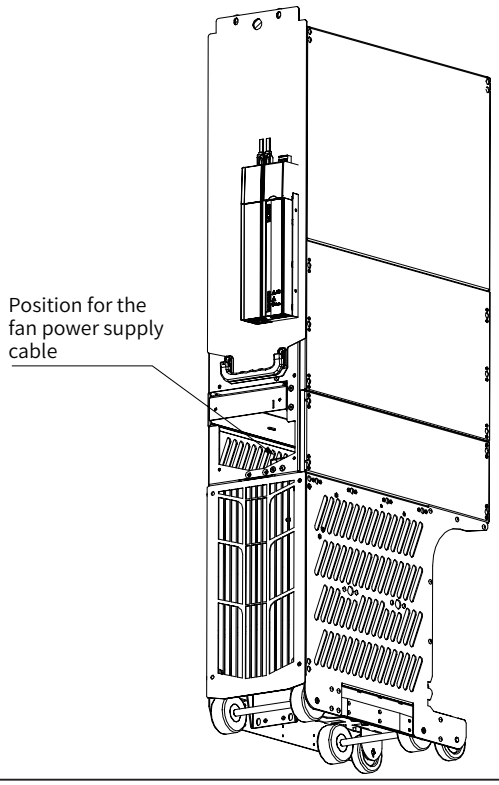
Installing the fan

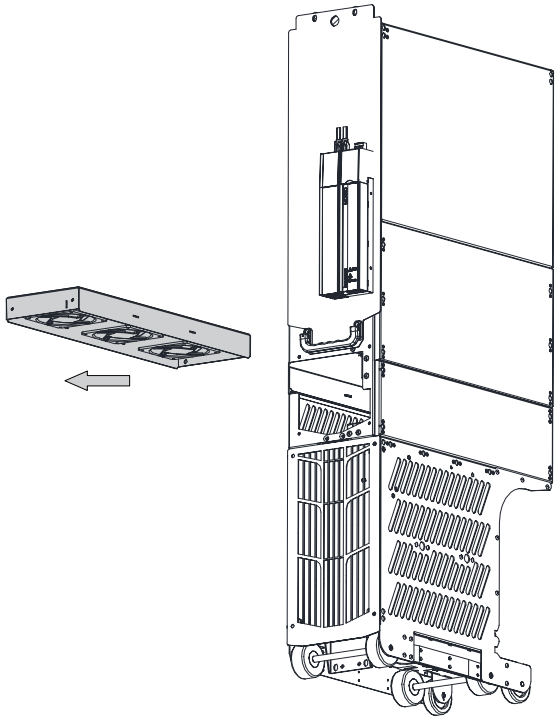
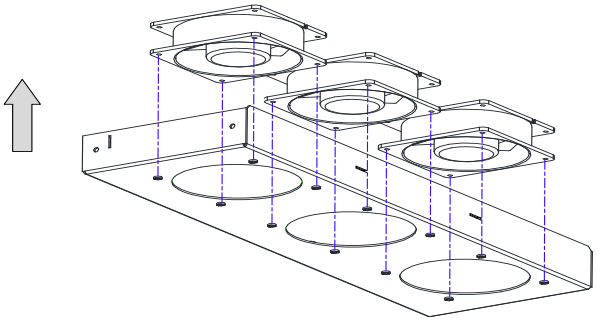
Install the fan in reverse order of removal. Ensure that the direction of the fan is correct.

- Align the fan box with the mounting rail and push it into the unit.
- Connect the fan power cable connector first and then fix the fan box. After replacing the fan, ensure the fan blows the air upwards.

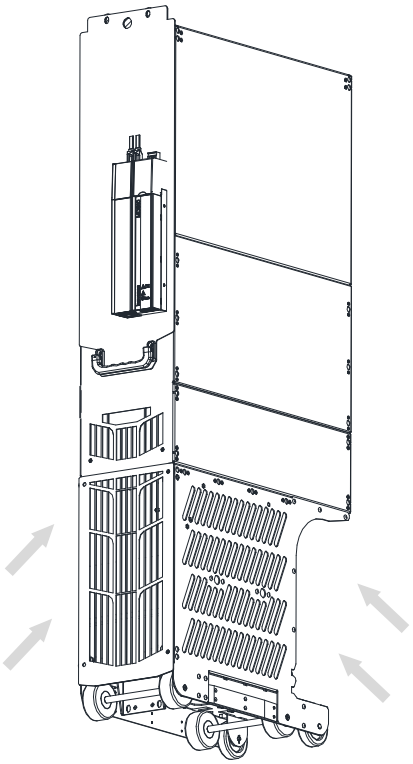


◆ Removing the fan of the vertical tower unit (230-mm width)

Removing the fan	
1. Remove the four fixing screws on the cover. Then hold the cover with both hands and remove the cover in the direction indicated by the arrow.	2. Disconnect the fan power cable connector from the power supply unit. Each fan has a power cable connector.
	

3. Remove the fan box in the direction indicated by the arrow.	4. Remove the four fixing screws from each fan cover and remove the fan.
	

◆ Installing the fan of the vertical tower unit (230-mm width)

Installing the fan
Install the fan in reverse order of removal. Ensure that the direction of the fan is correct. ● Align the fan box with the mounting rail and push it into the unit. ● Connect the fan power cable connector first and then fix the fan box. After replacing the fan, ensure the fan blows the air upwards. 

7.4 Warranty Agreement

1) Free warranty applies only to the drive.

2) Inovance provides an 18-month warranty to the equipment from the date of shipment (subject to the barcode on the drive or contract if there is any) for failure or damage that occurs under normal use. When the warranty period expires, reasonable maintenance fee will be charged. Within the warranty period, maintenance will be charged in the following cases:

   - Damage caused by operations not following the instructions in the guide
   - Damage caused by fire, flood, abnormal voltage, or other disasters
   - Damage caused by unintended use of the equipment
   - Damage caused by use outside the specifications
   - Damage caused by force majeure (natural disaster, earthquake, and lightning strike) and second damage caused thereof

3) 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.

4) For details, see Product Warranty Card.

Appendix A Communication

A.1 Parameter Communication Address

To perform read/write operations on parameters of the MD810, parameter communication addresses are used. This chapter mainly describes the method of obtaining communication addresses according to parameters as well as special parameter communication addresses for Modbus communication.

A.1.1 MD810 Parameter Introduction

Parameters of the MD810 are divided into basic function parameters and monitoring function parameters. Parameter

Groups F and A contain basic function parameters, as shown in the following table.

MD810 Parameter Data	Group F (Read/Write)	F0, F1, F2, F3, F4, F5, F6, F7, F8, F9, FA, FB, FC, Fd, FE, FF
	Group A (Read/Write)	A0, A1, A2, A3, A4, A5, A6, A7, A8, A9, AA, AB, AC, AD, AE, AF
	Group B (Read/Write)	B0, B1, B2

The following table shows the addresses used for the monitoring function parameters including running commands, running status, running parameters, and alarm information.

MD810 Monitoring Function Parameter	Status Data (Read-Only)	U0, 8000H
	Control Parameter (Write-only)	U3, 1000H, 731AH

A.1.2 Descriptions of Parameter Communication Address

There are multiple parameters in each of the parameter groups F0 to FF, A0 to AF, and B0 to B2. For example, F0-16 indicates parameter number 16 in group F0. High-order 16 bits in the communication address of a parameter are the parameter group number. Low-order 16 bits are the hexadecimal format of the parameter serial number in the parameter group.

For example, the communication address of F0-16 is 0xF010.

Writing basic function parameters and saving them upon power failure indicate frequent operations on the EEPROM, which reduces its service life. Therefore, you can modify some basic function parameters in the RAM through communication without saving them.

See the following table for details.

For parameters in groups F0 to FE, to obtain the RAM address, change the high-order bit F of the parameter address to 0.

For parameters in groups A0 to FA, to obtain the RAM address, change the high-order bit A of

the parameter address to 4.

That is, the communication RAM address of F3-12 is 0x030C; the communication RAM address of A0-05 is 0x4005.

Group No.	Communication Address	Parameter Address in RAM Changed Through Communication
F0 to FE	0xF000 to 0xFEFF	0x0000 to 0x0EFF
A0 to AF	0xA000 to 0xACFF	0x4000 to 0x4CFF
B0 to BF	0xB000 to 0xBFFF	0x5000 to 0x5FFF
U0	0x7000 to 0x70FF	

Note

- Group FF: The parameters in group FF cannot be read or changed.
- Group U0: Parameters can be read, but cannot be changed.
- 1000H and 8000H are Modbus specific communication addresses. Some functions are the same as group U.
- Only the write operation can be performed on communication RAM addresses. They are invalid addresses during the read operation.
- Some parameters cannot be changed when the drive is in the running state.
- Some parameters cannot be changed regardless of states of the drive.
- In addition, pay attention to setting range, unit and description of parameters when modifying them.

A.1.3 Modbus-specific Parameter Communication Addresses

Parameter Address	Description
Communication monitoring parameters	
1000H/731AH*	Communication reference (decimal) -10000 to 10000 The reference set through communication is a relative percentage. The value 10000 corresponds to 100.00%, and -10000 corresponds to -100.00%. For frequency dimension data, the frequency reference is the percentage of the maximum frequency (F0-10). For torque dimension data, the torque is the percentage of F2-10 (Digital setting of torque upper limit).
Control command inputted to the drive (write-only)	
7311H	0000: Stop mode set by F6-10 0001: Forward running 0002: Reverse running 0003: Forward jogging 0004: Reverse jogging 0005: Coast to stop 0006: Decelerate to stop 0007: Fault reset
Reading drive status	

Parameter Address	Description
703DH	0001: Forward running 0002: Reverse running 0003: Stop 0004: Auto-tuning 0005: Fault
Parameter lock password check	
1F00H	If the value returned is the actual password, it indicates the password passes the verification. If password protection is not applied (FP-00 = 0), the returned value is 0000H.
DO control	
7312H	Bit 0: DO1 output control Bit 1: DO2 output control Bit 2: RELAY1 output control Bit 3: Reserved Bit 4: FMR output control Bit 5 to Bit 9: Reserved
AO control	
7313H	0 to 7FFF represent 0% to 100%.
Pulse output control	
7315H	0 to 7FFF represent 0% to 100%.
Fault description	

Parameter Address	Description
8000H	0000: Normal 0001: Hardware fault 0002: Overcurrent during acceleration 0003: Overcurrent during deceleration 0004: Overcurrent during operation at constant speed 0005: Overvoltage during acceleration 0006: Overvoltage during deceleration 0007: Overvoltage during operation at constant speed 0009: Undervoltage 000A: Drive overload 000B: Motor overload 000C: Input phase loss 000D: Output phase loss 000E: Module overtemperature 000F: External fault 0010: Communication exception 0013: Motor auto-tuning fault 0014: Encoder/PG card fault 0015: Parameter reading/writing operation fault 0016: Motor auto-tuning result fault 0017: Motor short-circuited to ground 0018: Inter-phase short circuit 0019: Power supply unit fault 001A: Running time reach 001B: User-defined fault 1 001C: User-defined fault 2 001D: Power-on time reach 001E: Load loss 001F: PID feedback loss during running 002A: Excessive speed deviation 002B: Motor overspeed 002D: Motor overtemperature 0050: Fan fault

Note

- The parameter address 731AH is applicable only to MD810-50M4TXXG (200, 201, 210, 211) models.

A.2 Modbus Communication

A.2.1 Networking

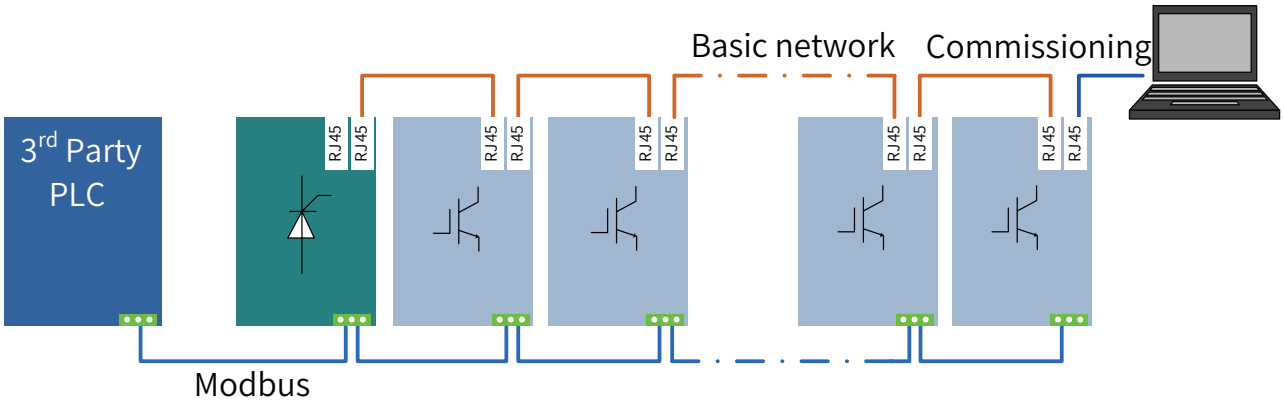


Figure B-3 Modbus communication networking

A.2.2 Terminal Descriptions

The 3-pin terminal block contains C485+, C485-, and CGND terminal from left to right. See the following figure.

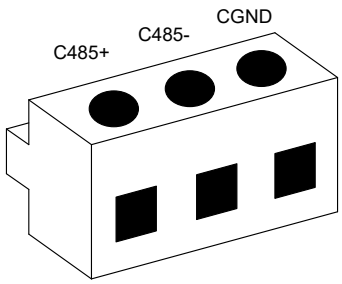


Figure B-4 3-Ping terminal block

A.2.3 Communication Performance

1. Up to 128 nodes are supported. The maximum baud rate is 115.2 kbps, the maximum communication distance is 1 km and the cross sectional area of the communication cable is 26AGW.

2. The maximum transmission distance corresponding to the baud rate of 19.2 kbps is 1 km.

A.2.4 Related Parameters

Para. Code	Parameter Name	Default	Value Range		Description
Fd-00	Modbus baud rate	5	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps	5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	This parameter defines the rate of data transmission between the host controller and the AC drive. The higher the baud rate, the faster the communication speed. Note that the baud rate of the host controller must be the same as that of the AC drive. Otherwise, communication will fail.

Para. Code	Parameter Name	Default	Value Range	Description
Fd-01	Modbus data format	0	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	The data format set in the host controller must be the same as that set in the AC drive. Otherwise, communication will fail.
Fd-02	Modbus local address	1	1 to 247 0: Broadcast address	When the local address is set to 0 (broadcast address), the AC drive communicates with the host controller in the broadcast mode. The local address is unique (except the broadcast address), which is the basis for point-to-point communication between the host controller and the AC drive.
Fd-03	Modbus response delay	2	0 ms to 20 ms	It is used to set the time interval from the time when the AC drive finishes receiving data to the time when the AC drive starts to send data to the host controller. If the response delay is shorter than the system processing time, the system processing time prevails. If the response delay is longer than the system processing time, the AC drive sends data to the host controller only after the response delay elapses.
Fd-04	Modbus communication timeout time	0.0	0.1s to 60.0s 0.0: Disabled	When it is set to 0.0s, the Modbus communication timeout time is invalid. Generally, set it to 0.0s. This parameter is used to monitor communication status in a system with continuous communication. When it is set to a valid value, if the communication interval between current communication and the next communication exceeds the value of Fd-04, the system reports a communication fault (Err16).
Fd-94	Modbus software version	0. 00	0. 00 to 655.35	This parameter indicates the version of Modbus communication software.

A.2.5 Modbus Communication Protocol

The MD810 provides RS485 communication interfaces and supports the Modbus RTU slave

communication protocol. You can carry out centralized control by using a PC or PLC. Through the communication protocol, you can also set the running commands, modify or read parameters, and read the operating status and fault information of the drive.

This protocol defines content and format of information transmitted during serial communication. The format includes master polling (or broadcasting) and master coding method, and the content includes parameters for the action, transmission data, and error check. The slave response uses the same structure including action confirmation, returned data, and error check. If an error occurs when the slave receives a message, or the slave cannot complete the action required by the master, the slave returns a fault message as a response to the master.

5) Application mode

The drive, acting as a communication slave, is connected to a PC/PLC controlled network consisting of one master and multiple slaves and equipped with the RS485 bus.

6) Bus structure

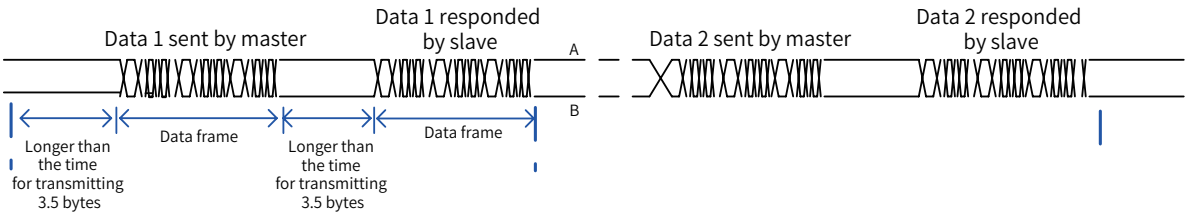
◆ Topology

The system consists of a single master and multiple slaves. Every communication device in the network has a unique slave address. One device as a communication host (generally the PC, host controller, PLC, HMI, etc.) actively initiates communication to perform the parameter read or write operation on salves. Other devices as communication slaves respond to the host's inquiry or communication operation on them. At the same moment, only one device can transmit data and the other can only receive data.

The setting range of the slave address is 1 to 247. The value 0 is a broadcast communication address. A slave address must be unique in the network.

◆ Communication transmission mode

The asynchronous serial and half-duplex transmission mode are used. During asynchronous serial communication, data is sent frame by frame in the form of packets. According to the Modbus RTU protocol, an interval that is longer than the transmission time of 3.5 bytes on the communication data line marks the start of a new communication frame.



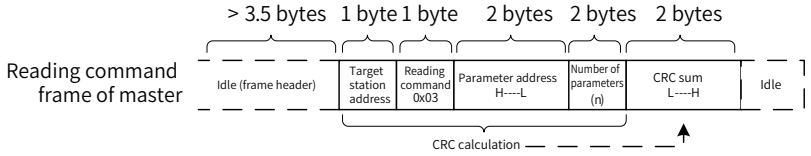
The built-in communication protocol of the AC drive is the Modbus RTU slave communication protocol, which allows the AC drive to respond to the query command from the master or execute the action according to query command from the master and respond with communication data.

A master can be a PC, an industrial control device, or a PLC, etc. The master can separately communicate with a slave or issue broadcast information to all slaves. When the master sends

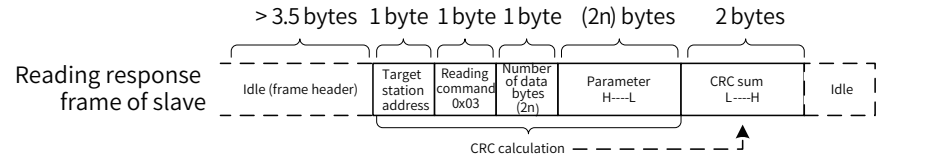
a query command to a single slave, the slave needs to return a response frame. For a broadcast message sent by the master, the slaves do not need to return a response to the master.

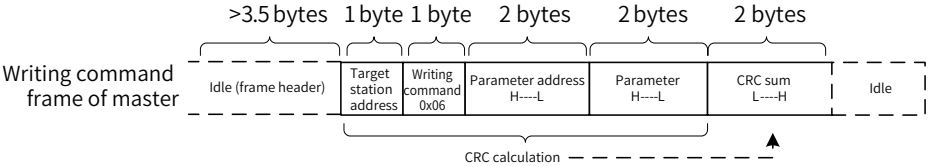
A.2.6 Communication Data Frame Structure

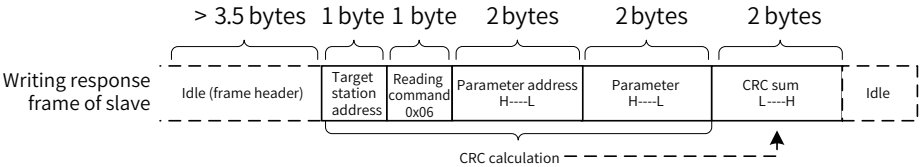
The Modbus-RTU protocol communication data format of the MD810 is described as follows. The drive supports read or write operations only on word type parameters. The read operation command is 0x03, the write operation command is 0x06, and the multi-data write operation command is0x10. Read/write operations on bytes or bits are not supported.

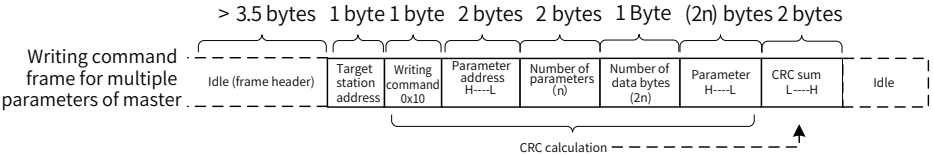


In theory, the host controller can read a maximum of 12 consecutive parameters. However, these parameters must be in the same group. Otherwise, a response error occurs.

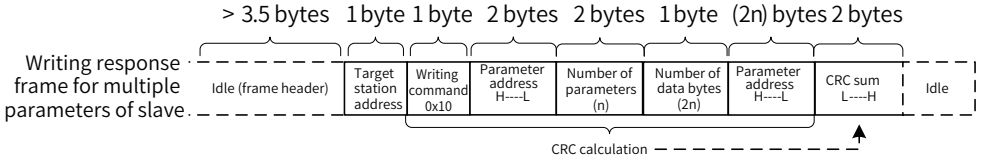








A maximum of 12 consecutive parameters can be read or written.



If the slave detects a communication frame error or a reading/writing failure caused by other

reasons, an error frame will be returned.

Note: No response will be given for CRC check error.

The command for a reading error responded by the slave is 0x83. The command for a writing error responded by the slave is 0x86. The command for a multi-data write error responded by the slave is 0x90.

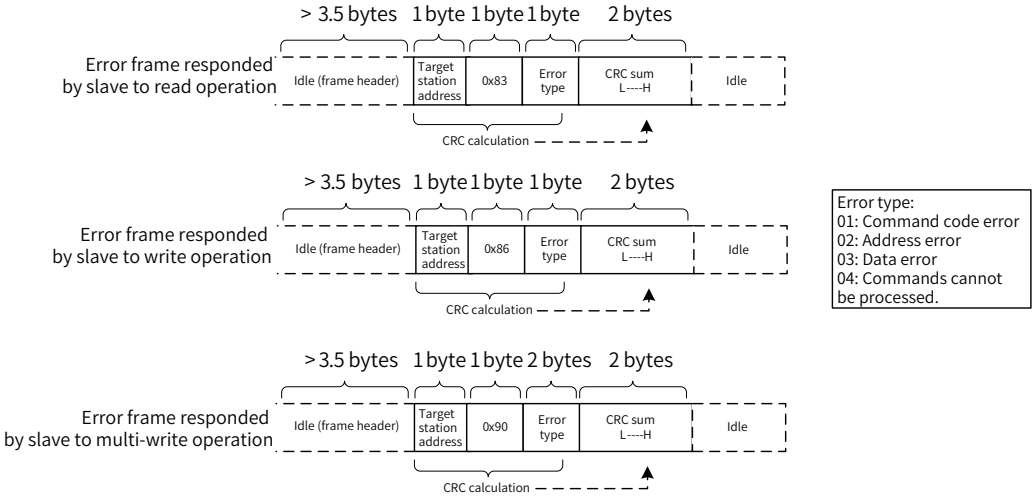


Table B-3 Data frame fields

Frame Header (START)	Longer than the time for transmitting 3.5 bytes
Slave Address (ADR)	Communication address range: 1 to 247; 0: Broadcast address
Command Code (CMD)	03: Read a slave parameter; 06: Write a slave parameter; 10: Write multiple slave parameters
Parameter Address (H)	Parameter addresses of the AC drive are represented in hexadecimal, which are divided into parameter type and non-parameter type (such as operating state parameters or operating commands). For details, see address definitions. Low-order bytes follow high-order bytes during transmission.
Parameter Address (L)	
Number of Parameters (H)	Number of parameters read in this frame. 1 indicates that one parameter is read. Low-order bytes follow high-order bytes during transmission. Only one parameter can be modified at a time.
Number of Parameters (L)	
Number of Data Bytes	The data length is twice the number of parameters.
Data (H)	Response data or data to be written. Low-order bytes follow high-order bytes during transmission.
Data (L)	
CRC Low-Order Bit	Detection value: CRC16 check value. High-order bytes follow low-order bytes during transmission. For the calculation method, see the following descriptions of CRC.
CRC High-Order Bit	
END	Time required for transmitting 3.5 bytes

CRC check:

The cyclical redundancy check (CRC) adopts the RTU frame format. A Modbus message includes a CRC-based error check field. The CRC field checks the content of the entire message. The CRC field is comprised of two bytes, containing a 16-bit binary value. It is added to the message after being calculated by the transmission device. The receiving device recalculates a CRC value in the message, and compares the calculated value with the CRC value in the received CRC field. If the two CRC values are different, transmission errors occur.

The CRC is first stored to 0xFFFF. Then a procedure is invoked to process the consecutive 8-bit byte in the message and the value in the register. Only the 8-bit data in each byte is valid for the CRC. The starting bit, stop bit and the parity bit do not apply to the CRC.

During CRC, each eight-bit byte is in exclusive or (XOR) with the content in the register. The result is shifted to the least significant bit (LSB), and 0 is filled in the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB is 1, the register then performs XOR with a preset value. If the LSB is 0, no XOR is performed. This process will be repeated eight times. After the last (eighth) shift, the next eight-bit byte is in XOR with the register's current value, and the process repeats for eight more shifts as described above. The final value of the register is the CRC value after all the bytes of the message have been applied.

The CRC is added to a message from the low-order byte to the high-order byte. A simple function for the CRC is as follows:

```
unsigned int crc_chk_value (unsigned char *data_value,unsigned char length)
{
unsigned int crc_value=0xFFFF;
    int i;
    while (length--)
    {
        crc_value^=*data_value++;
        For (i=0;i<8;i++)
        {
            If (crc_value&0x0001)
        {
                crc_value= (crc_value>>1) ^0xa001;
            }
            else
            {
                crc_value=crc_value>>1;
            }
        }
    }
Return (crc_value);
}
```

A.3 CANopen/CANlink Communication

The CANopen communication protocol is an international standard protocol. The CANlink communication protocol is a special protocol independently developed by Inovance based on CAN bus applications. This protocol can be used to communicate with only Inovance PLCs such as H2U and H3U.

A.3.1 Networking

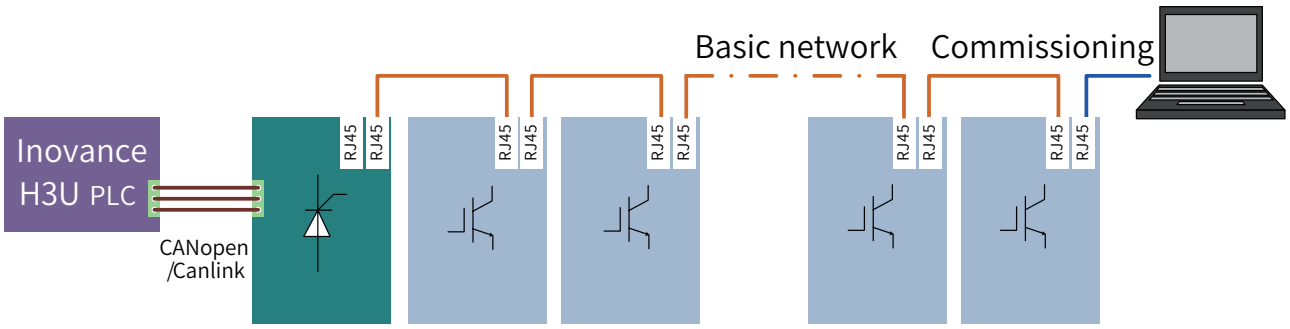


Figure B-5 CANopen/CANlink communication networking

Note

- Ensure that termination resistors are located at both ends of the CAN bus.
- A computer or commissioning tool can be connected at the end of the CAN network.

A.3.2 Terminal Descriptions

The dual RJ45 ports of the MD810 are CANopen/CANlink protocol communication ports, as shown in the following figure.

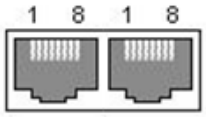


Figure B-6 CANopen/CANlink communication port

Pins of both ports are internally connected. The following table shows the assignment of the ports.

Table B-4 Assignment of RJ45 ports

Pin	Signal	Description
1	CANH	CAN bus high level
2	CANL	CAN bus low level
3	CGND	Communication common ground
4	Reserved by the manufacturer	

Pin	Signal	Description
5	Reserved by the manufacturer	
6	Not connected	Reserved
7	Not connected	Reserved
8	CGND	Communication common ground

A.3.3 CAN Bus Topology

The CAN bus topology is shown below. Use shielded twisted cables as the CAN bus, connect a 120 Ω termination resistor to both ends of the bus to prevent signal reflection, and ground the shield in the single point grounding mode.

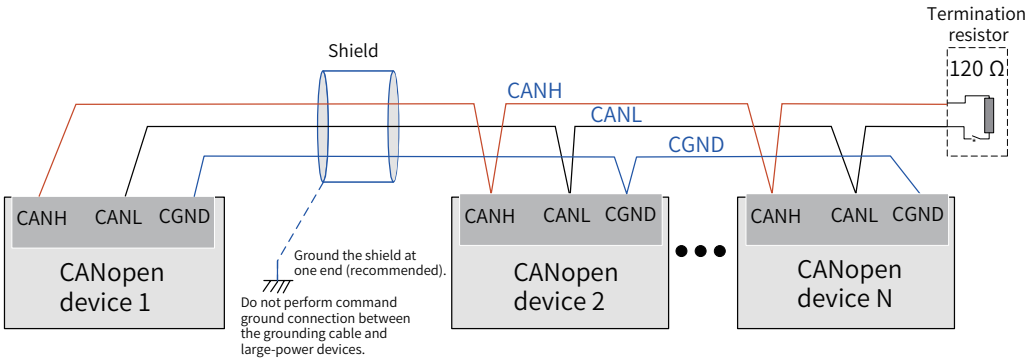


Figure B-7 CAN bus topology

A.3.4 CAN Transmission Distance

The transmission distance of the CAN bus is directly related to the baud rate and communication cables. The following table describes the relationship between the maximum bus length and the baud rate.

Table B-5 Relationship between the bus length and the baud rate

Baud Rate (bps)	1 Mbps	500 kbps	250 kpbs	125 kpbs	100 kpbs	50 kpbs	20 kpbs
Length (m)	25	100	250	500	500	1000	1000

A.3.5 Related Parameters

To use the CANopen/CANlink protocol, set the following parameters.

Table B-6 Parameters

Para. Code	Parameter Name	Default	Value Range	Description
Fd-09	Communication status	0	Ones (CANopen) 0: Stop 1: Initialization 2: Pre-operational 8: Running Tens place (CANlink) 0: Stop 1: Initialization 2: Pre-operational 8: Running Hundreds (PROFIBUS DP) 0: Stop 1: Initialization 2: Pre-operational 8: Running	This read-only parameter is used to monitor the communication status.
Fd-10	Communication protocol	1	1: CANopen 2: CANlink	This parameter is used to select the CAN communication protocol. If it is set to 1, the CANopen protocol is selected. If it is set to 2, the CANlink protocol is selected.
Fd-11	CiA 402 selection	1	0: Disable 1: Enable	It is used to select the CANopen mode. When it is set to 0, it indicates ordinary mode. When it is set to 1, the CiA 402 mode is used.
Fd-12	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	This parameter defines the baud rate for CAN communication, including CANlink and CANopen communication. In the same network, baud rates of all stations must be consistent. Otherwise, communication will fail.
Fd-13	CAN station number	1	1 to 247	This parameter defines the CAN station number, including that for CANlink and CANopen communication. In the same network, all station numbers must be unique. Otherwise, communication will fail.
Fd-14	Number of CAN frames received per unit of time	0	0 to 65535	It is used to monitor bus load. This parameter indicates the number of CAN frames received by this station each second.

Para. Code	Parameter Name	Default	Value Range	Description
Fd-15	Maximum number of error frames received by node	0	0 to 65535	This parameter is used to monitor bus errors. This parameter defines the maximum number of error frames received by the node.
Fd-16	Maximum number of error frames sent by node	0	0 to 65535	This parameter is used to monitor bus errors. This parameter defines the maximum number of error frames sent by the node.
Fd-17	Number of disconnections for the CAN bus	0	0 to 65535	This parameter is used to monitor bus errors. This parameter defines the number of disconnections for the CAN bus.
Fd-18	Power supply unit No.	1	1 to 99	This parameter indicates the common bus network group No. It is used for networking of multiple groups of common buses. Networks in a group that share a common bus must share one number. The number of each common bus network group must be unique.
Fd-34	CANopen mode	0	0: Ordinary mode 1: Expert mode	The common mode is the standard CANopen mode. In expert mode, the current node can send and receive PDOs according to the mapping configured in the parameter group AF.
Fd-35	CANopen inhibition time	0	0: Disable 1 to 65535: TPDO inhibition time (unit: 100 us)	This parameter is disabled when it is set to 0. When it is set to a value greater than 1, its value will be sent if the master does not set the inhibition time for a TPDO.
Fd-36	CANopen event time	0	0: Disable 1 to 65535: TPDO event time (Unit: ms)	This parameter is disabled when it is set to 0. When it is set to a value greater than 1, its value will be sent if the master does not set the event time for a TPDO.
Fd-95	CANlink software version	0. 00	0. 00 to 655.35	This parameter indicates the version of the CANlink communication software.
Fd-96	CANopen software version	0. 00	0. 00 to 655.35	This parameter indicates the CANopen communication software version.

A.3.6 Descriptions of CANopen Communication Protocol

1) Software feature

The CANopen protocol for the MD810 supports the following features:

- Supporting the Node Guard protocol, based on which the master can read the device status
- Supporting the heartbeat protocol, based on which the slave reports the current state to the master regularly
- The Service Data Object (SDO) supports only the accelerated transmission mechanism. One parameter or one object dictionary is transmitted at a time.
- Four TPDOs (transmit PDOs) and four RPDOs (receive PDOs) are supported.
- Supporting emergency objects
- Supporting the synchronization mode

2) Communication object COB-ID

The CANopen provides multiple communication objects. Every communication object has different features. For details, refer to "A.3.7 CANopen Communication Protocol". You can select a proper communication object according to different applications. The communication terminal adopts the predefined COB-ID. Specific rules are as follows:

- NMT object: 0x000
- SYNC object: 0x080
- SDO object:

  Transmit SDO— 0x600+Node-Id

  Receive SDO — 0x580+Node-Id

- PDO object:

  RPDO1 — 0x200+Node-Id

  RPDO2 — 0x300+Node-Id

  RPDO3 — 0x400+Node-Id

  RPDO4 — 0x500+Node-Id

  TPDO1 — 0x180+Node-Id

  TPDO2 — 0x280+Node-Id

  TPDO3 — 0x380+Node-Id

  TPDO4 — 0x480+Node-Id

- EMCY object: 0x80+Node-Id

  Node-Id: Equipment ID (station address) set in Fd-13.

3) Parameter confirmation

The MD810 parameters include parameters of the power supply unit and parameters of the

drive unit. Therefore, the mapping between parameters and object dictionaries is specified. This allows you to operate parameters conveniently.

◆ Mapping between parameters of CANopen object dictionary indexes

● Corresponding method

The parameter groups correspond to indexes 0x2000 to 0x20FF of the CANopen object dictionary. The corresponding method is as follows: An object dictionary index is the high-order 16 bits of a parameter address plus 0x2000; an object dictionary sub-index is the low-order 16 bits of the parameter address plus 1. For example, the communication address of F0-03 is 0xF003. The corresponding object dictionary index and sub-index are 0x20F0 and 0x04, respectively.

● Corresponding parameter groups

The parameter groups of the drive include groups F0 to FF, A0 to AF, and U0 to UF.

According to the preceding correspondence method, during parameter read/write operation, the relation between the parameter group numbers and the object dictionary indexes is as follows:

Parameter Group	CANopen Object Dictionary Sub-index
F0 to FF	0x20F0 to 0x20FF
A0 to AF	0x20A0 to 0x20AF
U0 to UF	0x2070 to 0x207F

A sub-index is the low-order 16 bits of a parameter address plus 1, so the mapping between parameter indexes in parameter groups and object dictionary sub-indexes is as follows.

Parameter Index	CANopen Object Dictionary Sub-index
0x0 to 0xFE	0x1 to 0xFF

Take F0-17 as an example. When the value of F0-17 is read, the parameter address is 0xF011. The object dictionary index and sub-index are 0x20F0 and 0x12 respectively.

◆ Read operations on SDOs

The CANopen SDO is used to perform the read operation on the parameters of the power supply unit and drive unit. The following table shows the data format sent by the master.

Take F0-02 as an example. According to the relation described in the preceding section, the index and sub-index are 0x20F0 and 0x03 respectively.

Table B-7 SDO object sent for the read operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	RTR	0	Remote frame flag "0"

8-byte frame data	DATA0	Command code (0x40)	0x40 read command
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	0 is reserved.
	DATA5	Data 2	0 is reserved.
	DATA6	Data 3	0 is reserved.
	DATA7	Data 4	0 is reserved.

The following table shows the SDOs returned for the read operation.

If the operation is successful, the command code returns "0x4B". The index and sub-index remain unchanged. DATA4 and DATA5 return the read data, and DATA6 and DATA7 return "0".

If the operation fails, the command code returns "0x80". The index and sub-index remain unchanged. DATA4, DATA5, DATA6 and DATA7 return the SDO failure error code. For error codes, refer to "6.4 Fault List and Solution".

Table B-8 SDOs returned for the read operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Returned value of the command code	Success: 0x4B Failure: 0x80
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	Success: 0 Failure: SDO operation failure error code (Refer to the CANopen protocol)
	DATA7	Data 4	

◆ SDO for the write operation

The CANopen SDO is used to perform the write operation on the parameters of the power supply unit and drive unit. The following table shows the data format sent from the master.

Table B-9 SDO sent for the write operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x600+Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	RTR	0	Remote frame flag "0"

8-byte frame data	DATA0	Command code	0x2B
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Low-order byte of data
	DATA5	Data 2	High-order byte of data
	DATA6	Data 3	0 is reserved.
	DATA7	Data 4	0 is reserved.

The following table shows the SDOs returned for the write operation.

If the operation is successful, the command code returns "0x60". The index and sub-index remain unchanged. DATA4, DATA5, DATA6, and DATA7 return "0".

If the operation fails, the command code returns "0x80". The index remains unchanged. DATA4, DATA5, DATA6, and DATA7 return the SDO failure error code. For error codes, refer to"6.4 Fault List and Solution".

Table B-10 SDO returned for the write operation

CAN Frame		CANopen Data	Description
COB-ID	11-bit ID	0x580+Node-ID	The Node-ID of the equipment is set via the DIP switch.
RTR	RTR	0	Remote frame flag "0"
8-byte frame data	DATA0	Returned value of the command code	Success: 0x60 Failure: 0x80
	DATA1	Low-order byte of index	Parameter group (group F0 "0xF0")
	DATA2	High-order byte of index	0x20
	DATA3	Sub-index	Parameter No. + 1 ("0x03")
	DATA4	Data 1	Success: 0
	DATA5	Data 2	Failure: SDO operation failure error code
	DATA6	Data 3	(Refer to A.3.7.)
	DATA7	Data 4	0 is reserved.

◆ Read/Write operation example

This section takes the read and write operation on F0-02 as an example. The CANopen address of the drive is set to "0x06".

● Reading the AC drive command source (F0-02)

To read the value of F0-02 (Command source selection, the master sends the following CANopen message.

Table B-11 Message sent by the master to read F0-02

Message ID (Hex)	RTR	Data (Hex)
0x606	0	40 F0 20 03 00 00 00 00

The following table shows the drive's response to the CANopen message. The current value of F0-02 is "0x0002", indicating the current command source of the drive is communication.

Table B-12 Message returned by the AC drive for the read operation of F0-02

Message ID (Hex)	RTR	Data (Hex)
0x586	0	4B F0 20 03 02 00 00 00

- Setting the command source (F0-02) to the operation panel

To set the command source to the operation panel, the master can send the following CANopen packet to write 0 to F0-02.

Table B-13 Message sent by the master for the write operation on F0-02

Message ID (Hex)	RTR	Data (Hex)
0x606	0	2B F0 20 03 00 00 00 00

The following table describes the CANopen message returned by the AC drive. Write 0 to F0-02 to set the current command source to the operating panel.

Table B-14 Message returned by the AC drive for the write operation on F0-02

Message ID (Hex)	RTR	Data (Hex)
0x586	0	60 F0 20 03 00 00 00 00

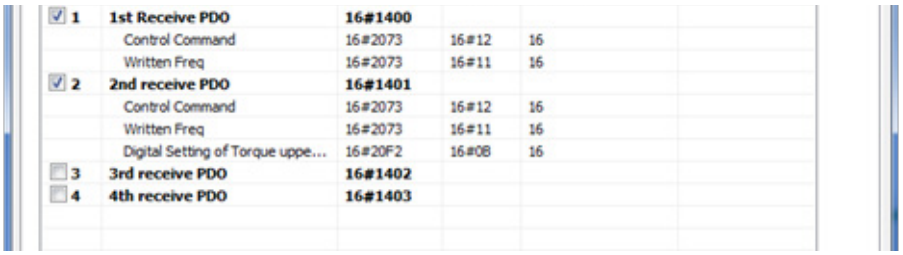
◆ PDO configuration

The AC drive supports four RPDOs (RPOD1, RPDO2, RPDO3 and RPDO4) and four TPDOs (TPOD1, TPDO2, TPDO3 and TPDO4), which can be configured as needed.

You can set the slave PDO mapping on the master or directly configure the slave PDO mapping. It is generally recommended to use the CANopen master to configure the mapping.

- Configuring the slave PDO on the master

Select an object to be configured on the master directly to enable the master to use the SDO to write the PDO mapping to each node, as shown in the following figure.



- Configuring a slave PDO directly

i. Configure a PDO using the background software

When using a master that cannot be used to configure a slave PDO mapping, you can directly configure the slave using the CANopen configuration interface of InoDriveShop.

Note

- Any modification operation via the background must be finished before a CANopen remote node is started up.

ii. Manually configure a PDO using the keypad

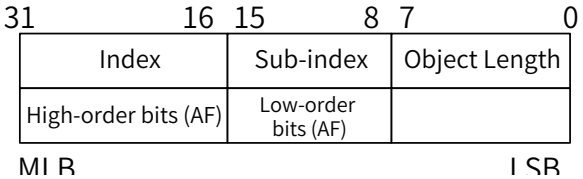
You can also configure the PDO mapping through modifying parameters in group AF manually. The following table shows the mapping relation of every PDO.

Table B-15 PDO mapping

RPDO	Group AF Address		TPDO	Group AF Address	
RPDO1	Sub-index 1	AF-00	TPDO1	Sub-index 1	AF-32
		AF-01			AF-33
	Sub-index 2	AF-02		Sub-index 2	AF-34
		AF-03			AF-35
	Sub-index 3	AF-04		Sub-index 3	AF-36
		AF-05			AF-37
	Sub-index 4	AF-06		Sub-index 4	AF-38
		AF-07			AF-39
RPDO2	Sub-index 1	AF-08	TPDO2	Sub-index 1	AF-40
		AF-09			AF-41
	Sub-index 2	AF-10		Sub-index 2	AF-42
		AF-11			AF-43
	Sub-index 3	AF-12		Sub-index 3	AF-44
		AF-13			AF-45
	Sub-index 4	AF-14		Sub-index 4	AF-46
		AF-15			AF-47
RPDO3	Sub-index 1	AF-16	TPDO3	Sub-index 1	AF-48
		AF-17			AF-49
	Sub-index 2	AF-18		Sub-index 2	AF-50
		AF-19			AF-51
	Sub-index 3	AF-20		Sub-index 3	AF-52
		AF-21			AF-53
	Sub-index 4	AF-22		Sub-index 4	AF-54
		AF-23			AF-55
RPDO4	Sub-index 1	AF-24	TPDO4	Sub-index 1	AF-56
		AF-25			AF-57
	Sub-index 2	AF-26		Sub-index 2	AF-58
		AF-27			AF-59
	Sub-index 3	AF-28		Sub-index 3	AF-60
		AF-29			AF-61
	Sub-index 4	AF-30		Sub-index 4	AF-62
		AF-31			AF-63

Each PDO can be configured with four mappings. To configure one mapping, you need to operate two parameters in group AF to implement 32-bit data, of which the high-order 16 bits

(with a smaller parameter No.) are the object dictionary index, and the low-order 16 bits (with a larger parameter No.) are the object dictionary sub-index and object length. The object length is calculated in bits. The format of mapping objects is as follows:



According to the preceding relation between the parameters and the object dictionary, when a parameter needs to be mapped to a PDO, you only need to write the object dictionary index and sub-index and data length corresponding to the parameter into group AF according to the preceding rules.

Take configurations of two mappings to RPDO1 as examples. One mapping directs to F0-01 and the other mapping is an object dictionary 0x6060-00. The operation is as follows.

Table B-16 Mapping example of group AF

Assumed Address	Group AF Address	Description	Remarks
F0-01	AF-00	0x20F0	Parameter address index Equal to group No. F0 + 0x2000
	AF-01	0x0210	High-order bit 02: Parameter group No. offset + 1; Low-order bit 10: 16-bit parameter length.
0x6060-00	AF-02	0x6060	Object dictionary index
	AF-03	0x0008	High-order bit 00: Object dictionary sub-index Low-order bits (08): 8-bit object length

Note

- Any write operation via the background or keypad must be finished before a CANopen remote node is started up.

1. Expert mode

You can select the CANopen expert mode using Fd-34. In the expert mode, the PDO mapping is subject to configurations in group AF and the configurations performed through the CANopen master are omitted. If the CANopen master is used to configure the PDO mapping, the configured mapping is not written. However, the number of PDOs and the length must be consistent with those set in group AF. Failure to comply may result in an error in the configuration phase.

In the expert mode, you can manually set a PDO by the method described in the preceding section "Manually configure a PDO using the keypad" in the case that the master is not used to perform configurations. After receiving a start command, the MD810 power supply unit performs communication according to any configured mapping in group AF.

2. Manually configure inhibition time/event time

You can manually configure inhibition time/event time using Fd-35 and Fd-36. Take inhibition time as an example to describe the work mode of parameter Fd-35.

When Fd-35 is set to 0, this parameter is invalid.

When Fd-35 is set to a value greater than 1 and the inhibition time of a TPDO (e.g. TPDO1) is configured on the master, the TPDO communicates according to the inhibition time configured on the master. When Fd-35 is set to a value greater than 1 and the inhibition time of the TPDO is not configured on the master, the TPDO communicates according to the value of Fd-35.

The work mode of Fd-36 is the same as that of Fd-35.

Note: The unit of Fd-35 (inhibition time) is 100 μs; the unit of Fd-36 (event time) is ms.

A.3.7 CANopen Communication Protocol

1) Overview of the CANopen communication protocol

CANopen is an application layer protocol of the network transmission system based on the CAN serial bus. The CAN bus follows an ISO/OSI standard model. This protocol defines the data link layer and some physical layers in the OSI model. It allows the multi-master mode, in which any node in the network can send a message to other nodes. Network nodes are assigned with different priorities based on system real-time requirements, which can reduce the bus arbitration time in case of a transmission collision. The CAN network does not use the traditional address coding method. Instead, it uses the communication data block coding method. With data block coding, the number of nodes in the network is not limited theoretically, and different nodes can receive the same data at the same time. This coding mode also features short transmission byte, fast speed, good fault tolerance, and reliable data transmission, making it suitable for industrial control and distributed real-time control. The CANopen device model is shown in the following figure.

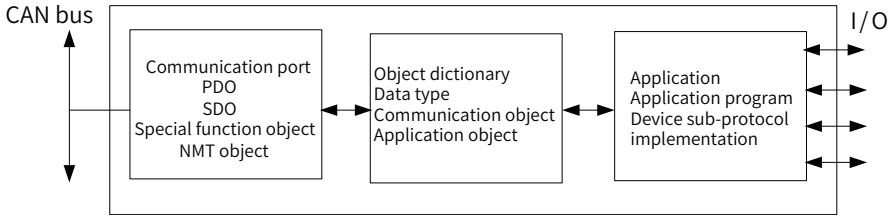


Figure B-8 CANopen device model

2) Object dictionary

The object dictionary is the most important part in device specifications. It is an ordered set of parameters and variables and includes all parameters of device descriptions and device network status. A group of objects can be accessed in an ordered and pre-defined way through the network.

The CANopen protocol uses object dictionaries with 16-bit index and 8-bit sub-index. The following figure shows the structure of the object dictionary.. One master node or configuration tool can access all values in a slave node object dictionary.

Index	Object
000	Not used
0001—001F	Static data types (standard data types, such as Boolean and Integer 16)
0020—003F	Complex data types (structure consisting of simple types, such as PDOCommPar and SDOParmeter)
0040—005F	Manufacturer specific complex data types
0060—007F	Device profile specific static data types
0080—009F	Device profile specific complex data types
00A0—0FFF	Reserved
1000—1FFF	Communication profile area (such as device type, error register, and number of supported PDOs)
2000—5FFF	Manufacturer specific profile area
6000—9FFF	Standardised device profile area (such as DSP-401 I/O module profile: Read State 8 and Input Lines)
A000—FFFF	Reserved

Figure B-9 Structure of the object dictionary

3) Commonly-used communication object

- Network management (NMT)

An NMT object includes the Boot-up message, heartbeat protocol, and NMT message. Based on the master/slave communication mode, the NMT is used to manage and monitor each node in the network to implement node status control, error control, and node startup.

- SDO

By using indexes and sub-indexes, SDOs enable clients to access entries in the object dictionary of devices.

An SDO is achieved through a CMS object of the multi-element domain in CAL and transmitting data in any length is allowed. When the data exceeds four bytes, the data is divided into several packets.

The SDO protocol produces a response for every message. The SDO request and response packets always contain eight bytes.

- PDO

A PDO is used to transmit real-time data from one creator to one or multiple receivers. The data length ranges from one to eight bytes.

Each CANopen device has eight default PDO channels, that is, four TPDO channels for transmitting and four RPDO channels for receiving.

The PDO supports synchronous and asynchronous transmission modes, which are determined by the communication parameter corresponding to the PDO.

The content of a PDO message is pre-defined and is determined by the mapping parameter corresponding to the PDO.

- SYNC object

A SYNC object is a message periodically broadcast by the CANopen master to the CAN bus. It is used to provide basic network clock signals. Each device determines whether to perform

synchronous communication with other network devices using the event based on its configuration.

4) Description of CANopen packet format

- NMT module control message

Only an NMT-Master node can send an NMT Module ControlNMT packet. "Table B-17 NMT message format" shows the packet format. COB-ID is fixed to "0x000". Data0 is a command word occupying one byte, as shown in "Table B-18 NMT message command". Data1 is a CANopen network device address occupying one byte. When it is 0, it indicates a broadcast message that is valid for all slaves in the network.

For example, the command for setting a device with device address "6" to operable state is "0x000 0x01 0x06".

Table B-17 NMT message format

COB-ID	RTR	Data0	Data1
0x000	0	Command word	Node ID

Table B-18 NMT message command

Command	Description
0x01	Start Remote Node
0x02	Stop Remote Node
0x80	Enter Pre-operational State
0x81	Reset Node
0x82	Reset Communication

- NodeGuarding packet

By using the node protection service, the MNT master node can check the current state of every node. Especially, this service is significant when these nodes have no data to be transmitted.

The standard protocol object 0x100C is used to set GuardTime and 0x100D is used to set the multiplication factor of GuardTime. The GuardTime and its multiplication factor jointly determine the node protection time period.

The following table shows a remote frame sent from the NMT master node.

Table B-19 NodeGuarding packet sent by the master node

COB-ID	RTR
0x700+Node-ID	1

"Table B-20 NodeGuarding response packet returned from the slave" describes the response message returned by the NMT slave. "Table B-21 NodeGuarding status word returned by the slave node" describes the one-byte format of the status word.

Table B-20 NodeGuarding response packet returned from the slave

COB-ID	RTR	Data0

0x700+Node-ID	0	Status word

Table B-21 NodeGuarding status word returned by the slave node

Data Bit	Description
Bit 7	0 or 1 alternative
Bit 6 to bit 0	State: 4: Stopped 5: Operational 127: Pre-operational

- Heartbeat packet

A node can be configured to produce periodic heartbeat messages, in which bit 7 is set to 0, and bit 6 to bit 0 are the same as those of the NodeGuarding message. See the following table for details. The heartbeat time is defined by the standard protocol object 0x1017. A node can support either the NodeGuarding protocol or the Heartbeat protocol.

Table B-22 Heartbeat message

COB-ID	RTR	Data0
0x700+Node-ID	0	Status word

A.4 PROFIBUS DP Communication

A.4.1 Networking

If more than 32 nodes are deployed, relays are required. With two relays, a maximum of 32 nodes (including the relays) can be connected.

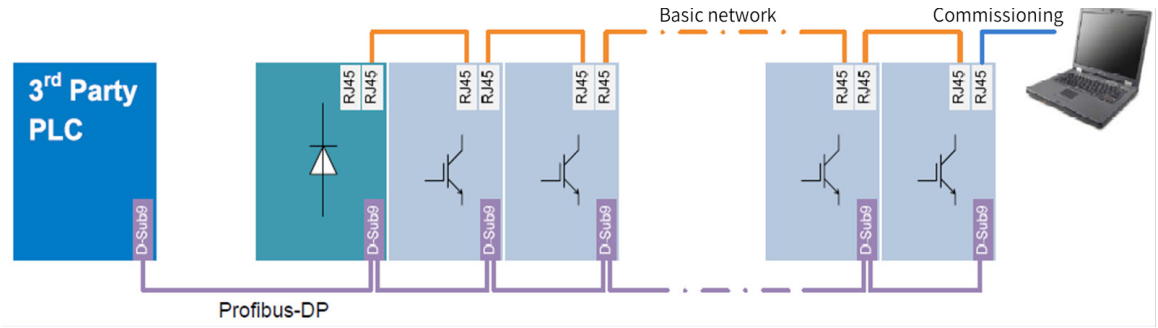


Figure B-10 PROFIBUS DP communication networking

A.4.2 Terminal Descriptions

This section describes the PROFIBUS DP 9-pin standard interface.

The PROFIBUS DP interface is connected to the PROFIBUS master using the standard DB9 socket. The pin signal definition of the PROFIBUS DP interface complies with the DB9 socket standard of Siemens. See the following figure.

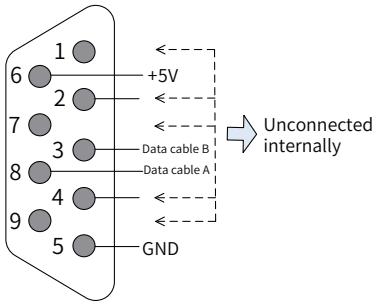


Figure B-11 PROFIBUS DP interface pin

Table B-23 PROFIBUS DB9 interface functions

Type	Terminal Mark	Terminal Name	Function Description
PROFIBUS DP communication interface	1, 2, 4, 7, 9	NC	Unconnected internally
	3	TR+	PROFIBUS DP bus positive end
	5	CGND	PROFIBUS DP bus power supply ground
	6	C5V	PROFIBUS DP bus power supply
	8	TR-	PROFIBUS DP bus negative end

A.4.3 Baud Rate and Communication Distance

Baud Rate (bps)	12 Mbps	6 Mbps	3 Mbps	1.5 Mbps	500 kbps	187.5 kbps	19.2 kbps	9.6 kbps
Length (m)	100	100	100	100	200	600	1200	1200

A.4.4 Related Parameters

Parameter Code	Parameter Name	Default	Value Range	Description
Fd-20	PROFIBUS DP communication address	1	0: PROFIBUS DP communication function disabled 1 to 125: PROFIBUS DP communication address	It indicates the slave station number for PROFIBUS DP communication. The value 0 indicates that the PROFIBUS DP communication function is disabled. In the same network, all station numbers must be unique. Otherwise, communication will fail.
Fd-97	PROFIBUS DP software version	0. 00	0. 00 to 655.35	It indicates the version of PROFIBUS DP communication software.

A.4.5 Descriptions of PROFIBUS DP Communication Protocol

◆ Data transmission format

The PROFIdrive protocol defines the Parameter Process Data Object (PPO) as the format for data transmission. PPO includes five types: PPO1, PPO2, PPO3, PPO4, and PPO5. The MD810 supports all the five types of the PPO.

Table B-24 Functions of PPO data formats

Data Type	Supported Function	Data Type	Supported Function
PPO1	Operation on a single function parameter Setting of AC drive commands and frequencies Reading of AC drive status and running frequency	PPO4	Setting of AC drive commands and frequencies Reading of AC drive status and running frequency Cyclic writing of four function parameters Cyclic reading of four function parameters
PPO2	Operation on a single function parameter Setting of AC drive commands and frequencies Reading of AC drive status and running frequency Cyclic writing of four function parameters Cyclic reading of four function parameters	PPO5	Operation on a single function parameter Setting of AC drive commands and frequencies Reading of AC drive status and running frequency Cyclic writing of 10 function parameters Cyclic reading of 10 function parameters
PPO3	Setting of AC drive commands and frequencies Reading of AC drive status and running frequency		

Data blocks of the PPO data format are divided into two areas, namely PKW area (parameter area) and PZD area (process data area). The following figure shows the PPO data formats supported by the MD810, and the following table lists the data length in different areas.

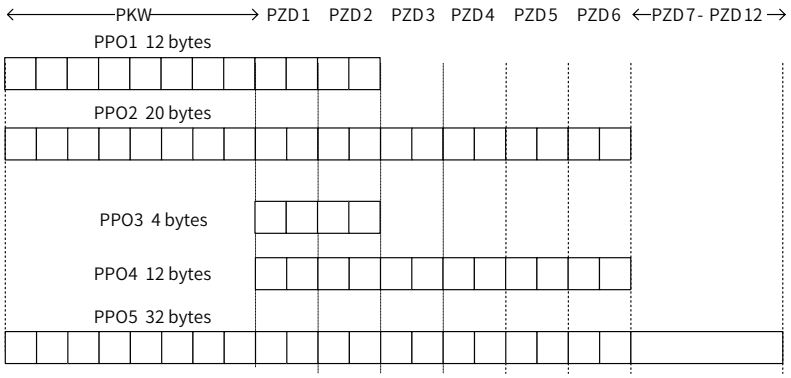


Figure B-12 PPO data format

Table B-25 PPO data length description

PPO Type	Data Length in the PKW Area (Byte)	Data Length in the PZD Area (Byte)	Total PPO Data Length (Byte)
PPO1	8	4	12
PPO2	8	12	20
PPO3	0	4	4
PPO4	0	12	12

PPO5	8	24	32

◆ PKW data description

The PKW data is used by the master station to read/write a single parameter of the AC drive. Communication addresses of the AC drive parameters are directly determined by the communication data. The PKW data is used to:

a) Reading AC drive function parameters

b) Modifying AC drive function parameters

● Data format

The PKW data includes three groups of arrays, namely PKE, IND, and PWE. The PKE, IND, and PWE data length is two bytes, two bytes, and four bytes respectively. Their data formats are as follows.

	PKW Data Sent by Master	PKW Data Responded by AC Drive
Operation command	PKE	PKE
Parameter address	IND	IND
Reserved	IND	IND
	PWE	PWE
	PWE	PWE
Writing operation: parameter value Reading operation: null	PWE	-
	PWE	
Success: returned value Failure: error information	-	PWE
		PWE

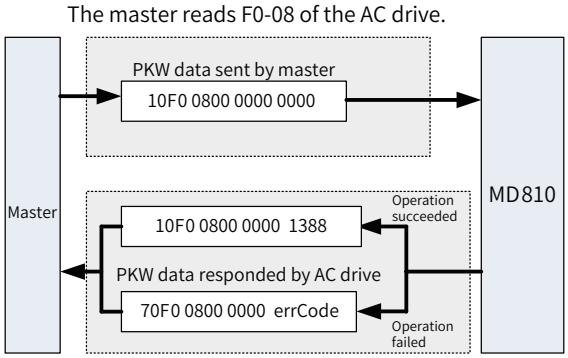
● Data description

PKW Data Sent by Master		PKW Data Responded by AC Drive	
PKE	High-order four bits: Command code 0: No request 1: Reading parameters 2: Modifying parameter data (The preceding command code is in decimal format.) Low-order four bits: Reserved Low-order eight bits: High-order bits of the parameter address	PKE	High-order four bits: Response code 0: No request 1: Correct parameter operation 7: Execution failed Low-order eight bits: High-order bits of the parameter address
IND	High-order eight bits: Low-order bits of the parameter address Low-order eight bits: Reserved	IND	High-order eight bits: Low-order bits of the parameter address Low-order eight bits: Reserved

PWE	High-order 16 bits: Reserved Low-order 16 bits: Reserved in case of read request or parameter value in case of write request	PWE	Request succeeded: Parameter value Request failed: error code (consistent with standard Modbus) 1: Invalid command 2: Invalid address 3: Invalid data 4: Other error

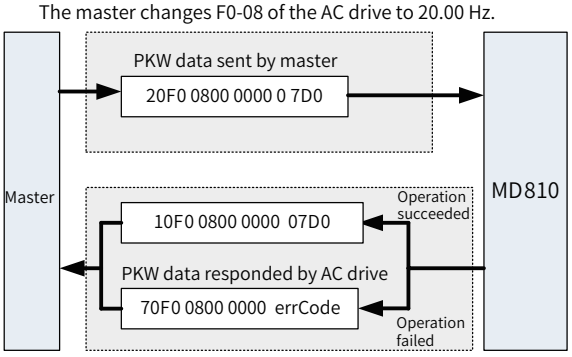
Example

The following figure shows the PKW data sent by the master and PKW response data sent by the AC drive when the master reads the AC drive function parameter F0-08.



1) Example of PKW data transmitted when the master requests to read an AC drive parameter

The following figure shows the PKW data sent by the master and PKW response data sent by the AC drive when the master modifies the AC drive function parameter F0-08.



2) Example of PKW data transmitted when the master requests to write an AC drive parameter

PKW data exchange with the AC drive is performed circularly. If the write command (PKE=0x20xx) is continuously used on EEPROM, the service life of the AC drive' s main control chip will be shortened. Therefore, it is recommended that non-periodic write operations (SFB53 described in "Non-periodic Read/Write Operations ") or RAM addresses in the PKW area be used to modify AC drive parameters. The following table lists RAM addresses of param-

eters.

Parameter Group	Address
F0 to FF	0x00 to 0x0F
A0 to AF	0x40 to 0x4F
B0 to BF	0x50 to 0x5F
C0 to CF	0x60 to 0x6F

The hexadecimal value converted from the parameter group are the lower-order eight bits of the RAM address. For example, the RAM address of parameter F0-10 is 0x000A.

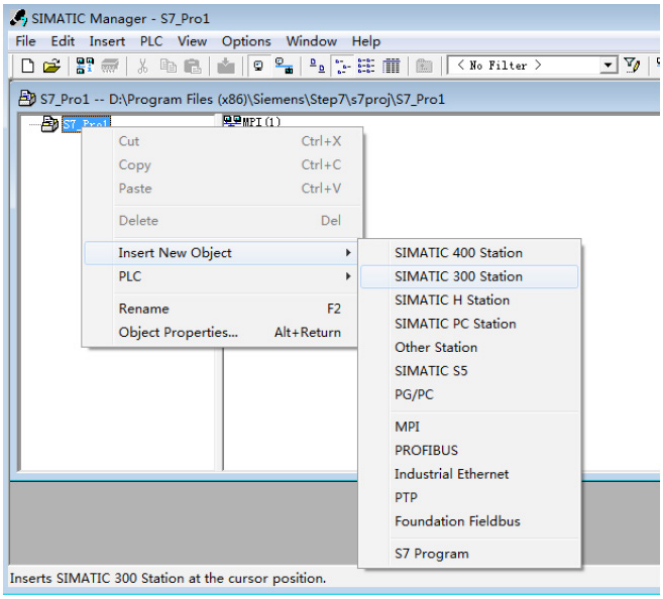
◆ PZD data description

The PZD data is used by the master to modify and read AC drive data in real time and perform periodic data exchange. Data communication addresses are directly configured through DP network parameters. Specific data definition of PZD1 to PZD12 is determined by PZD configuration. For details about PZD configuration, see step 5 in the next chapter.

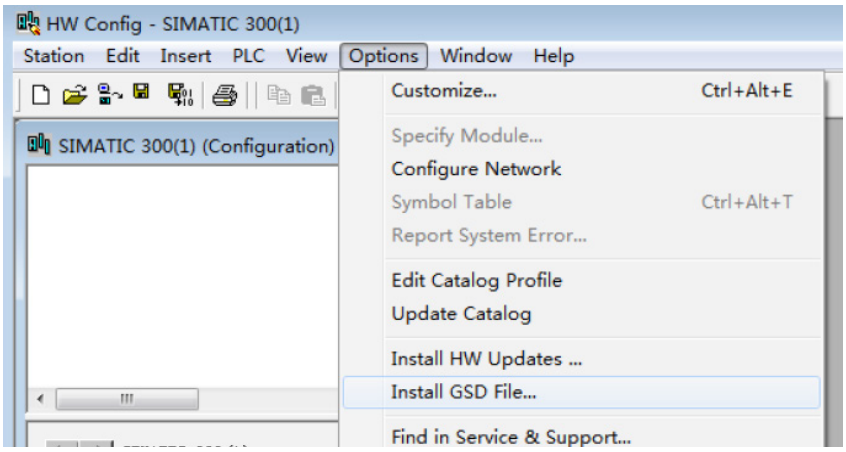
◆ Configuring slaves on the S7-300 master

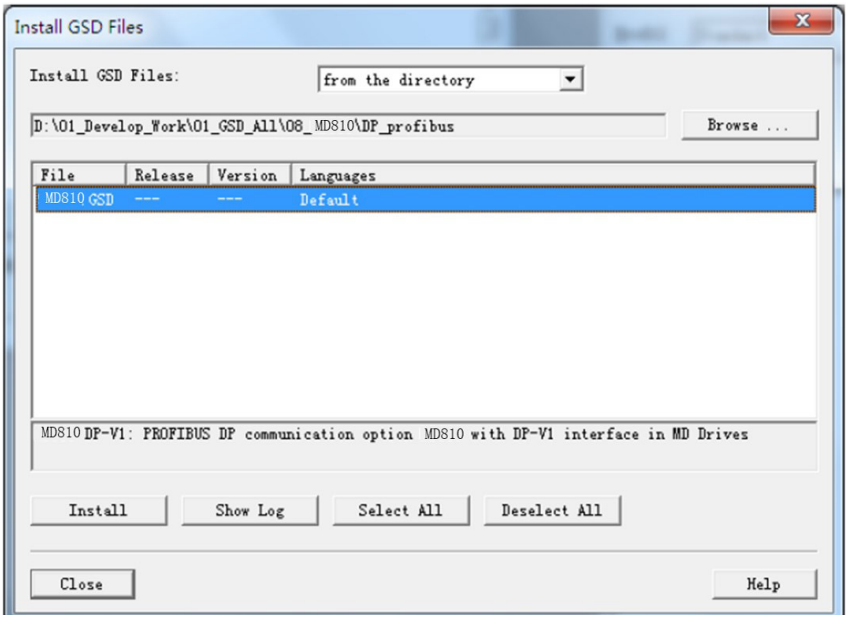
Before using the PROFIBUS DP master, you must configure the slave GSD file first to add the slave to the master system. If the file exists, omit step 2. You can obtain the GSD file from Inovance or its agent. To configure the slave, do as follows:

Step 1: Establish a project in STEP7, and add an S7-300 master in the project, as shown in the following figure.

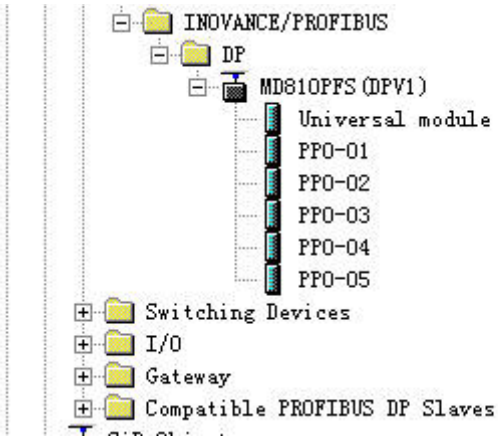


Step 2: Double-click the hardware icon to access the **HW Config** interface, and choose **Options** > **Install GSD File** to add the MD810DP.GSD file (Note that the file must be stored in an English path; otherwise, the STEP7 may fail to recognize the file).

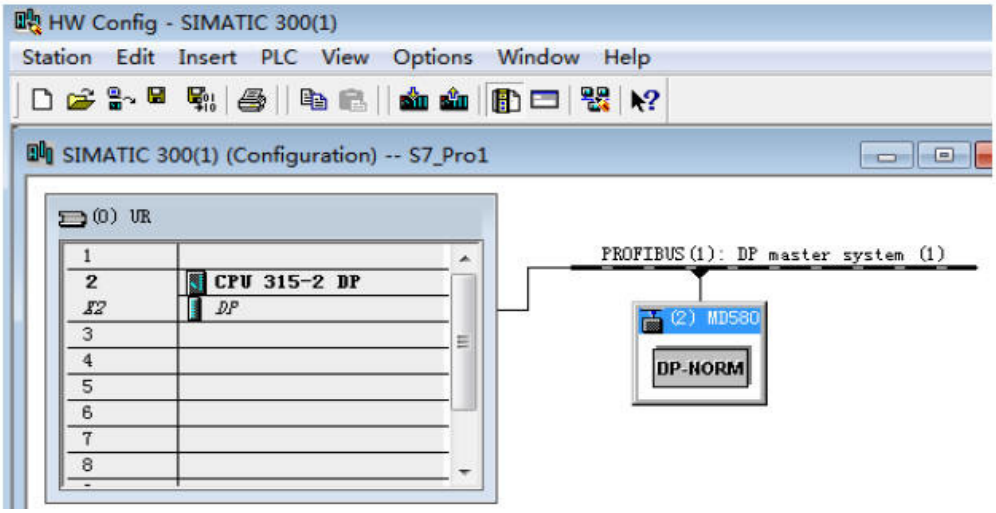




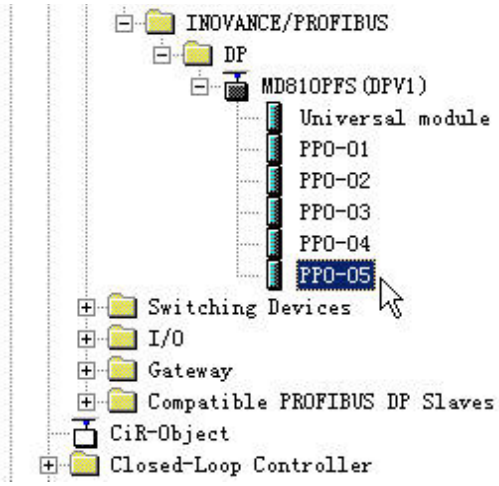
Click **Install**. After the installation is complete, the PROFIBUS DP module of the MD810 is displayed, as shown in the following figure.



Step 3: Configure the actual hardware system, as shown in the following figure.



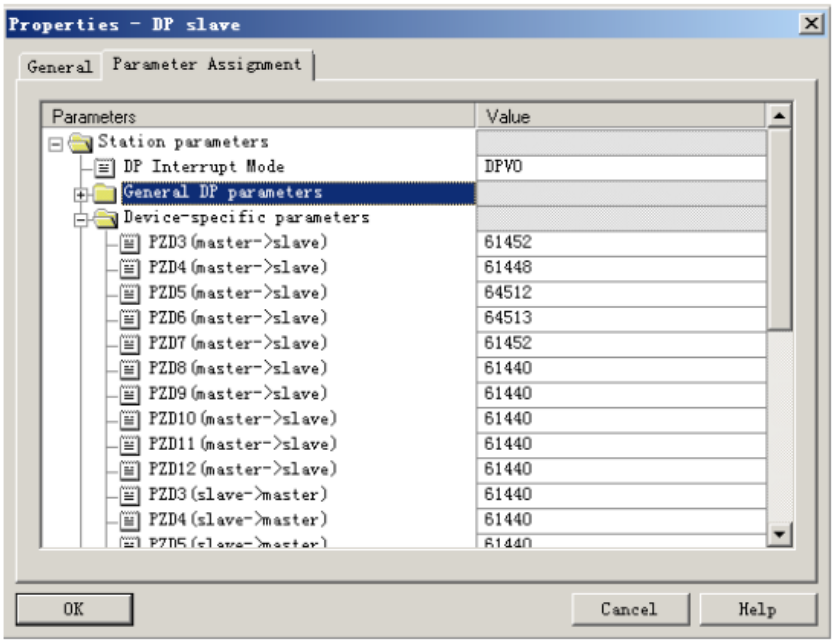
Step 4: Configure data features of the slave.



Step 5: Configure the PZD.

Two DP interruption modes are provided, including DPV0 and DPV1. For all Inovance DP modules, only DPV0 can be selected. By default, DPV0 is selected in STEP 7, and DPV1 is selected in Portal. Therefore, you need to change DPV1 to DPV0 if Portal is used.

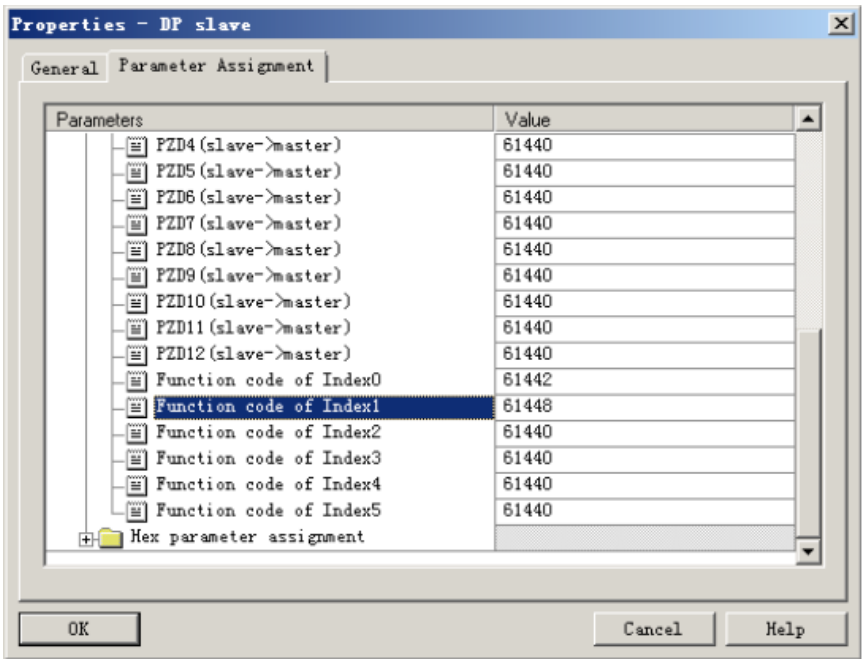
PZD1 to PZD12 are for customized periodic data exchange. They can be set in hardware configuration. Double-click the MD810DP icon in **HW Config**, click **Device-specific parameters**, and configure corresponding parameter addresses as required.



PZDx (master->slave) indicates the address used by the master to write data to the slave, whereas PZDx (slave->master) indicates the address used by the master to read data from the slave. PZDx can be set to any one from PZD1 to PZD12, which are displayed in decimal. For example, to set PZD3 (master->slave) to F0-12, enter 61452.

By default, the default of all PZDs for the MD810 is F0-00 (61440 in decimal). For unused PZDs, modification is not required and default values can be retained. PZD mapping relations must be set independently for each slave as required. If mapping relations of various slaves are the same, you can select one configured slave, press **Ctrl**+**C**, select the PROFIBUS DP bus in the configuration, press **Ctrl**+**V**, and modify the station number.

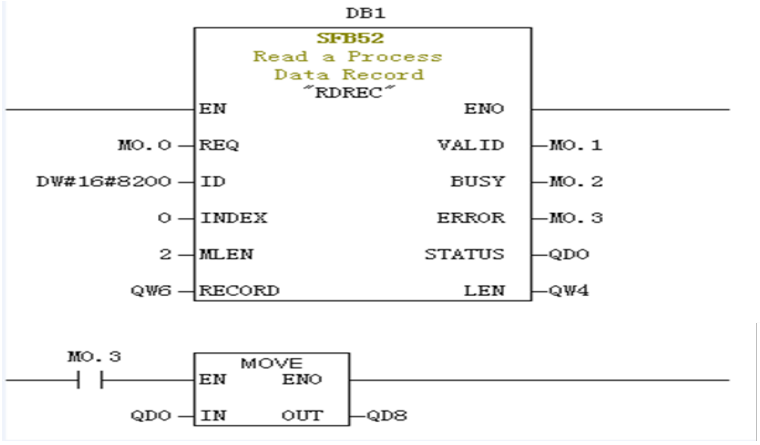
To enable the function of non-periodically reading and writing parameters of DPV1, set corresponding parameters in customized indexes at the end of **Device-specific parameters**. The MD810 provides six customized indexes numbered from 0 to 5. For example, set indexes 0 and 1 to F0-02 and F0-08, respectively.



After all the preceding operations are completed, the PROFIBUS slave is configured. Then, you can compile programs in the S7-300 to control the AC drive.

◆ Non-periodic reading and writing on the drive DP slave

To perform non-periodic reading and writing on the drive DP slave, enable the Siemens system function modules SFB52 (for reading) and SFB53 (for writing). Create an organization block in the program, and add relevant function blocks and programs in the organization block.



After M0.0 is set, the function block reads F0-02 (Index 0 has been set to F0-02) of the AC drive No. 3 and saves it in QW6. Field definitions are as follows:

REQ: It is used to enable or disable the function block. When it is set to 1, the function block is enabled.

ID: It indicates the logic address. To specify this field, convert any Q address of the AC drive slave to a decimal value, and set bit 15 of the value to 1. For example, after Q512 is converted

to the decimal value H200, and bit 15 of H200 is set to 1, H8200 is obtained.

1	4AX	PPO-05	512...519	512...519
2	12AF	--> PPO-05	520...543	520...543

INDEX: It is an index number ranging from 0 to 5. You can define the index mapping address of a slave as required.

MLEN: It indicates the maximum length of the data to be obtained. For MD38DP2, this field must be set to 2.

RECORD: It indicates the target area of an obtained data record. This field is used to store read data when the read operation is performed and sent data when the write operation is performed.

VALID: The new data record is received and valid.

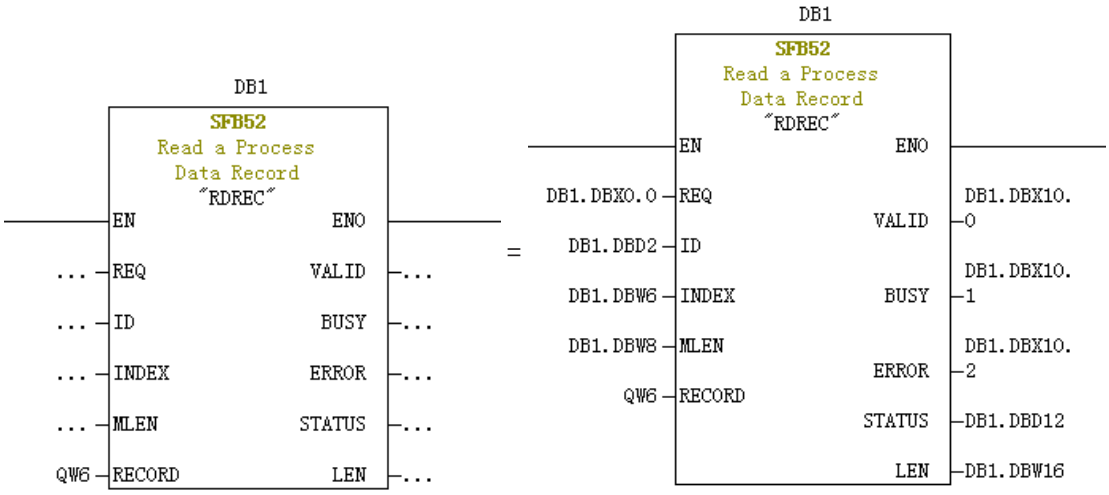
BUSY: When the field value is ON, operations are not complete.

ERROR: When tand OUTs, or INs, OUTs. See the illustrationhe field value is ON, an error occurs.

STATUS: It indicates the block status or error information.

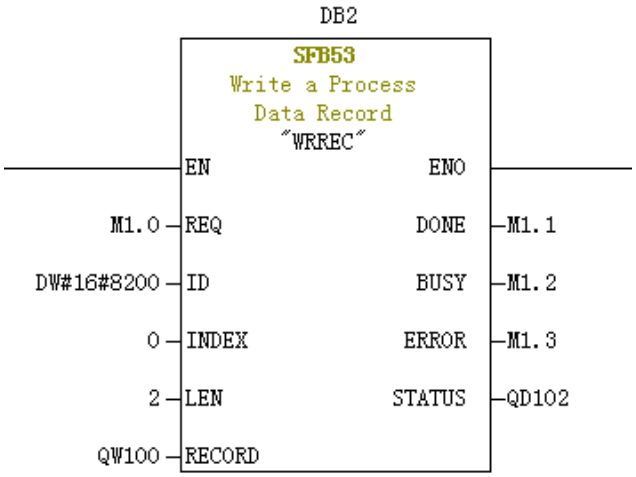
LEN: It indicates the obtained data record length.

During the invocation, you can customize parameters or use partial or all default parameters, as shown in the following figure.



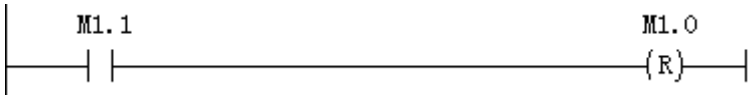
The left figure shows all the default parameters. If you want to customize parameters, set them according to the right figure. You can customize parameters or use default parameters for corresponding blocks as required. However, if multiple invocations are involved, you need to customize parameters to avoid invocation errors caused by default parameters (note: RECORD must be customized).

Non-periodic write operations are similar to non-periodic read operations. The RECORD field stores data to be written, as shown in the following figure.



Note that before running an organization block, you need to download data blocks (above the function block, DB1 and DB2 in this example) to the PLC. Otherwise, an error indicating that the DB blocks are not loaded will be reported.

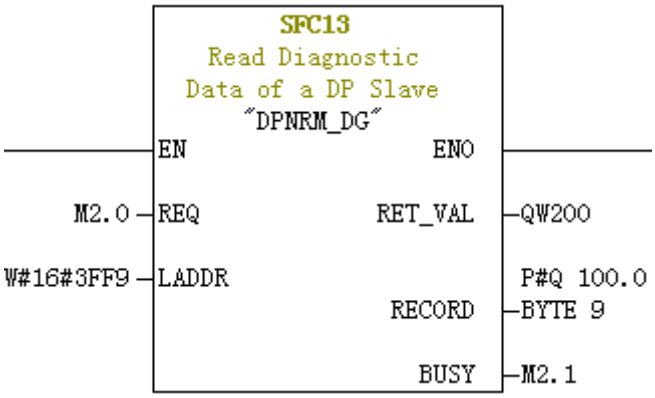
SFB53 is used to perform operations on the EEPROM. Therefore, relevant operations are invoked when necessary, and relevant operations are disabled in time in the program. After the write operation is complete (M1.1 is set to 1), the program is invoked to reset M1.0, as shown in the following figure.



Execution of SFB52 and SFB53 requires invoking relevant blocks for multiple times each time. Therefore, do not invoke them when single execution is required.

◆ Diagnosis

Specific diagnosis information of slaves can be read using SFC13 in the program, as shown in the following figure.



REQ: It is used to enable or disable diagnosis information reading. When this field is set to ON, diagnosis information reading is enabled.

LADDR: It indicates the configured diagnosis address of the PROFIBUS DP slave. The actual value is shown in the following figure. For SFC13, the address must be specified in hexadeci-

mal.

RET_VAL: It displays the error code (negative) when invocation errors occur or displays the actual transmitted data length (positive) when no error occurs.

RECORD: It indicates the target area of the read diagnosis data. The value must be nine bytes. Otherwise, an error is reported during invocation. The nine bytes are defined as follows:

Byte	Assignment
Byte 0 to 2	Station status
Byte 3	Master number
Byte 4	Supplier ID (high-order byte)
Byte 5	Supplier ID (low-order byte)
Byte 6 to 10	Dedicated device diagnosis information

BUSY: When this field is **1**, reading is not complete.

Device-specific diagnosis provides relevant AC drive fault information, which is consistent with the value of U0-45.

A.5 EtherCAT Communication

A.5.1 Networking

The EtherCAT communication topology structure features high flexibility. It supports various topological structures including star, bus, and tree topologies and their combination. This enables flexible and convenient equipment connection and wiring. The specific EtherCAT-IN and EtherCAT-OUT I/O interfaces and bus connections of the MD810 drive unit are shown in the following figure.

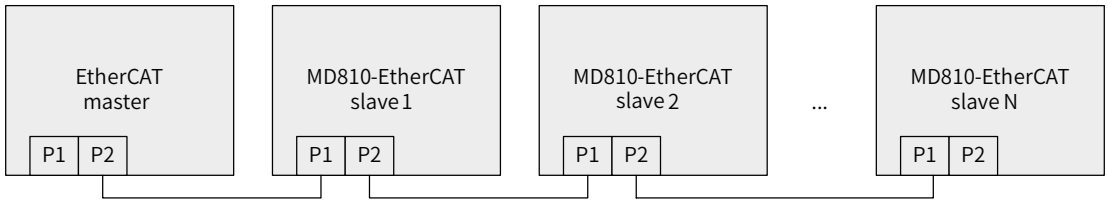


Figure B-13 Bus topology

A.5.2 Terminals Descriptions

The MD810-ECAT drive unit is connected to the EtherCAT master using the standard Ethernet RJ45 socket. The signal definitions of pins are the same as those of the standard Ethernet pins. Crossover cables and straight-through cables are available. The electric characteristics are compliant with IEEE 802.3 and ISO 8877 standards.

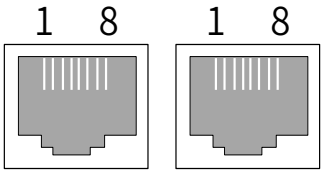


Table B-26 Pin signal definitions

Pin	Assign-ment	Description
1	TX+	Data transmitting (-)
2	TX-	Data transmitting (-)
3	RX+	Data receiving (+)
4	NULL	Not connected
5	NULL	Not connected
6	RX-	Data receiving (-)
7	NULL	Not connected
8	NULL	Not connected

Note

- Note that the input (EtherCAT-IN) and output (EtherCAT-OUT) interfaces cannot be connected inversely. The Cat 5e shielded twisted pair (STP) network cable must be used for ensuring stability.

A.5.3 Communication Performance

Transmission Rate	2 x 100 Mbit/s (high-speed Ethernet, full duplex mode)
Synchronization	Synchronization jitter < 1 μs (300 nodes between two devices and cable length being 120 m)
Refresh time	● 256 digital I/Os: 11 μs ● 1000 on-off I/Os distributed in 100 nodes: 30 μs (0.03 ms) ● 200 analog I/Os (16-bit): 50 μs; sampling rate: 20 kHz ● 100 servo axes (eight-byte IN+OUT for each axis): 100 μs = 0.1 ms ● 12000 digital I/Os: 350 μs

A.5.4 Related Parameters

The following parameters must be set to enable the MD810 drive unit to connect to the Ether-CAT fieldbus network.

Parameter Code	Parame-ter Name	Value Range	Value	Definition

F0-02	Operation command source	0: Operating panel 1: Terminal 2: Communication	2	Running command given through communication
F0-03	Main frequency reference input selection	0: Digital setting (non-retentive upon power failure) 1: Digital setting (retentive upon power failure) 2: AI1 3: AI2 4: Reserved 5: Pulse reference (DIO1) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Synchronous control	9	Target frequency given through communication

◆ Parameters related to communication control

Parameter Code	Parameter Name	Value Range	Decimal Address
U3-16	Frequency reference	Negative maximum frequency to positive maximum frequency 0.01 Hz	29456
U3-17	Control command	0000: Stop according to the stop mode 0001: Forward running 0002: Reverse running 0003: Forward jogging 0004: Reverse jogging 0005: Coast to stop 0006: Decelerate to stop 0007: Fault reset	29457
U3-18	DO control	Bit 0: DO1 output control Bit 1: DO2 output control Bit 2: RELAY1 output control Bit 3: RELAY2 output control Bit 4: FMR output control Bit 5: VDO1 Bit 6: VDO2 Bit 7: VDO3 Bit 8: VDO4 Bit 9: VDO5	29458
U3-19	AO1 control	0 to 7FFF represent 0% to 100%.	29459
U3-20	AO2 control	0 to 7FFF represent 0% to 100%.	29460
U3-21	FMP control	0 to 7FFF represent 0% to 100%.	29461
U3-22	Reserved	Reserved	
U3-23	Speed control	Signed data, 1 rpm	29463

When MD810-ECAT communication is used, the written PDO1 and PDO2 are mapped to U3-17 and U3-16 respectively by default. Note that the first two items of TxPDO configured on the master must be U3-17 and U3-16 in sequence. Besides, if the eight high-order bits of U3-17 are written with any non-zero value, the AC drive will report a communication fault.

◆ Parameters related to communication monitoring

Parameter Code	Parameter Name	Unit	Decimal Address
U0-00	Running frequency (Hz)	0.01 Hz	28672
U0-01	Frequency reference (Hz)	0.01 Hz	28673
U0-02	Bus voltage (V)	0.1 V	28674
U0-03	Output voltage (V)	1 V	28675
U0-04	Output Current (A)	0.01 A	28676
U0-05	Output power (kW)	0.1 kW	28677
U0-06	Output torque (%)	0.1%	28678
U0-07	DI input state	1	28679
U0-08	DO output state	1	28680
U0-09	AI1 voltage (V)	0.01 V	28681
U0-10	AI2 voltage (V)	0.01 V	28682
U0-11	Motor speed	1 rpm	28683
U0-12	Counting value	1	28684
U0-13	Length value	1	28685
U0-14	Load speed display	1	28686
U0-15	PID reference	1	28687
U0-16	PID feedback	1	28688
U0-17	PLC stage	1	28689
U0-18	Pulse input frequency (Hz)	0.01 kHz	28690
U0-19	Feedback speed (Hz)	0.01 Hz	28691
U0-20	Remaining running time	0.1 min	28692
U0-21	AI1 voltage before correction	0.001 V	28693
U0-22	AI2 voltage before correction	0.001 V	28694
U0-24	Linear speed	1 m/min	28696
U0-25	Current power-on time	1 min	28697
U0-26	Current operating time	0.1 min	28698
U0-27	Pulse input frequency	1 Hz	28699
U0-28	Communication setpoint	0.01%	28700
U0-29	Encoder feedback speed	0.01 Hz	28701
U0-30	Display of main frequency X	0.01 Hz	28702
U0-31	Display of auxiliary frequency Y	0.01 Hz	28703
U0-33	Synchronous motor rotor position	0.1°	28705
U0-34	Motor temperature	1° C	28706
U0-35	Target torque (%)	0.1%	28707
U0-37	Power factor angle	0.1°	28709
U0-39	Target voltage for V/f separation	1 V	28711
U0-40	Output voltage for V/f separation	1 V	28712
U0-41	DI input state display	1	28713
U0-42	DO output state display	1	28714
U0-45	Fault subcode	1	28717

U0-46	Heatsink temperature	1° C	20718
U0-47	PTC channel voltage before correction	0.001 V	20719
U0-48	PTC channel voltage after correction	0.001 V	20720
U0-49	Number of position lock deviation pulses	1	20721
U0-58	Z signal counter	1	28730
U0-59	Frequency reference (%)	0.01%	28731
U0-60	Running frequency (%)	0.01%	28732
U0-61	AC drive state	1	28733
U0-62	Fault code	1	28734
U0-68	Drive state 2	1	28740
U0-69	Feedback speed (Hz)	0.01 Hz	28741
U0-74	Target torque in torque mode	0.1%	28746
U0-75	Real-time target torque in torque mode	0.1%	28747
U0-76	Target torque upper limit	0.1%	28748
U0-77	Torque upper limit in generating state	0.1%	28749

When MD810-ECAT communication is used, the read PDO1 and PDO2 are mapped to U0-68 and U0-69 respectively by default. Note that the first two items of TxPDO configured on the master must be U0-68 and U0-69 in sequence.

A.5.5 Descriptions of EtherCAT Communication Protocol

In the DC mode, the DC synchronous mode period must be at least 1 ms but shorter then 100 ms. Otherwise, an EtherCAT communication fault will occur.

◆ State machine

Four EtherCAT state machines are supported to coordinate the state relationship between the master and slave during initialization and operation. The four states are: Init (I), Pre-Operational (P), Safe-Operational (S), and Operational (O).

Transition from Init state to Operational state must be in the sequence of Init, Pre-Operational, Safe-Operational, and then Operational step by step. In transition from Operational state to Init state, certain steps can be skipped. The following figure describes the EtherCAT state transition.

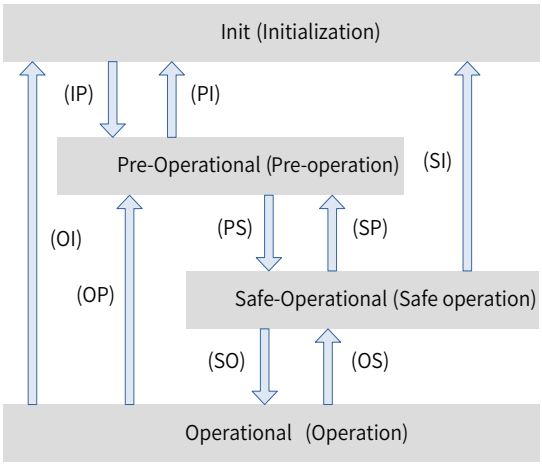


Figure B-14 EtherCAT state machine

◆ Communication structure

Multiple kinds of application protocols are available for EtherCAT communication. The IEC 61800-7–CANopen motion control protocol is used for the MD810 drive unit. The following figure shows the EtherCAT communication structure at the CANopen application layer.

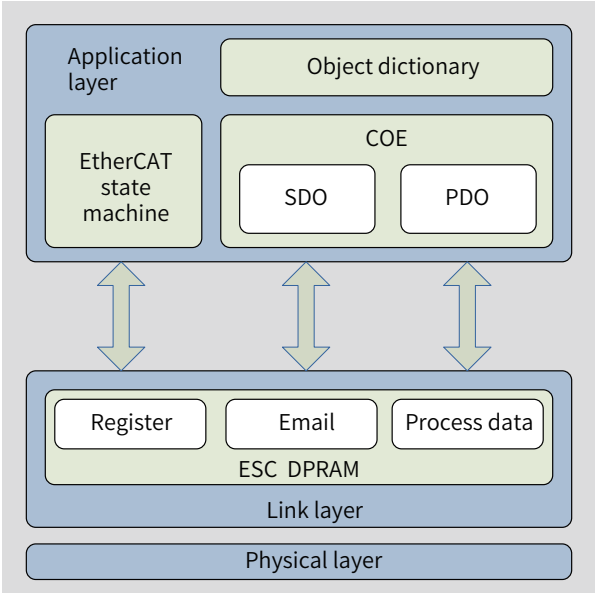


Figure B-15 EtherCAT communication structure at the CANopen application layer

The object dictionary in the application layer contains communication parameters, application data, and mapping data of the PDO. The PDO process data object contains real-time data during the operation of the drive and is periodically read and written. In the SDO mailbox communication, the communication parameter objects and PDO objects are accessed and modified aperiodically.

◆ PDO data description

The PDO data enables the master to modify and read AC drive data in real time and perform

periodic data exchange with the AC drive. The data communication addresses are directly configured by the AC drive. The data mainly includes the following:

1. Real-time settings of AC drive control commands and target frequencies
2. Real-time reading of AC drive current state and running frequency
3. Function parameter and monitoring data real-time exchange between the AC drive and the EtherCAT master

The PDO process data is used for periodic data exchange between the master and AC drive, as described in the following table.

PDO (1600h) Sent by the Master		
Fixed RPDO		Variable RPDO
AC drive command	AC drive frequency reference	Real-time modification of AC drive parameters
RPDO1	RPDO2	RPDO3 to RPDO12
PDO Responded by AC Drive (1A00h)		
AC drive state	AC drive running frequency	Real-time reading of AC drive parameters
TPDO1	TPDO2	TPDO3 to TPDO12

◆ Data sent by the master

Descriptions of RPDO sent by the master	
RPDO1	AC drive command word (command source set to communication)
	01: Forward running 02: Reverse running 03: Forward jogging 04: Reverse jogging 05: Coast to stop 06: Stop according to F4-10 (Stop mode) 07: Fault reset
RPDO2	AC drive target frequency (frequency source set to "communication")
	The frequency reference ranges from -100.00% to +100.00%. When the frequency reference exceeds this range, the frequency reference is not responded.
RPDO3 to RPDO12	It specifies parameters (in group F and group A) to be modified in real time. The modification is not written to the EEPROM.
	FE-02 to FE-11 correspond to RPDO3 to RPDO12. For the configuration, see PDO data configuration.

◆ Data responded by the AC drive

TPDO Responded by the AC Drive	
TPDO1	It indicates the AC drive state.
	The AC drive running state is determined by the bits as follows: Bit 0: 0: Stop; 1: Running Bit 1: 0: Forward running; 1: Reverse running Bit 2: 0: No fault; 1: AC drive fault Bit 3: 0: Running frequency not reached; 1: Running frequency reached

TPDO2	It indicates the AC drive running frequency (unit: 0.01 Hz).
	The current AC drive running frequency is returned as 16-bit signed data.
TPDO3 to TPDO12	The TPDOs are used to read function parameters in groups F and A and monitoring parameters in group U in real time.
	FE-22 to FE-31 correspond to TPDO3 to TPDO12. For the configuration, see PDO data configuration.

◆ SDO

The SDO is used to transfer non-cyclic data, such as communication parameter configuration, and drive running parameter configuration. The CoE service type includes: 1) emergency message, 2) SDO request, 3) SDO response, 4) TxPDO, 5) RxPDO, 6) remote TxPDO transmit request, 7) remote RxPDO transmit request, and 8) SDO information.

Currently, the MD810 drive supports 2) SDO request and 3) SDO response. For details about the parameters, see the appendix.

◆ Distributed clock

The distributed clock enables all EtherCAT devices to use the same system time and implement synchronization between the devices. A slave can generate synchronous signals according to the synchronized system time. The MD810 drive unit only supports the DC synchronization mode. The synchronization cycle is determined by SYNC0. The cycle varies according to the motion mode.

A.6 PROFIBUS DP-to-CANopen Gateway

A.6.1 Networking

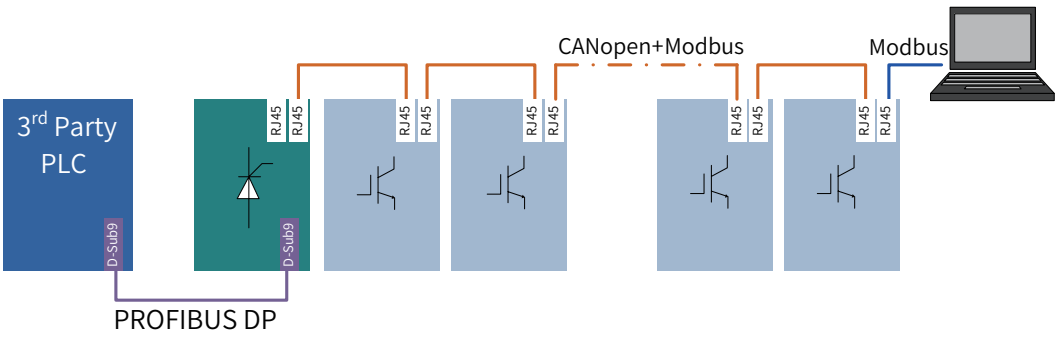


Figure B-16 PROFIBUS DP-to-CANopen gateway communication networking

A.6.2 Terminal Descriptions

The definition of the PROFIBUS DP terminal is the same as the terminal definition in the standard PROFIBUS DP. For details, see Terminal Descriptions in “A.4 PROFIBUS DP Communication”.

The definition of the CANopen terminal is the same as the terminal definition in the standard

CANopen. For details, see Terminal Descriptions in “A.3 CANopen/CANlink Communication”.

A.6.3 Communication Performance

One gateway unit (PROFIBUS DP slave) can be connected with up to 30 CANopen slaves. Note: The gateway unit is also a CANopen slave.

One gateway unit (PROFIBUS DP slave) can send up to 122 parameters to or receive up to 122 parameters from the PLC.

Each CANopen slave can send and receive up to eight parameters.

The communication distance is the same as that in the standard PROFIBUS DP and CANopen networks. See “A.4 PROFIBUS DP Communication” and “A.3 CANopen/CANlink Communication” for details.

A.6.4 Related Parameters

Parameter Code	Parameter Name	Default	Value Range	Remarks
Fd-09	Communication status	0	Ones (CANopen) 0: Stop 1: Initialization 2: Pre-operational 8: Running Hundreds (PROFIBUS DP) 0: Stop 1: Initialization 8: Running	The tens place is used for CANlink communication. It is read-only and used to monitor communication status.
Fd-10	Communication protocol	1	1: CANopen 3: PROFIBUS DP gateway function (power supply unit)	For the power supply unit, set this parameter to 3. For the drive unit, set this parameter to 1.
Fd-12	CAN baud rate	5	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	It indicates the CAN communication baud rate of the power supply unit and drive unit. Note: After the network runs, modifying the baud rate of the power supply and drive units will take effect immediately, and the network will detect an error. The error must be manually cleared. Use the default if there is no special application.
Fd-13	CANopen address	1	0 to 127	It is used to configure a CANopen slave address.

Parameter Code	Parameter Name	Default	Value Range	Remarks
Fd-20	PROFIBUS DP communication address	1	0: PROFIBUS DP communication function disabled 1 to 125: PROFIBUS DP communication address	It is used to set whether to enable the PROFIBUS DP communication function of the AC drive. It is also used to configure a PROFIBUS DP node address.
Fd-22	Network mode	0	0: Communication disabled 1: Communication enabled	It is specially designed for the power supply unit. It is used to select whether to normally establish communication when the number of slaves configured in the PLC does not match with that in the actual network.
Fd-23	Number of online slave		0 to 29	It is specially designed for the power supply unit. It indicates the number of online slaves after communication is established. It is used to view the consistency of the number of online slaves with that in the actual network when Fd-22 is set to 1.
Fd-24	Gateway power-on delay	8	5 to 20 (s)	It is specially designed for the power supply unit and indicates the gateway power-on delay. When there are many common bus drive slaves, the power-on time becomes long and the network bridge communicates first, but slaves are not ready, causing error. In this case, set this parameter to a large value.
Fd-25	Online status of slaves 1-15	0	0 to 65535	Specially designed for power supply unit. Bit 1: Network bridge itself. Bit 2: Slave 2. The rest can be done in the same manner. The values 0 and 1 indicate offline and online, respectively.
Fd-26	Online status of slaves 16-30	0	0 to 65535	Specially designed for power supply unit. Bit 0: Slave 16; Bit 1: Slave 17. The rest can be done in the same manner. The values 0 and 1 indicate offline and online, respectively.
Fd-33	Communication period	0	0-65535 ms	Process data interaction period in network bridge mode.
Fd-96	CANopen software version	0.00	0.00 to 655.35	This parameter indicates the CANopen communication software version.
Fd-98	DP gateway software version	0.00	0.00 to 655.35	It indicates the communication software version for DP-to-CANopen gateway.

Parameter Code	Parameter Name	Default	Value Range	Remarks
AF-00 to AF-31	Process data mapping received by the power supply unit or drive unit			It indicates the process data mapping from the PLC to the power supply unit or drive unit. For the specific configuration method, refer to the CANopen slave configuration chapter.
AF-32 to AF-63	Process data mapping sent from the power supply unit or drive unit			It indicates the process data mapping from the power supply unit or drive unit to the PLC. For the specific configuration method, refer to the CANopen slave configuration chapter.
AF-66	Number of data mappings received by the power supply unit or drive unit			It indicates the valid number of mappings in this station and corresponds to OUT of the PLC.
AF-67	Number of data mappings sent from the power supply unit or drive unit			It indicates the valid number of mappings in this station and corresponds to IN of the PLC.

A.6.5 Fault Descriptions

The fault codes of the power supply unit are as follows.

Fault Code	Description	Troubleshooting
E16.31	PROFIBUS DP slave communication times out.	Check the connection of the PROFIBUS DP cable.
E16.34	A CAN slave is offline during PROFIBUS DP-to-CANopen gateway configuration.	Check whether the value of "The number of devices" in the special device parameter of the PLC is consistent with the actual number of stations or whether the setting of the slave station No. is correct.
E16.35	Parameters of stations except the power supply unit are incorrectly set during PROFIBUS DP-to-CANopen gateway configuration.	According to the diagnosis packet of the PLC, check whether the IN/OUT values of "NO. n" in the special device parameter of the PLC is consistent with the values of AF-66/67 of the slave.
E16.42	Parameters of the power supply unit are incorrectly set during PROFIBUS DP-to-CANopen gateway configuration.	According to the diagnosis packet of the PLC, check whether the IN/OUT values of "NO. 1" in the special device parameter of the PLC is consistent with the values of AF-66/67 of the gateway.

Note

- In case of configuration error, the PROFIBUS DP device is reconfigured only after the error of the gateway is reset.

The fault codes of the drive unit is as follows.

Fault Code	Description	Troubleshooting
E16.11	CANopen slave communication times out.	Check the connection of the cable.
E16.12	CANopen configuration mappings are inconsistent with actual transmission mappings.	Check mappings in group AF.
E16.13	Communication between the power supply unit and drive unit fails.	1: Check whether the cable is correctly connected. 2: Check whether the termination resistor wiring of the grid is correct. 3: View Fd-12 to check whether the CAN baud rate is consistent.

A.6.6 Application Descriptions

1) Configure parameters of the power supply unit or the drive unit

Step 1: Set the power supply unit or drive unit as the gateway.

- Set Fd-10 to 3 (gateway mode).
- Set Fd-20 (PROFIBUS DP slave station No.) to a value that is consistent with the slave station No. on the PLC.
- Configure interaction data between the gateway and the PLC by setting AF-00 to AF-63. The default values of the parameters can be directly used. The gateway generally does not need to perform data interaction with the PLC. For specific settings, refer to "A.6.7 CANopen Slave Configuration Description".

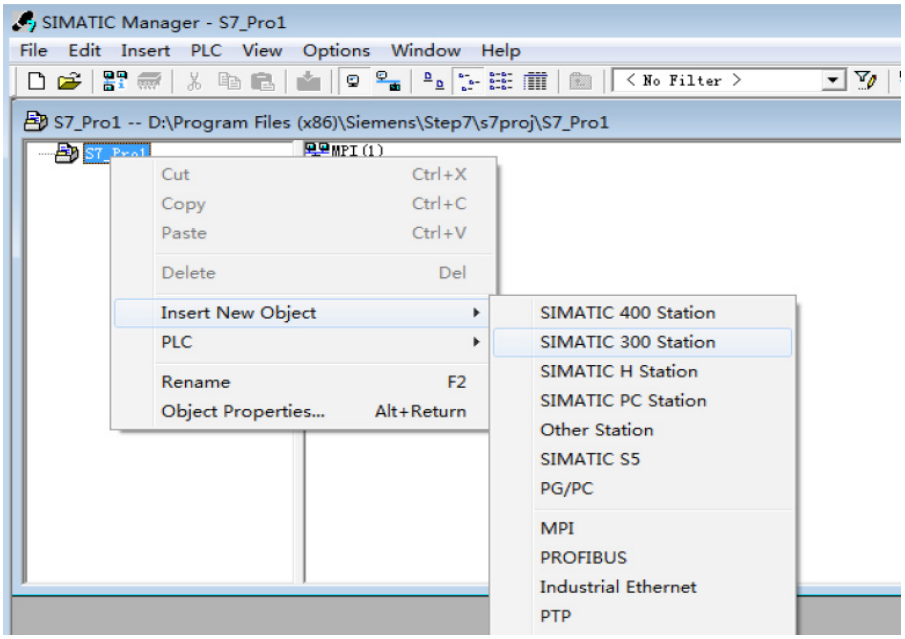
Step 2: Set the drive unit or power supply unit that serves as the gateway.

- Set the station No. of every slave in Fd-13. The station No. must start from 2. In addition, the station No. must be unique and be set sequentially. If there are any unused power supply or drive units in the network and networking control is not required, Fd-13 does not need to be set. The default value 1 is used.
- Configure interaction data between the gateway and the PLC by setting AF-00 to AF-63. Default values of parameters for the drive unit can be used directly. For specific settings, refer to "A.3.6 Descriptions of CANopen Communication Protocol".

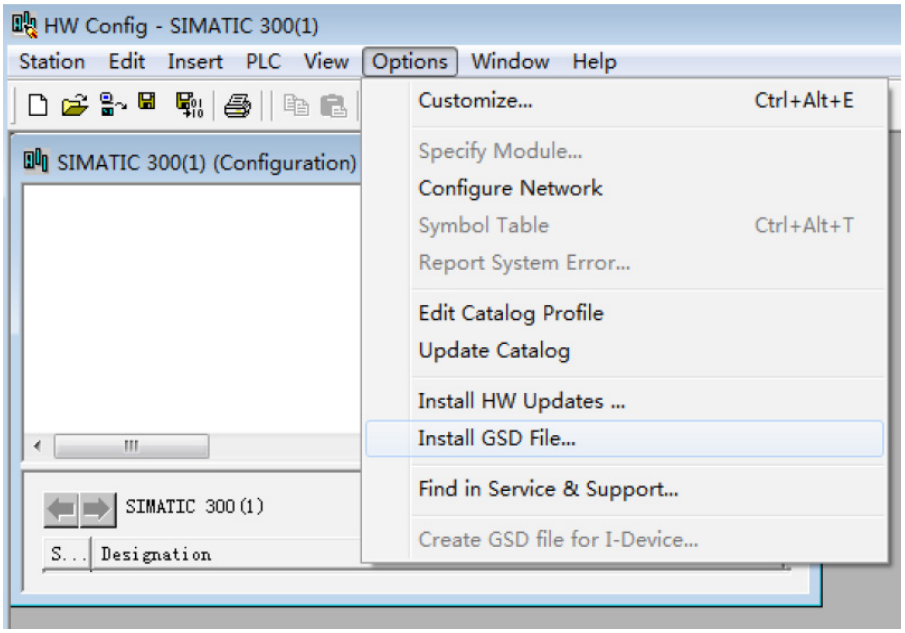
2) Configure information on the master S7-300.

Before using the PROFIBUS DP master, you must configure the slave GSD file first to add the slave to the master system. If the file exists, omit step 2. You can obtain the GSD file from Inovance or its agent. To configure the slave, do as follows:

Step 1: Establish a project in STEP7, and add an S7-300 master in the project, as shown in the following figure.

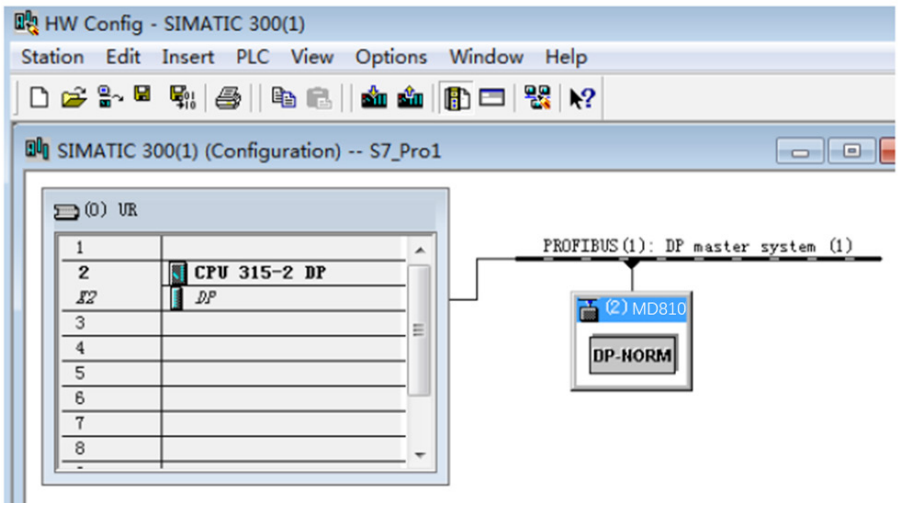


Step 2: Double-click the hardware icon to access the **HW Config** interface, and choose **Options** > **Install GSD File** to add the MD810DP.GSD file (Note that the file must be stored in an English path; otherwise, the STEP7 may fail to recognize the file).

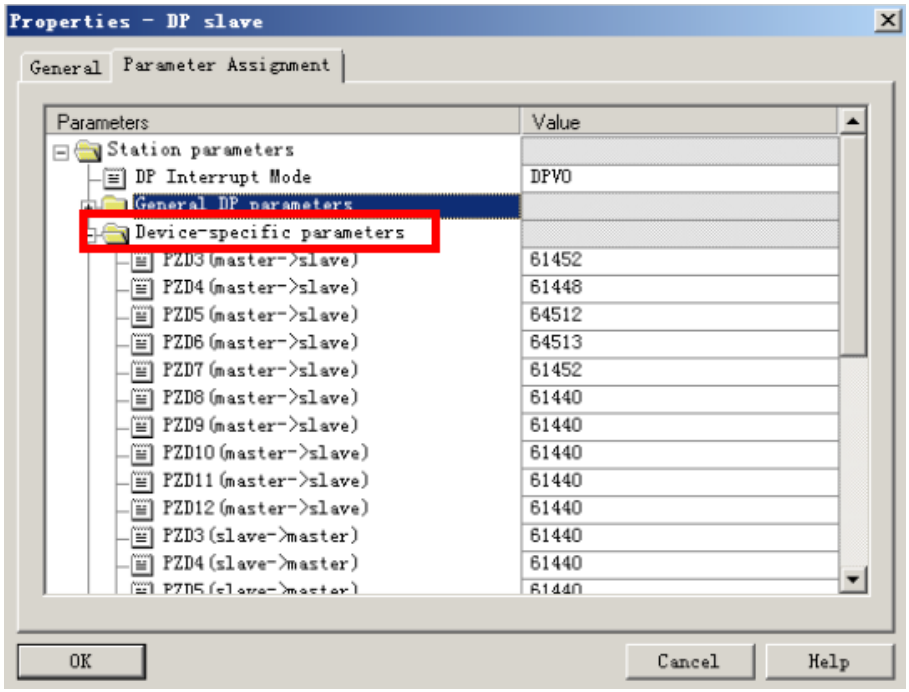


Click **Install**. After the file is installed, the MD810-gateway module is displayed under **Gateway**, as shown in the following figure.

Step 3: Establish a slave system, as shown in the following figure. The establishment of the master is not described here.



Step 4: Configure DP slave parameters. Double-click the MD810 slave, as shown in the following figure.



- The number of devices: It refers to the number of CANopen slaves (including the gateway) in the network. The maximum value is30 . For example, if there are five drive units and one power supply unit (serving as the gateway) on the network, the number of slaves is 6.

- NO.1, NO.2, NO.3…: NO.1 indicates the gateway. NO.2 indicates that the slave station No. is 2 (Fd-13 = 2), NO.3 indicates that the slave station No. is 3 (Fd-13 = 3), and so on.

- IN and OUT: IN indicates data from the drive to the PLC and OUT indicates data from the PLC to the drive.

- NO.2 IN indicates the number of data in the unit of words from the station No. 2 to the PLC. No.2 OUT indicates the number of data in the unit of words from the PLC to the

station No. 2.

Note

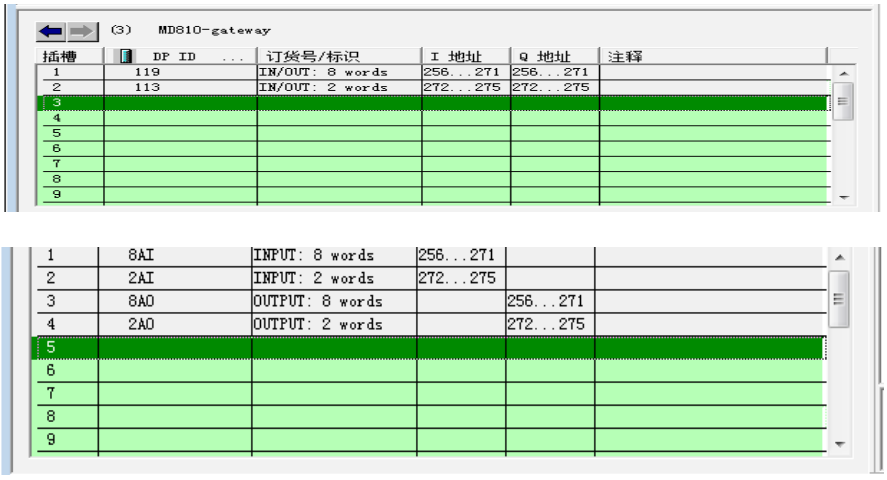
- For specific IN and OUT values, view AF-67 and AF-66 of every station,respectively.
- The values of IN and OUT equal the sum of bits of AF-66 and AF-67. For example, if the value of AF-66 is 0012, the value of OUT is 3 (1+2).

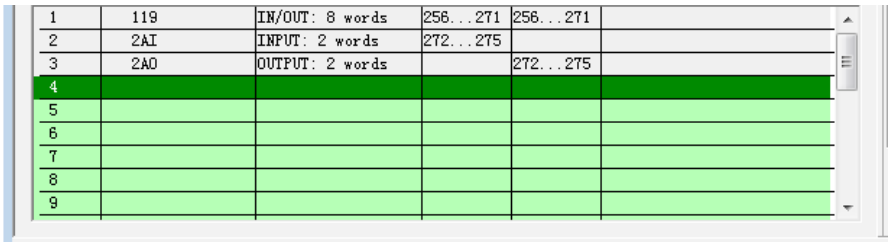
Step 5: Configure INPUT and OUTPUT data length.

- IN/OUT: 1 word and IN/OUT: 2 words: It indicates the number of INs and OUTs. For example, 1 word indicates one IN and one OUT, 2 words indicates two INs and two OUTs, and so so.
- INPUT: 1 word and INPUT: 2 words: It indicates the number of INs. 1 word indicates one IN, 2 words indicate two INs, and so on.
- OUTPUT: 1 word and OUTPUT: 2 words: It indicates the number of OUTs. 1 word indicates one OUT, 2 words indicate two OUTS, and so on.

The number of slot INs and OUTs is equal to the sum of INs and OUTs of valid stations in the special device parameter in step 4. If **The number of devices** is 6, the sum of INs equals the result of NO.1 IN + NO.2 IN + ... NO.6 IN. The sum of OUTs equals the result of NO.1 OUT + NO.2 OUT + … NO.6 OUT. The value shown in the preceding figure is for reference. The sum of INs is 10 and the sum of OUTs is 10.

Insert 10 INs and 10 OUTs for the corresponding slot in the following figure.This can be a combination of INs and OUTs, or INs, OUTs. See the illustration below.





1	119	IN/OUT: 8 words	256...271	256...271	
2	2AI	INPUT: 2 words	272...275		
3	2AO	OUTPUT: 2 words		272...275	
4					
5					
6					
7					
8					
9					

Note

- Any inserted I and Q addresses must be continuous. Inserting I and Q address for slot 1 is a must, and the number of slots is not limited. In addition, the total number of INs and OUTs for the slot must be the same as the number of INs and OUTs in the special device parameter; otherwise, communication cannot be established.

Step 6: Obtain the process data relation between the I/Q address of the PLC and the drive by referring to the CANopen slave configuration description section.

A.6.7 CANopen Slave Configuration Description

1) Process data mapping

Every CANopen slave supports sending of up to 8-byte process data and receiving of up to 8-byte process data. Any mapping is allowed. The sum of sent and received process data shall not exceed 244 bytes and 244 bytes respectively.

OUT: PLC -> drive; IN: Drive->PLC

◆ Manual modification via the keypad

You can select received/sent parameters by modifying parameters in group AF of the drive.. Take the following table as an example. The method of configuring F0-01 in OUT1 is as follows:

a. Enter the group No. of received/sent parameters plus 0x2000 in the first parameter in group AF of the corresponding INPUT or OUTPUT. For example, F0 corresponds to 0x20F0. Set the group No. plus 0x2000 to AF-00.

b. Plus the group No. of received/sent parameters by 1, convert the result into a hexadecimal number, and enter the value in the high-order bits of the second parameter in group AF of the corresponding INPUT or OUTPUT. Convert the parameter data length into a hexadecimal number and set the value to the low-order bits of the second parameter in group AF of the corresponding INPUT or OUTPUT.

For example, if the parameter data length of F0-01 is 16 bits, enter 0x0210.

Target Parameter Code	Group AF Address	Value	Remarks

F0-01	AF-00	0x20F0	Parameter address index Equal to group No. F0 + 0x2000
	AF-01	0x0210	High-order bit 02: Parameter group No. offset + 1 Low-order bit 10: 16-bit parameter length For example, the value is 20 for a 32-bit parameter. Note: The offset value must be converted into a hexadecimal number.

You can also map the CANOPEN object dictionary to group AF. Except that an object dictionary sub-index does not need to be added by 1, other steps are similar, as shown in the following table.

Target Object Dictionary	Group AF Address	Value	Remarks
0x2073-12	AF-00	0x2073	Object dictionary index
	AF-01	0x1210	High-order bits 12: Object dictionary sub-index Low-order bit 10: 16-bit object length

The following table shows the relation between the parameters in group AF and INPUT/OUTPUT.

	Group AF Address		Default of Drive Unit Parameter			Group AF Address		Default of Drive Unit Para.	
OUT	OUT 1	AF-00	0x2073	0x7311 (Control word)	IN	IN 1	AF-32	0x2070	0x7044 (Status word)
		AF-01	0x1210				AF-33	0x4510	
	OUT 2	AF-02	0x2073	0x7310 (Frequency reference)		IN 2	AF-34	0x2070	0x7045 (Running frequency)
		AF-03	0x1110				AF-35	0x4610	
	OUT 3	AF-04				IN 3	AF-36		
		AF-05					AF-37		
	OUT 4	AF-06				IN 4	AF-38		
		AF-07					AF-39		
	OUT 5	AF-08				IN 5	AF-40		
		AF-09					AF-41		
	OUT 6	AF-10				IN 6	AF-42		
		AF-11					AF-43		
	OUT 7	AF-12				IN 7	AF-44		
		AF-13					AF-45		
	OUT 8	AF-14				IN 8	AF-46		
		AF-15					AF-47		

Note

- The power supply unit has no default.
- If received or sent data needs to be reserved, Fd-93 is used by both the power supply unit and the drive unit. Assume that the first received data reserved by the power supply unit corresponds to AF-00 and AF-01. In this case, set AF-00 to 0x20Fd and AF-01 to 0x5E10.

  AF-00 = 0x2000 + Fd = 0x20Fd

  High-order eight bits of AF-01 = 93+1 = 0x5E

  Low-order eight bits of AF-01 = 0x10

◆ Modification through software

You can also configure slave process data using the software of the MD810.

2) Mapping relation between I/Q addresses of the PLC and the process data

The PLC I address corresponds to the slave INPUT, as indicated by drive -> PLC. The PLC Q address corresponds to the slave OUTPUT, as indicated by PLC -> drive. The PLC I/Q addresses are sorted according to the number of stations with data and IN/OUT No. of corresponding stations in an ascending order. The minimum PLC I address is 256, corresponding to IN1 of station 2 and then 258 corresponding to IN2, as shown in the following figure. Because station 2 has only two INs, the next PLC I address corresponds to IN1 of station 3 and so on.

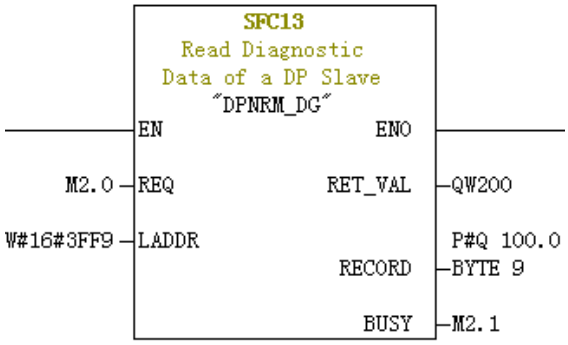
Station No.	Parameter	Value							PLC Q Add.							PLC I Add.
	The number of devices	9														
Station No. 1	NO.1 IN (words)	0	OUT	OUT 1						IN	IN 1					
				OUT 2							IN 2					
				OUT 3							IN 3					
				OUT 4							IN 4					
	NO.1 OUT (words)	0		OUT 5							IN 5					
				OUT 6							IN 6					
				OUT 7							IN 7					
				OUT 8							IN 8					
Station No. 2	NO.2 IN (words)	2	OUT	OUT 1	U3-17	AF-00 : 0x2073	AF-01 : 0x1210		256	IN	IN 1	U0-69	AF-32 : 0x2070	AF-33 : 0x4510		256
				OUT 2	U3-16	AF-02 : 0x2073	AF-03 : 0x1110		258		IN 2	U0-70	AF-34 : 0x2070	AF-35 : 0x4610		258
				OUT 3							IN 3					
				OUT 4							IN 4					
	NO.2 OUT (words)	2		OUT 5							IN 5					
				OUT 6							IN 6					
				OUT 7							IN 7					
				OUT 8							IN 8					
Station No. 3	NO.3 IN (words)	2	OUT	OUT 1	U3-17	AF-00 : 0x2073	AF-01 : 0x1210		260	IN	IN 1	U0-69	AF-32 : 0x2070	AF-33 : 0x4510		260
				OUT 2	U3-16	AF-02 : 0x2073	AF-03 : 0x1110		262		IN 2	U0-70	AF-34 : 0x2070	AF-35 : 0x4610		262
				OUT 3							IN 3					
				OUT 4							IN 4					
	NO.3 OUT (words)	2		OUT 5							IN 5					
				OUT 6							IN 6					
				OUT 7							IN 7					
				OUT 8							IN 8					
									OUT: 4							IN: 4

This table can be generated by clicking the button for exporting configuration files on the PDO mapping configuration interface of the software in this section. The PLC I/Q base address, namely the address with the minimum value, must be entered before export.

A.6.8 PLC Fault Diagnosis

PROFIBUS DP master diagnosis information

Specific diagnosis information of slaves can be read using SFC13 in the program, as shown in the following figure.



REQ: It is used to enable or disable diagnosis information reading. When this field is set to ON, diagnosis information reading is enabled.

LADDR: Diagnosis address of configured DP slaves. The following figure shows the actual value. The hexadecimal format of this address, namely 3FF9 of 16337, must be filled in SFC13.

RET_VAL: It displays the error code (negative) when invocation errors occur or displays the actual transmitted data length (positive) when no error occurs.

RECORD: It indicates the target area of the read diagnosis data. The value must be nine bytes. Otherwise, an error is reported during invocation. The nine bytes are defined as follows:

Byte	Assignment
Byte 0 to 2	Station status
Byte 3	Master number
Byte 4	Supplier ID (high-order byte)
Byte 5	Supplier ID (low-order byte)
Byte 6 to 10	Dedicated device diagnosis information

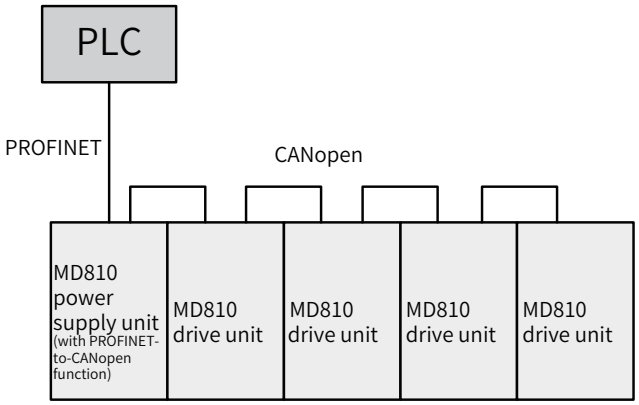
Dedicated device diagnosis provides fault information defined for the gateway, as described in the following table.

Byte 6	Byte 7	Byte 8	Byte 9	Byte 10
Dedicated device diagnosis length	Type	CANopen slave station No.	Fault Code	
4	Parameter error (1)	1 to 30	The parameter PDO length does not match that configured on the drive (35).	Reserved
4	Parameter error (1)	1 to 30	A node in the configuration is not online (34).	Reserved
4	CANopen network fault (3)	1 to 30	A CANopen slave becomes offline during operation (32).	Reserved
5	Drive fault (4)	1 to 30	The drive is faulty. (High-order byte)	The drive is faulty. (Low-order byte)

A.7 PROFINET-to-CANopen Gateway

A.7.1 PROFINET Introduction

The PROFINET-to-CANopen gateway function is used to convert the PROFINET protocol to the CANopen protocol for the MD810 power supply unit. The following figure shows the basic network structure.



The gateway function implements data exchange for a total of 30 nodes (including the power supply unit). Detailed data is as follows.

1) Power supply unit The power supply unit supports three RPDOs and three TPDOs, each of which supports a maximum of 24 bytes.

2) The drive unit (of the MD810 or IS810) supports a maximum of 29 nodes. Each node can be configured with up to four RPDOs and four TPDOs, each of which supports a maximum of 32 bytes. The total number of RPDOs and TPDOs configured for the 29 nodes cannot exceed 63. The maximum input and output data length supported by the 29 nodes is 504 bytes (63 x 8).

In this section, the CANopen node of the MD810 drive unit, Siemens S300 PLC, and Siemens STEP7 are used to describe how to configure the PROFINET-to-CANopen gateway function.

A.7.2 Configuration Preparations

To use PROFINET-to-CANopen gateway function, configure the following:

1) Power supply unit: Set FD-10 to 5 and FD-12 to the CANopen baud rate to be used for the model supporting the PROFINET-to-CANopen gateway function.

2) Drive unit: Set FD-10 to 1. Set FD-12 to the required baud rate. Set FD-13 to the CANopen station number. You cannot set FD-13 to 1, and you must set the station number in an ascending order. However, for a node without process data, you can set FD-13 to 1.

NOTE

◆The power supply unit that supports the PROFINET-to-CANopen gateway function has four Ethernet interfaces in two groups. Ensure that the PROFINET and CANopen cables are connected correctly.

A.7.3 Configuring the Process Data on the Drive

The process data required for communication is configured through parameters in group AF in

the same way for the power supply unit and the drive unit.

Every CANopen slave supports sending up to 32-byte process data and receiving up to 32-byte process data. Each PDO supports up to eight bytes. Any parameter can be used.

The sent/received parameters can be configured in the following two ways: IN (Drive -> PLC) and OUT (PLC -> Drive).

You can select the parameters c by modifying parameters in group AF of the drive. Take the following table as an example. The method of configuring F0-01 in OUT1 is as follows:

1) Enter the parameter group No. of the sent/received parameters plus 0x2000 in the first parameter in group AF of the corresponding INPUT or OUTPUT. For example, F0 corresponds to 0x20F0. Enter the group No. plus 0x2000 in AF-00.

2) Add the group No. of the received/sent parameters by 1, convert the result into a hexadecimal number, and enter the high-order bits of the second parameter in group AF of the corresponding INPUT or OUTPUT. Convert the parameter data length into a hexadecimal number and enter the low-order bits of the second parameter in group AF of the corresponding INPUT or OUTPUT. For example, if the parameter data length of F0-01 is 16 bits, enter 0x0210.

Parameter Code	Group AF Address	Value	Remarks
F0-01	AF-00	0x20F0	Equal to group No. F0 + 0x2000
	AF-01	0x0210	High-order bit 02: Number of the parameter group + 1 Low-order bit 10: Length of the parameter. The length for 16-bit data is 10, for 32-bit data 20, and for 8-bit data is 08. Note: The parameter group number must be converted into a hexadecimal number.

You can also map the CANopen object dictionary to group AF. Except that an object dictionary sub-index does not need to be added by 1, other steps are similar, as shown in the following table.

Target Object Dictionary	Group AF Address	Value	Remarks
0x2073-12	AF-00	0x2073	Object dictionary index
	AF-01	0x1210	High-order bits 12: Object dictionary sub-index Low-order bits 10: 16-bit object length

■ Mapping configuration mode of the MD810

Thefollowing table describes the relationship between parameters in group AF and INPUT and OUTPUT.

		Group AF Address		Parameter Value	Process Data Address			Group AF Address		Parameter Value	Process Data Address
OUT	RPDO1	OUT1	AF-00	0x2073	0x7311	INPUT	TPDO1	INPUT1	AF-32	0x2070	0x7044
			AF-01	0x1210					AF-33	0x4510	
		OUT2	AF-02	0x2073	0x7310			INPUT2	AF-34	0x2070	0x7045
			AF-03	0x1110					AF-35	0x4610	
		OUT3	AF-04					INPUT3	AF-36		
			AF-05						AF-37		
		OUT4	AF-06					INPUT4	AF-38		
			AF-07						AF-39		
	RPDO2	OUT5	AF-08				TPDO2	INPUT5	AF-40		
			AF-09						AF-41		
		OUT6	AF-10					INPUT6	AF-42		
			AF-11						AF-43		
		OUT7	AF-12					INPUT7	AF-44		
			AF-13						AF-45		
		OUT8	AF-14					INPUT8	AF-46		
			AF-15						AF-47		
	RPDO3	OUT9	AF-16				TPDO3	INPUT9	AF-48		
			AF-17						AF-49		
		OUT10	AF-18					INPUT10	AF-50		
			AF-19						AF-51		
		OUT11	AF-20					INPUT11	AF-52		
			AF-21						AF-53		
		OUT12	AF-22					INPUT12	AF-54		
			AF-23						AF-55		
	RPDO4	OUT13	AF-24				TPDO4	INPUT13	AF-56		
			AF-25						AF-57		
		OUT14	AF-26					INPUT14	AF-58		
			AF-27						AF-59		
		OUT15	AF-28					INPUT15	AF-60		
			AF-29						AF-61		
		OUT16	AF-30					INPUT16	AF-62		
			AF-31						AF-63		

NOTE

- If 32-bit data is configured, ensure thatthe number of bytes in each PDO is not higher than 8 bytes.
- The power supply unit supports input of up to 24 bytes and output of up to 24 bytes. After modifying the process data of the power supply unit, power on the unit again.
- If received or sent data needs to be reserved, Fd-93 is used by both the power supply unit and drive unit. Assume that the first received data reserved by the power supply unit corresponds to AF-00 and AF-01. In this case, set AF-00 to 0x20FD and AF-01 to 0x5E10.
- AF-00 = 0x2000 + FD = 0x20FD
- High-order eight bits of AF-01 = 93+1 = 0x5E
- Low-order eight bits of AF-01 = 0x10

■ Mapping configuration mode of the IS810

The IS810 is developed based on the IS620P. For details, see the IS620P user guide.

The PROFINET gateway of the IS810 is configured as follows: Set the CANopen slave station No. by 0C-00 and set 0C-45 to 1 to select the gateway mode.

Different from the PROFIBUS DP-to-CANopen gateway function, the PROFINET-to-CANopen gateway function of the IS810 supports four RPDOs/TPDOs and supports 8-bit/16-bit/32-bit data structures. The following table describes the related parameters.

		2D Group Address		2D Parameter Value	Process Data Address			2E Group Address		Para. Value	Process Data Address
OUT	RPDO1	Number of mapping objects	2D-32			INPUT	TPDO1	Number of mapping objects	2E-20		
		OUT1	2D-33					INPUT1	2E-21		
			2D-34						2E-22		
		OUT2	2D-35					INPUT2	2E-23		
			2D-36						2E-24	0x4610	
		OUT3	2D-37					INPUT3	2E-25		
			2D-38						2E-26		
		OUT4	2D-39					INPUT4	2E-27		
			2D-40						2E-28		
	RPDO2	Number of mapping objects	2D-49				TPDO2	Number of mapping objects	2E-37		
		OUT5	2D-50					INPUT5	2E-38		
			2D-51						2E-39		
		OUT6	2D-52					INPUT6	2E-40		
			2D-53						2E-41		
		OUT7	2D-54					INPUT7	2E-42		
			2D-55						2E-43		
		OUT8	2D-56					INPUT8	2E-44		
			2D-57						2E-45		
	RPDO3	Number of mapping objects	2D-66				TPDO3	Number of mapping objects	2E-54		
		OUT9	2D-67					INPUT9	2E-55		
			2D-68						2E-56		
		OUT10	2D-69					INPUT10	2E-57		
			2D-70						2E-58		
		OUT11	2D-71					INPUT11	2E-59		
			2D-72						2E-60		
		OUT12	2D-73					INPUT12	2E-61		
			2D-74						2E-62		
	RPDO4	Number of mapping objects	2D-83				TPDO4	Number of mapping objects	2E-71		
		OUT13	2D-84					INPUT13	2E-72		
			2D-85						2E-73		
		OUT14	2D-86					INPUT14	2E-74		
			2D-87						2E-75		
		OUT15	AF-88					INPUT15	2E-76		
			AF-89						2E-77		
		OUT16	AF-90					INPUT16	2E-78		
			AF-91						2E-79		

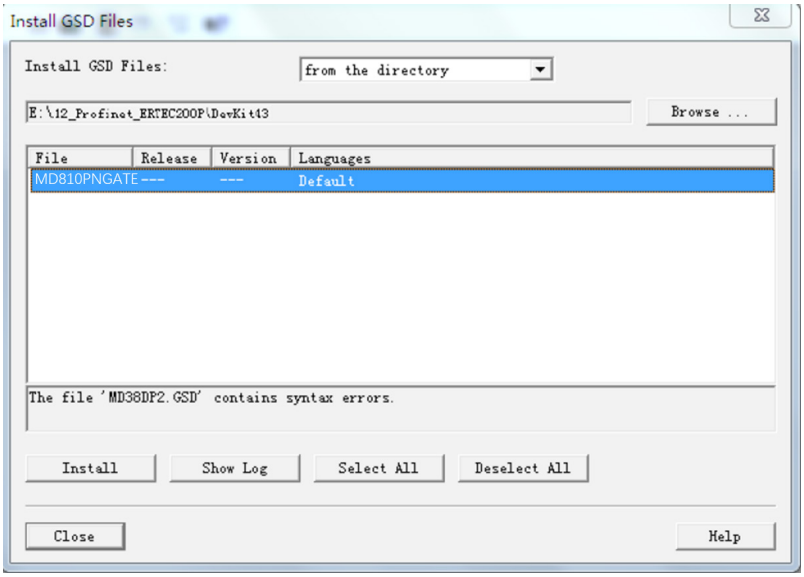
NOTE

- Note the length of the mapping object. Ensure that the number of bytes in each PDO does not exceed eight bytes.
- Clear the value of the parameter for the PDO that is not required for communication. Otherwise, the configuration will fail.
- The number of mappings must match the actual number.

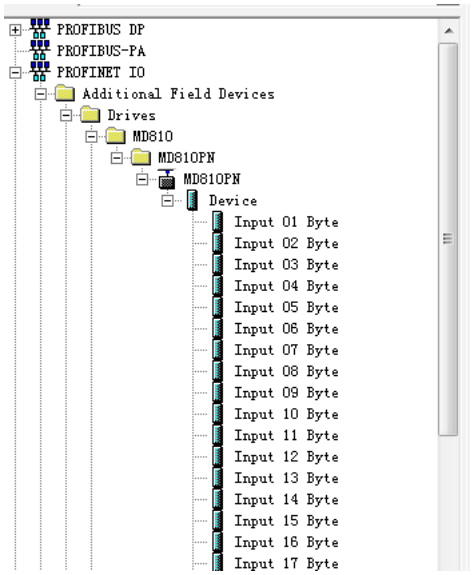
A.7.4 Configurations on the STEP7

1) Import the GSDML file.

Import the GSDML file on the STEP7.

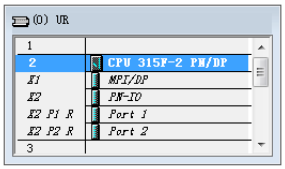


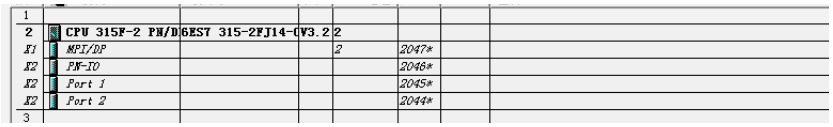
After the import is successful, the device is displayed. See the following figure.



2) Create a PROFINET network.

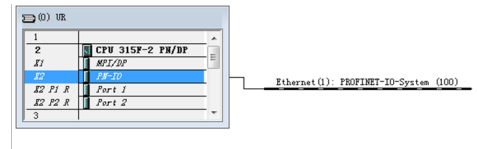
Suppose that the PLC has been configured. As shown in the following figure, a PROFINET network needs to be added.

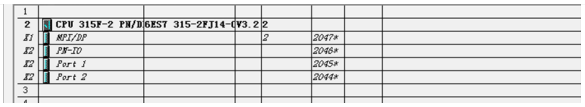




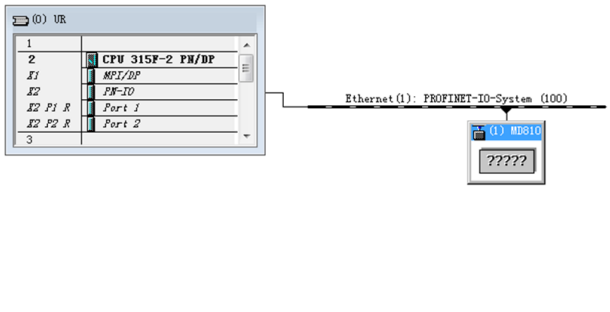
Right-click **PN-IO** and select **Insert PROFINET IO System**. Select **Property**.

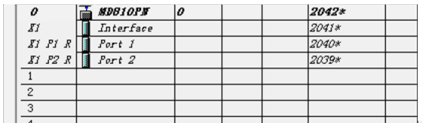
Click **New**, and then click **OK**, as shown in the following figure.





Drag the MD810PN device added to the bus, as shown in the following figure.





3) Assign a device name.

Each device needs to be assigned a device name in the PROFINET communication. You can as-

sign a specific name to each device as required. The assigned device name must be consistent with that in the configuration. Otherwise, PROFINET communication will fail.

After double-click the dragged device, you can modify the device name as required or use the default name.

Assign the name to the PROFINET-to-CANopen device. Select **Ethernet** for **PLC**, and then click **Assign device name**.

Select the target station, and click **Assign Name**. Click **Close**.

4) Configure the process data.

Before configuring the process data, ensure that the parameters and process data of the AC drive have been configured.

The configuration rules of the PROFINET-to-CANopen gateway function are described as follows.

- Add a station by double-clicking or dragging and dropping a device.
- The power supply unit is Device 1. Device 1 must be added no matter whether the process data of the power supply unit is present.
- Device 2 corresponds to CANopen station 2, and so on.
- There are two sub-slots under each device. The first sub-slot can only be used to insert Input data, and the second sub-slot can only be used to insert Output data.
- The data length (in bytes) in each sub-slot must be the same as the total length of the Input or Ouput of the AC drive.
- If there is no Input or Output data for a certain station, insert Input No Data or Output No Data in the corresponding sub-slot.
- If the process data needs to be changed after the PROFINET-to-CANopen communication is established, power on the power supply unit again.

Example:

0	MD810PN	0			2042*
E1	Interface				2041*
E1 P1 R	Port 1				2040*
E1 P2 R	Port 2				2039*
1	**Device**				**256***
1.1	Input 02 Byte		256...257		
1.2	Output No Data				2038*
2	**Device**				**258***
2.1	Input 12 Byte		258...269		
2.2	Output 12 Byte			258...269	
3	**Device**				**2037***
3.1	Input No Data				2037*
3.2	Output No Data				2036*
4	**Device**				**270***
4.1	Input 04 Byte		270...273		
4.2	Output 04 Byte			270...273	
5	**Device**				**274***
5.1	Input 04 Byte		274...277		
5.2	Output 04 Byte			274...277	
6	**Device**				**278***
6.1	Input 04 Byte		278...281		
6.2	Output 04 Byte			278...281	
7	**Device**				**282***
7.1	Input 32 Byte		282...313		
7.2	Output 32 Byte			282...313	
8	**Device**				**314***
8.1	Input 04 Byte		314...317		
8.2	Output 04 Byte			314...317	
9					
10					

As shown in the preceding figure, Device 1 is the power supply unit. It has only one Input data in the length of two bytes in group AF. Therefore, the first slot displays **Input 02 Byte**. Because

there is no output data, the second slot displays **Output No Data**.

Device 2 is CANopen station 2. It has six Inputs and six Outputs. Each Input or Output has two bytes in the length, so there are 12 bytes of Inputs and 12 bytes of Outputs in total.

Device 3 is CANopen station 3 and does not have process data. This station can be set directly to station 1, that is, the station does not serve as the gateway. However, it can operate normally according to the configuration shown in the figure.

The following stations are similar.

Process data address mapping:

Take Device 5 as an example. The Input length is four bytes, corresponding two process data (such as 0x7044 and 0x7045) in group AF. In the PLC, I addresses 270 to 273 correspond to the two data. I270 to I271 correspond to 0x7044. I270 is the high-order bit of 0x7044 and I271 is the low-order bit of 0x7044. The correspondence relationship for I272 and I273 is similar.

NOTE

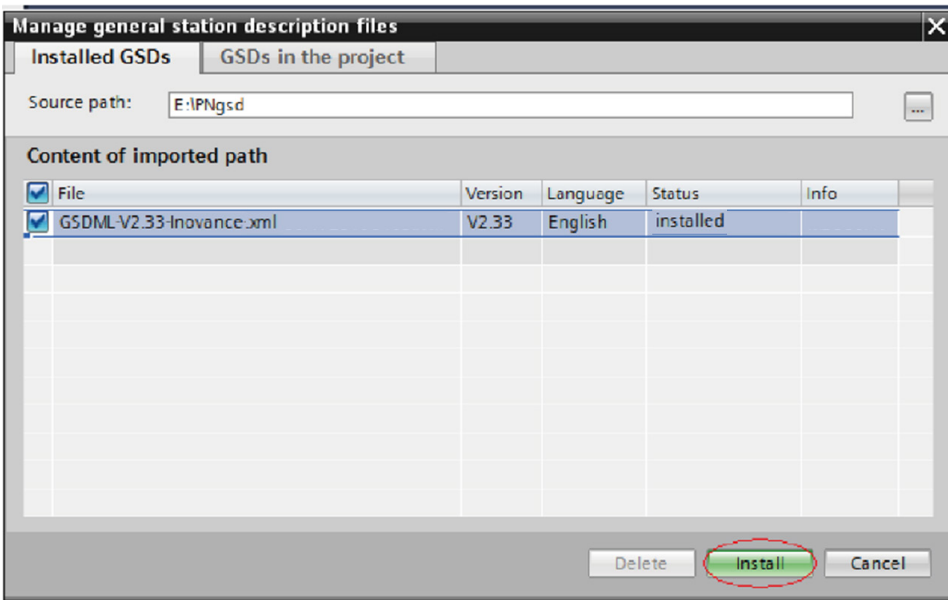
◆Ensure that the device configured on the AC drivecorresponds to the device configured on the STEP7. Otherwise, an error will be reported.

After the configuration is completed, communication can be established after the configuration is downloaded to the PLC.

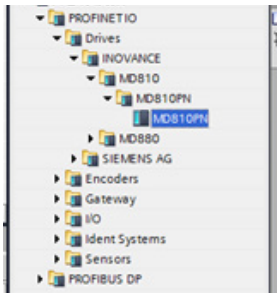
A.7.5Configuration on the TIA Portal

1） Import the GSDML file.

In the menu bar, choose **Option** > **Manage general station description files (GSD)**.

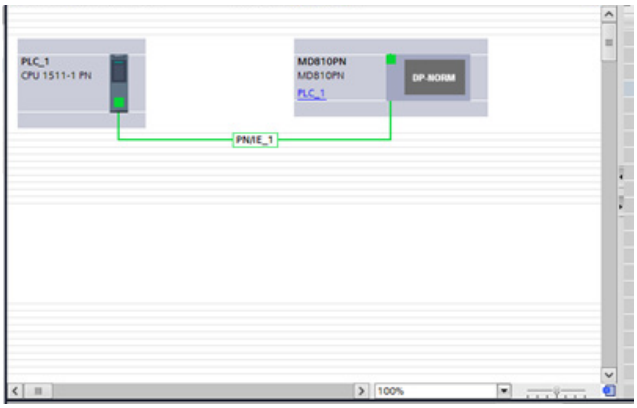


After the import is successful, the device is displayed. as shown in the following figure.



2) Create a PROFINET network.

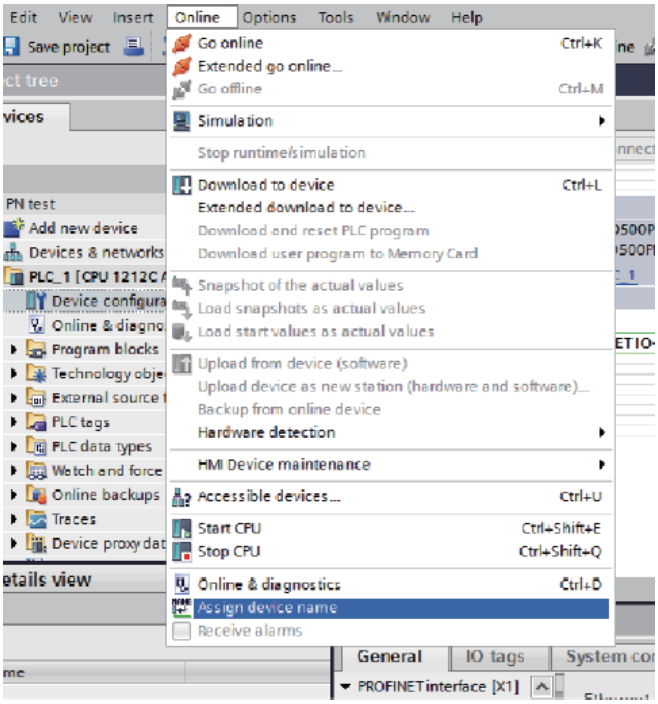
After adding a PLC to the interface, drag a MD810PN device to the interface and configure the connection between the PLC and the MD810PN.



3) Assign a device name.

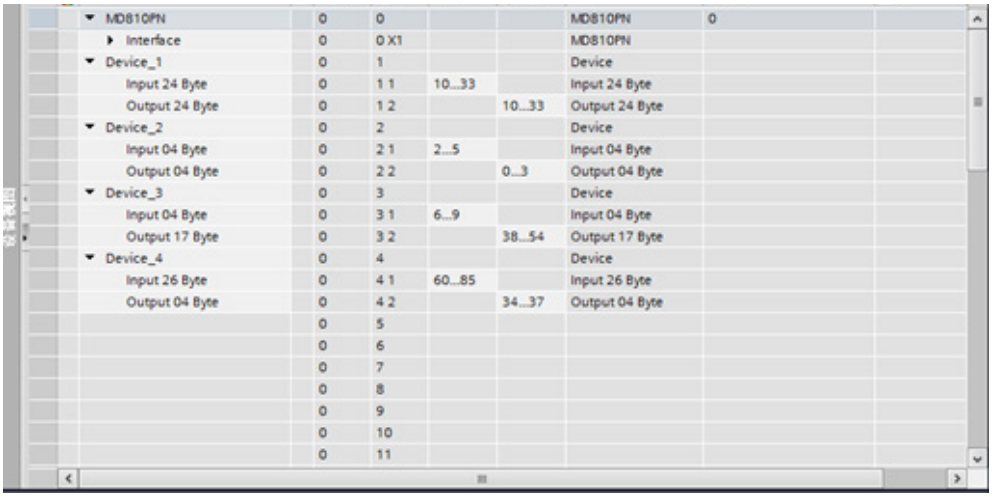
Right-click the device and select **Assign device name**.

The device name assignment on the TIA Portal is the same as that on the STEP7. For details, see "Assign a device name" in "A.6.4 Configuration on the STEP7".



4) Configure the process data.

The process data configuration on the TIA Portal is the same as that on the STEP7. For details, see "Configure the process data" in "A.6.4 Configuration on the STEP7". The following figure describes the configured interface.



MD810PN	0	0			MD810PN	0
Interface	0	0 X1			MD810PN	
Device_1	0	1			Device	
Input 24 Byte	0	1 1	10...33		Input 24 Byte	
Output 24 Byte	0	1 2		10...33	Output 24 Byte	
Device_2	0	2			Device	
Input 04 Byte	0	2 1	2...5		Input 04 Byte	
Output 04 Byte	0	2 2		0...3	Output 04 Byte	
Device_3	0	3			Device	
Input 04 Byte	0	3 1	6...9		Input 04 Byte	
Output 17 Byte	0	3 2		38...54	Output 17 Byte	
Device_4	0	4			Device	
Input 26 Byte	0	4 1	60...85		Input 26 Byte	
Output 04 Byte	0	4 2		34...37	Output 04 Byte	
	0	5				
	0	6				
	0	7				
	0	8				
	0	9				
	0	10				
	0	11				

After the configuration is completed, communication can be established after the configuration is downloaded to the PLC.

A.7.6 Auxiliary Functions

1) Start with offline station

This function is applicable to scenarios where you want to start the network without modifying the PLC configuration and program when a CANopen slave fails to go online. In this case, set FD-50 to 1, And power on the slave again.

NOTE

- This function is an auxiliary function which cannot be used to rectify faults (such as E16.74). Enable this function only after commissioning is done. Do not commission the network when this function is enabled.
- Use this function only after ensuring that the node cannot go online. If the node goes online slowly, do not use this function.

2) PN timeout time

The maximum timeout allowed on the PN side can be configured through FD-55 (unit: ms, 350 by default) according to the field conditions. After the configuration takes effect, the CANopen network becomes unavailable when the timeout period expires. The function takes effect after power-on again.

A.7.7 Error Report and Diagnosis Mechanism

When a gateway function configuration error occurs, an error is reported on both the PLC and the power supply unit panel. The error codes reported by the power supply unit are as follows.

Error Code	Description
16.71	PROFINET device offline

Error Code	Description
16.72	A CANopen slave is disconnected. Check which slave is disconnected and ensure that the wiring is correct.
/	A slave reports an alarm. Check which slave reports the alarm. (The alarm is generated only on the PLC.)
16.74	The CANopen slave is not configured. Check whether the CANopen station number is configured correctly.
16.75	Configurations of some process data of the CANopen slave do not match those on the PLC.
16.76	Configurations of the process data of the power supply unit does not match those on the PLC.
16.77	The PN function in the power supply unit is faulty. Set FD-10 to 5 and power on again. (The PLC will report an alarm when the PROFINET device goes offline.)
16.78	The PN function in the power supply unit is faulty. Set FD-10 to 5 and power on again. (The PLC will report an alarm when the PROFINET device goes offline.)

The PLC allows you to query the description of the corresponding error through the diagnostic function. For example, if a slave is offline, the error 16.72 will be reported on the power supply unit panel, and the following error will be reported in the slot of the corresponding PLC node.

A.7.8 Monitoring Function

You can monitor the online status and other parameters of the slave by using the parameters of the power supply unit.

Parameter Code	Description
FD-51	Prohibition time for CANopen slave communication
FD-52	Number of online CANopen slaves
FD-53	This parameter defines the status of stations 1 to 15. Bit 1 indicates station 1, bit 2 indicates station 2, and so on.
FD-54	This parameter defines the status of stations 16 to 31. Bit 0 indicates station 16, bit 1 indicates station 17, and so on.
FD-59	PN software version
FD-61	High-order two bytes of the MAC address
FD-62	Middle-order two bytes of the MAC address
FD-63	Low-order two bytes of the MAC address

A.7.9 Configuration of the PN gateway with Siemens PLC S1500

The following models are used as examples for hardware configuration:

Inovance MD810 power supply unit (used as the gateway); model: MD81020M4T22G120

Inovance IS810P-CO CANopen bus servo drive; model: IS810P50M4T005CO

Inovance standard servo motor; model: ISMH2-15C30CD-U231Y

Siemens PROFINET bus PLC; model: S7-1500

1. Servo configuration

■ Preparations before configuration

1) Check whether the MD810 power supply unit can serve as the PROFINET gateway

(whether the power supply unit provides the PROFINET interface), and ensure that the drive unit supports the CANopen bus.

2) Ensure that the main circuit is correctly connected, including three-phase input, inter-unit bridging, and output motor connection.

NOTE

- The MD810 must be connected to a three-phase 380 VAC power supply. Do not connect it to a single-phase power supply.

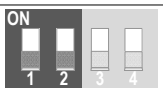
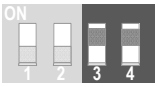
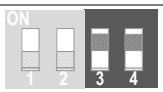
3) Connect the network cable correctly.

Connect the PROFINET interface of the MD810 power supply unit to the communication interface of the PLC through a network cable.

Connect the RJ45 network port of the MD810 power supply unit to that of the drive unit through a network cable.

Toggle positions 3 and 4 of the CAN1 termination resistor to ON.

Install a termination resistor to the last drive unit. Otherwise, the CANopen communication may be abnormal and the alarm A16.13 may be reported.

Mark	Terminal Name	Function Description	Position
S1	DIP switch for connecting the RS485 termination resistor	Toggle positions 1 and 2 to ON: Termination resistor connected	
		Toggle positions 1 and 2 to OFF: Termination resistor not connected	
	DIP switch for connecting the CAN1 termination resistor	Toggle positions 3 and 4 to ON: Termination resistor connected	
		Toggle positions 3 and 4 to OFF: Termination resistor not connected	
S2	DIP switch for connecting the C485 termination resistor	Toggle positions 1 and 2 to ON: Termination resistor connected	
		Toggle positions 1 and 2 to OFF: Termination resistor not connected	
	DIP switch for connecting the CAN2 termination resistor	Toggle positions 3 and 4 to ON: Termination resistor connected	
		Toggle positions 3 and 4 to OFF: Termination resistor not connected	

■ Communication parameter configuration

1) Power supply unit (master)

Set FD-10 (Communication protocol selection) to 5 (PROFINET-to-CANopen gateway).

Set FD-12 (CANopen baud rate) to 5. The value 5 indicates the baud rate of 500 kbps.

Set FD-13 (Station No.) to 1 to set station 1 as the master.

2) Drive unit (slave)

MD810 drive unit

Set FD-10 (Communication protocol selection) to 1 (CANopen).

Set FD-12 (CANopen baud rate) to 5. The value 5 indicates the baud rate of 500 kbps. The baud rate set for the slave must be the same as that for the master.

Set FD-13 (Station No.) to any value other than 1.

3) IS810 drive unit

Set H0C-45 (Communication protocol selection) to 1 (CANopen).

Set H0C-00 (Station No.) to any value other than 1.

Set H0C-02 (CANopen baud rate) to 5. The value 5 indicates the baud rate of 500 kbps. The baud rate set for the slave must be the same as that for the master.

■ Process data transmission configuration

The CANopen transmission parameters related to the IS810 servo drive unit belong to groups 2D and 2E. The following table lists the mappings.

		2D Group Address		2D Para. Value	Process Data Address			2E Group Address		Para. Value	Process Data Address
OUT	RPDO1	Number of mapping objects	2D-32			INPUT	TPDO1	Number of mapping objects	2E-20		
		OUT1	2D-33					INPUT1	2E-21		
			2D-34						2E-22		
		OUT2	2D-35					INPUT2	2E-23		
			2D-36						2E-24		
		OUT3	2D-37					INPUT3	2E-25		
			2D-38						2E-26		
		OUT4	2D-39					INPUT4	2E-27		
			2D-40						2E-28		
OUT	RPDO2	Number of mapping objects	2D-49				TPDO2	Number of mapping objects	2E-37		
		OUT5	2D-50					INPUT5	2E-38		
			2D-51						2E-39		
		OUT6	2D-52					INPUT6	2E-40		
			2D-53						2E-41		
		OUT7	2D-54					INPUT7	2E-42		
			2D-55						2E-43		
		OUT8	2D-56					INPUT8	2E-44		
			2D-57						2E-45		
OUT	RPDO3	Number of mapping objects	2D-66				TPDO3	Number of mapping objects	2E-54		
		OUT9	2D-67					INPUT9	2E-55		
			2D-68						2E-56		
		OUT10	2D-69					INPUT10	2E-57		
			2D-70						2E-58		
		OUT11	2D-71					INPUT11	2E-59		
			2D-72						2E-60		
		OUT12	2D-73					INPUT12	2E-61		
			2D-74						2E-62		
OUT	RPDO4	Number of mapping objects	2D-83				TPDO4	Number of mapping objects	2E-71		
		OUT13	2D-84					INPUT13	2E-72		
			2D-85						2E-73		
		OUT14	2D-86					INPUT14	2E-74		
			2D-87						2E-75		
		OUT15	AF-88					INPUT15	2E-76		
			AF-89						2E-77		
		OUT16	AF-90					INPUT16	2E-78		
			AF-91						2E-79		

1) You can configure up to 32-byte RPDO and 32-byte TPDO process data. Each PDO can be configured with process data not exceeding 8 bytes in length.

2) The PDO can be configured with the servo parameter or with the CANopen object dictionary, as shown in the following figure.

Parameter (Take the servo parameter as an example)

Example: Assume that you want to assign values to servo parameters H11-12 and H11-14 through the PLC. The value of H11-12 consists of 32 bits, and that of H11-14 consists of 16 bits.

You can select the configuration method based on the number of PDOs and data types as required, as described below.

Configuration method 1:

Mode 1	2D Address			Value	Remarks
RPDO1	Number of mapping objects	2D32		2	
	OUT1	2D33	H1112	2011	1st displacement
		2D34		0D20	32 bits
	OUT2	2D35	H1114	2011	1st speed
		2D36		0F10	16-bit
	OUT3	2D37			
		2D38			
	OUT4	2D39			
		2D40			

Configuration method 2:

	2D Address			Value	Remarks
RPDO1	Number of mapping objects	2D32		1	
	OUT1	2D33	H1112	2011	1st displacement
		2D34		0D20	32 bits
	OUT2	2D35			
		2D36			
	OUT3	2D37			
		2D38			
	OUT4	2D39			
		2D40			

RPDO2	Number of mapping objects	2D49		1	
	OUT5	2D50	H1114	2011	1st speed
		2D51		0F10	16-bit
	OUT6	2D52			
		2D53			
	OUT7	2D54			
		2D55			
	OUT8	2D56			
		2D57			

Configuration principle:

Set H11-12 to 20110D20.

(a) 20110D20: Add H11 by 0x2000 to obtain 0x2011. 2011 will befilled in the high-order bits of OUT1.

(b) 20110D20: 12 in H11-12 is in decimal, which is 0C in hexadecimal. An offset of 1 is required, and the final result is 0D.

(c) 20110D20: The 32-bit parameter corresponds to 20, the 16-bit parameter corresponds to 10, and the 8-bit parameter corresponds to 08. For details on the parameter length, see the IS620P Series Servo Drive Application Guide-CANopen Communication.

Object dictionary:

You can also configure the CANopen object dictionary to the servo drive.

Example: Assume that you want to read object dictionary 0x6077-12 from the servo drive through the PLC. The data type is 16-bit. No offset is required by object dictionaries. The following table lists the formats.

	2E Address			
TPDO1	Number of mapping objects	2E 20	1	
	IPUT1	2E 21	6077	
		2E 22	1210	16-bit
	IPUT2	2E 23		
		2E 24		
	IPUT3	2E 25		
		2E 26		
	IPUT4	2E 27		
		2E 28		

3) You can select RPDO1/TPDO1 (RPDO2/TPDO2, RPDO3/TPDO3, or RPDO4/TPDO4) to configure no more than four parameters with a total length of no more than 32 bytes. The number of mapping objects must be consistent.

The CANopen transmission parameters related to MD810 drive unit belong to group AF,

where:

The AF-00 to AF-31 parameters, which are transmitted by the host controller to the drive, correspond to the RPDO.

The AF-32 to AF-63 parameters, which are transmitted by the drive to the host controller, correspond to the TPDO.

		Group AF Address		Para. Value	Process Data Address			Group AF Address		Para. Value	Process Data Address
OUT	RPDO1	OUT1	AF-00			INPUT	TPDO1	INPUT1	AF-32		
			AF-01						AF-33		
		OUT2	AF-02					INPUT2	AF-34		
			AF-03						AF-35		
		OUT3	AF-04					INPUT3	AF-36		
			AF-05						AF-37		
		OUT4	AF-06					INPUT4	AF-38		
			AF-07						AF-39		
	RPDO2	OUT5	AF-08				TPDO2	INPUT5	AF-40		
			AF-09						AF-41		
		OUT6	AF-10					INPUT6	AF-42		
			AF-11						AF-43		
		OUT7	AF-12					INPUT7	AF-44		
			AF-13						AF-45		
		OUT8	AF-14					INPUT8	AF-46		
			AF-15						AF-47		
	RPDO3	OUT9	AF-16				TPDO3	INPUT9	AF-48		
			AF-17						AF-49		
		OUT10	AF-18					INPUT10	AF-50		
			AF-19						AF-51		
		OUT11	AF-20					INPUT11	AF-52		
			AF-21						AF-53		
		OUT12	AF-22					INPUT12	AF-54		
			AF-23						AF-55		
	RPDO4	OUT13	AF-24				TPDO4	INPUT13	AF-56		
			AF-25						AF-57		
		OUT14	AF-26					INPUT14	AF-58		
			AF-27						AF-59		
		OUT15	AF-28					INPUT15	AF-60		
			AF-29						AF-61		
		OUT16	AF-30					INPUT16	AF-62		
			AF-31						AF-63		

4) You can configure up to 32-byte RPDO and 32-byte TPDO process data. Each PDO can be configured with process data not exceeding 8 bytes in length.

5) The PDO can be configured with the AC drive parameter or the CANopenobject dictionary. The following figure shows the relationship.

Parameter (Take the drive parameter as an example)

Example: Assume that you want to set values to drive parameters F0-01 and F0-10 through the PLC. The value of F0-01 consists of 16 bits, and that of F0-10 consists of 16 bits.

You can select the configuration method based on the number of PDOs and data types as required, as described below.

Mode 1	Group AF Address			Value	
RPDO1	OUT1	AF-00	F0-01	20F0	1st displacement
		AF-01		0210	16-bit
	OUT2	AF-02	F0-10	20F0	1st speed
		AF-03		0B10	16-bit
	OUT3	AF-04			
		AF-05			
	OUT4	AF-06			
		AF-07			

Configuration rules (take F0-10 as an example)

(a) 20F00B10: Add F0 by 0x2000 to obtain 0x20F0. 20F0 will be filled in the high-order bits of OUT1 of AF-00.

(b) 20F00B10: 10 in F0-10 is in decimal, which is 0A in hexadecimal. An offset of 1 is required, and the final result is 0B.

(c) 20F00B10: The 32-bit parameter corresponds to 20, the 16-bit parameter corresponds to 10, and the 8-bit parameter corresponds to 08. The length of the AC drive parameter is 16 bits, corresponding to 10.

Object dictionary

You can also configure the CANopen object dictionary to the AC drive.

Example: Assume that you want to write 0x2073-12 to the AC drive through the PLC. The data type is 16 bits. No offset is required by object dictionaries. The following table lists the formats.

	Group AF Address		Value	Data length
RPDO1	OUT1	AF-00	2073	
		AF-01	1210	16-bit
	OUT2	AF-02		
		AF-03		
	OUT3	AF-04		
		AF-05		
	OUT4	AF-06		
		AF-07		

6) You can select RPDO1/TPDO1 (RPDO2/TPDO2, RPDO3/TPDO3, or RPDO4/TPDO4) to configure no more than four parameters with a total length of no more than 32 bytes. The number of mapping objects must be consistent.

7) After the configuration on the drive is complete, refer to "2 PLC Configuration" for PLC configuration. Configurations on both sides must match. Otherwise, E16.75

will be reported on the drive side.

Common fault

Fault Code	Fault Description and Solution
E16.71	The PROFINET device goes offline. Reconnect the network.
E16.72	A CANopen slave is disconnected. Check which slave is disconnected and ensure that the wiring is correct. Reconnect the network.
E16.74	The CANopen slave is not configured. Check whether the CANopen station number is correct and whether the device configured on the PLC is correct.
E16.75	Configurations of some process data of the CANopen slave do not match those on the PLC. Check the configuration of both the PLC and the drive. Ensure that the length of the data configured on the PLC and the drive is consistent.
E16.76	Configurations of the process data for the power supply unit do not match those on the PLC. Check the configuration of both the PLC and the drive. Ensure that the length of the data configured on the PLC and the drive is consistent.
E16.77	The PN function in the power supply unit is faulty. Set FD-10 to 5 and try to power on again.
E16.78	The PN function in the power supply unit is faulty. Set FD-10 to 5 and try to power on again.
A16.13	The communication between the slave and master is abnormal. Check whether the wiring is correct. Check whether the DIP switch of the MD810 power supply unit is correct and whether the termination resistor is connected to the drive unit at the rear end. (Reducing the baud rate can temporarily solve the problem. However, the termination resistor still needs to be installed.)

8. PLC configuration

On the PLC, you can install and configure the GSD file, and configure projects, networks, hardware, and monitoring.

■ Basic configurations

1) Hardware configuration: Inovance MD810 power supply unit (serves as the gateway, MD81020M4T22G120), Inovance IS810P-CO (IS810P50M4T005CO), and Siemens PN bus PLC

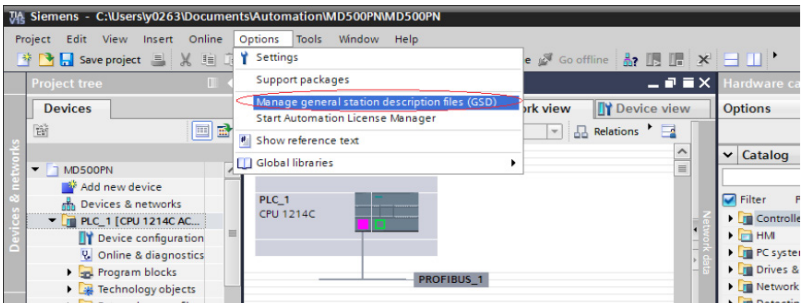
2) Software: Siemens TIA Portal V14, Inovance servo commissioning software (manual entering supported).

■ GSD file configuration

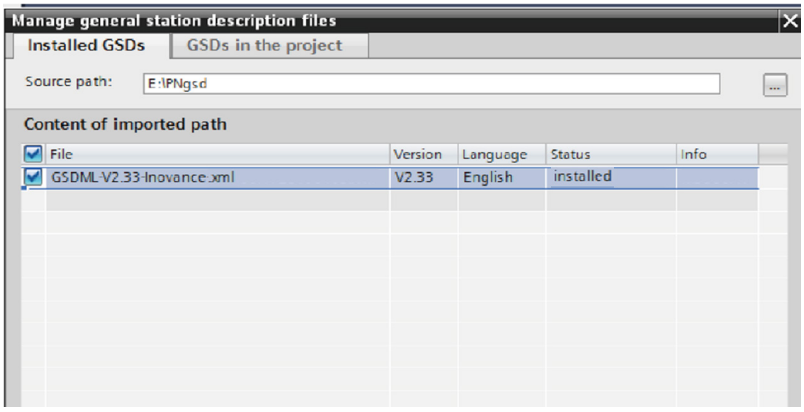
1) Open the Siemens TIA Portal. The section takes TIA Portal V14 as an example. Other versions of the TIA Portal can also be supported.

2) Create a project.

3) Install the GSD file



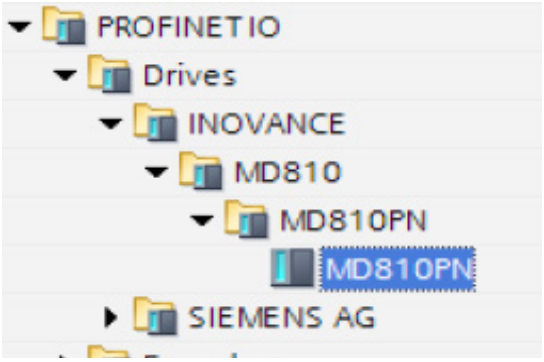
4) Select and install the matched GSD file. A prompt is displayed if the GSD file is not installed.



■ Project configuration

1) Add a new device. Add a PLC based on the actual situation.

2) Configure a slave. The following figure shows the master after a slave is added. Add the slave MD810PN on the right.



3) Configure the slave.

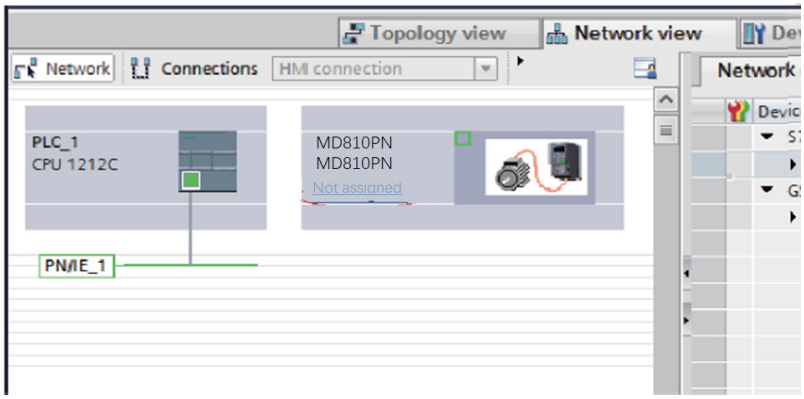
■ Network configuration

1) Add a subnet to the master.

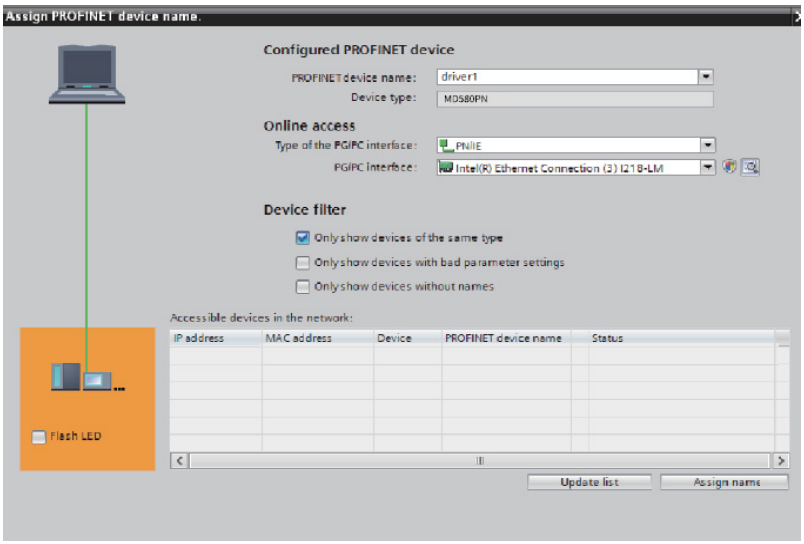
2) Allocate the slave to the subnet.

3) Select the subnet.

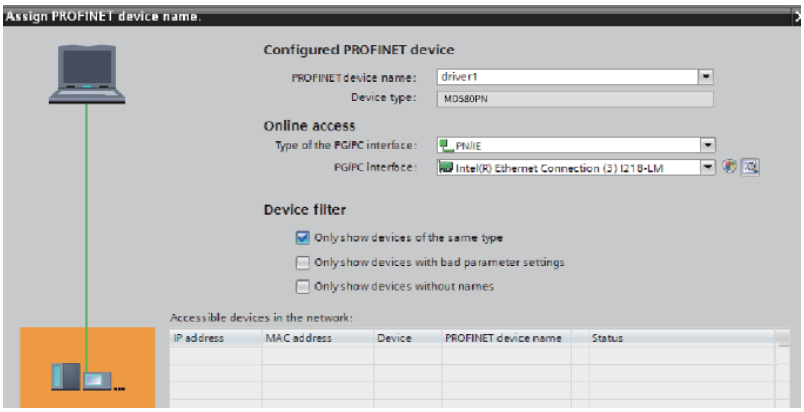
4) The following figure shows the added network. Click **PN/IE_1**, select **Assign device name**, and allocate a name to the slave.



5) Connect the device correctly, allocate a device interface, and click **Update list**.

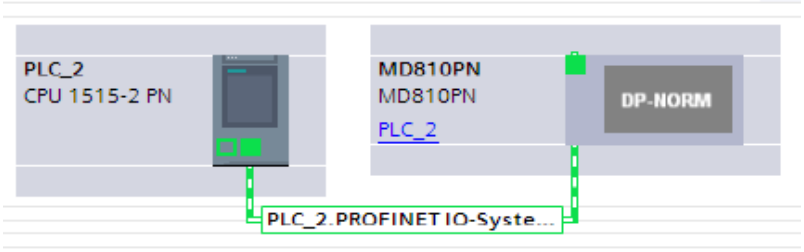


6) Allocate a name to the slave.



7) Select an interface.

8) The following figure shows the correct connection.



9) Switch to the online mode.

10) Select the device during initial connection.

■ Hardware configuration

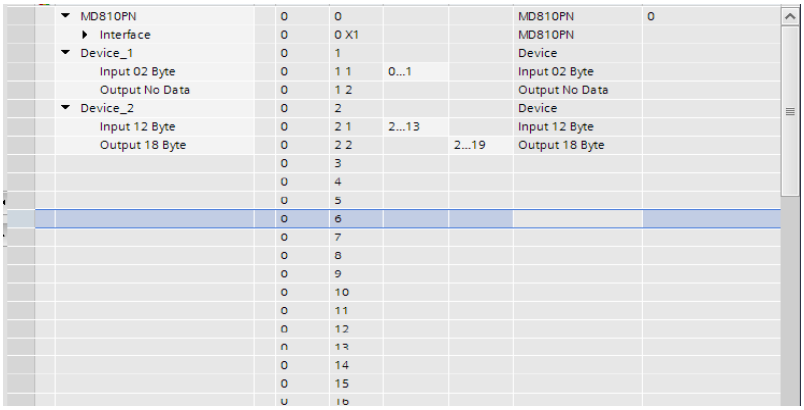
1) Double-click the added MD810 device configuration to perform hardware configuration on the MD810 power supply unit and the attached drive unit. Edit the configuration in the **Device overview** window.

2) Perform configuration based on the PDO settings of the MD810 power supply unit and the attached drive unit. You can only set the number of bytes on the PLC and ensure that the set number is consistent with the number of bytes occupied by the PDOs of the drive; otherwise, an alarm indicating hardware mismatch is generated and the drive generates the E16.75 alarm. For example, if the drive TPDO is configured with a 32-bit PDO and a 16-bit PDO, add 6-byte Input to the drive and add Output of the same number of bytes to RPDO.

Brief description:

In the following figure, Device_1 is the power supply unit configured with 2-byte Input data.

Device_2 is the drive unit configured with 12-byte input data and 18-byte output data.



3) Download the configuration to the PLC. After the hardware configuration in step 2 is modified, download the configuration to the PLC again. If only the hardware configuration is changed, you can download only the hardware configuration.

4) Click **Load** to download the configuration to the PLC. Then, the PLC stops running.

5) Click **Finish** after the download is complete. The PLC restarts.

■ Adding the online monitoring list

1) Add the monitoring list and add the variables to be monitored.

2) Switch to the online mode.

3) Click **Monitor all**.

4) Modify values.

The configuration of the drive must be consistent with that of the PLC; otherwise, an alarm will be generated.

Common fault

Fault Code	Fault Description and Solution
E16.71	The PROFINET device goes offline. Reconnect the network.
E16.72	A CANopen slave is disconnected. Check which slave is disconnected and ensure that the wiring is correct. Reconnect the network.
E16.74	The CANopen slave is not configured. Check whether the CANopen station number is correct and whether the device configured on the PLC is correct.
E16.75	Configurations of some process data of the CANopen slave do not match those on the PLC. Check the configuration of both the PLC and the drive. Ensure that the length of the data configured on the PLC and the drive is consistent.
E16.76	Configurations of the process data for the power supply unit do not match those on the PLC. Check the configuration of both the PLC and the drive. Ensure that the length of the data configured on the PLC and the drive is consistent.
E16.77	The PN function in the power supply unit is faulty. Set FD-10 to 5 and try to power on again.
E16.78	The PN function in the power supply unit is faulty. Set FD-10 to 5 and try to power on again.
A16.13	The communication between the slave and master is abnormal. Check whether the wiring is correct. Check whether the DIP switch of the MD810 power supply unit is correct and whether the termination resistor is connected to the drive unit at the rear end. (Reducing the baud rate can temporarily solve the problem. However, the termination resistor still needs to be installed.)

A.8 Communication Positioning

A.8.1 Communication Control

Set F0-02 to 2 to enable communication control. The communication addresses are described below.

1) Control word

Control word address 0x7311

Instruction	Definition
0	Stop based on the stop mode
1	Start positioning
3	Forward jog
4	Reverse jog
5	Coast to stop
6	Decelerate to stop
7	Fault reset

2) Control word for position control

Control word address 0x731E

Instruction	Definition
0	Position control invalid
1	Position control valid

3	Position control pause valid (B4-57 = 1)
5	Re-positioning valid (B4-59 = 1)

3) Communication parameter address

When B4-50 is set to 4 and B5-12 is set to 3, the communication position and speed reference addresses are as follows.

Speed Reference Address	Definition
0x7320	Positioning speed upper limit (r/min)
0x7321	Position reference (high-order 16 bits)
0x7322	Position reference (low-order 16 bits)
0x0800 (Write 0xF800 to EEPROM)	Jog frequency (0.01 Hz)

4) U2 parameter address for status reading

If forward jogging and reverse jogging are valid at the same time, the jogging command is canceled. Therefore, add a stop command (write 0 to 0x7311) during switchover between forward jogging and reverse jogging.

A.8.2 Other Parameter Addresses

Parameter Name	Parameter Address (Hexadecimal)	Parameter Address (Decimal)	Description
Frequency reference	0x7310	29456	Two decimal places. For example, if the decimal value 1000 is written, the frequency reference is 10.00 Hz. Note: Frequency reference and speed reference (0x7317) cannot be used at the same time.
Running state 1	0x703D	28733	1: Forward running 2: Reverse running 3: Stop 4: Motor auto-tuning 5: Faulty
Running state 2	0x7044	28740	
Output frequency	0x7000	28672	Two decimal places. For example, if the decimal value 1000 is read, the frequency is 10.00 Hz.
Encoder feedback frequency	0x701d	28701	Two decimal places. For example, if the decimal value 1000 is read, the frequency is 10.00 Hz. The parameter value is a signed number.
Speed reference	0x7317	29463	The unit is 1 rpm. Note: Speed reference and frequency reference (0x7310) cannot be used at the same time.
Output current	0x7004	28676	One decimal place. For example, if the decimal value 100 is read, the current is 10.0 A.
Output voltage	0x7003	28675	Zero decimal places. For example, if the decimal value 100 is read, the voltage is 100 V.
Bus voltage	0x7002	28674	One decimal place. For example, if the decimal value 5680 is read, the voltage is 568.0 V.
DI state	0x7007	28679	See the description below.
DO control	0x7312	29458	See the description below.
AO1	0x7313	29459	0 to 7FFF corresponds to 0% to 100%.

Parameter Name	Parameter Address (Hexadecimal)	Parameter Address (Decimal)	Description
Pulse output	0x7315	29461	0 to 7FFF indicate 0% to 100%. The maximum frequency is set by F5-09.

DI Status (0X7007)															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 10	Bit 09	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
0	0	0	0	0	0	0	0	0	0	0	DIO2	DIO1	DI3	DI2	DI1

If the hexadecimal value 0x0008 of the DI state is read, and it is converted into the binary value 0000_0000_0000_1001 (that is, DIO1), the DI1 input is valid.

DO Settings (0X7312)															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 10	Bit 09	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
0	0	0	0	0	0	0	0	0	0	0	FMR Control	Reserved	RELAY1 control	DIO2 Output control	DIO1 Output control

Running State 2 (0x7044)															
Bit 15	Bit 14	Bit 13	Bit 12	Bit 10	Bit 09	Bit 09	Bit 08	Bit 07	Bit 06	Bit 05	Bit 04	Bit 03	Bit 02	Bit 01	Bit 00
Fault Code								Reserved	Reserved	Reserved	Reserved	Frequency reached	Fault	Forward/ Reverse	Operation Status

Bit 00: 1: Running
0: Stop

Bit 01: Bit 01: 1: Reverse running; 0: Forward running

Bit 02: Bit 02: 1: Faulty; 0: Normal

Bit 03: Bit 03: 1: The output frequency reaches the set frequency; 0: The output frequency does not reach the set frequency.

Bit 04: Reserved bit. The read value is 1.

Appendix B Parameter List of the Drive Unit

If FP-00 is set to a non-zero value (password protection enabled), the parameter menu is accessible in parameter mode and user-modification mode only after the correct password is entered. To disable password protection, set FP-00 to 0.

If a password is set to lock the operating panel, password authentication is required every time you access the parameter menu for reading or writing parameter values using the operating panel. During communication control, the values of parameters (excluding parameters in groups FP and FF) can be read and written without password authentication.

The parameter menu in the user-defined parameter mode is not protected by password.

Groups F and A include standard function parameters. Group U includes the monitoring function parameters. The symbols in the parameter table are described as follows:

☆ : The parameter can be changed when the drive is in either stop or running state.

★ : The parameter cannot be changed when the drive is in the running state.

● : The parameter value is the actual measured value and cannot be changed.

*: The parameter is the "factory parameter" that can be set only by the manufacturer.

B.1 Parameter List of the Drive Unit (Non G53X Models)

Note

- This section applies only to drive units other than MD810-50M4TXXXG53X.

◆ Basic function parameters

Para. Code	Parameter Name	Value Range	Default	Change
Group F0: Basic Function Parameters				
F0-00	G/P type display	1: G type (constant torque load)	Model dependent	●
F0-01	Motor control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC) 2: Voltage/Frequency control (V/f control, unavailable for synchronous motor)	0	★
F0-02	Command source	0: External LCD operating panel/Software 1: Terminal 2: Communication	0	★

Para. Code	Parameter Name	Value Range	Default	Change
F0-03	Main frequency source	0: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, non-retentive upon power failure) 1: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, retentive upon power failure) 2: AI1 3: AI2 4: Reserved 5: Pulse reference (DIO1) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Synchronous control	0	★
F0-04	Auxiliary frequency Y source	Same as F0-03 (Main frequency reference source)	0	★
F0-05	Base value of range of auxiliary frequency source Y for superposition	0: Relative to the maximum frequency 1: Relative to main frequency X	0	☆
F0-06	Range of auxiliary frequency source Y for superposition	0% to 150%	100%	☆
F0-07	Frequency source superposition	Ones place: Frequency source selection 0: Main frequency source X 1: Main and auxiliary frequency operation result (based on tens place) 2: Switchover between main frequency X and auxiliary frequency Y 3: Switchover between main frequency X and the main and auxiliary frequency operation result 4: Switchover between auxiliary frequency Y and the main and auxiliary frequency operation result Tens place: Main and auxiliary frequency operation result 0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x auxiliary frequency	0	☆
F0-08	Preset frequency	0.00 Hz to maximum frequency (F0-10)	50.00 Hz	☆
F0-09	Running direction	0: Run in the same direction 1: Run in the opposite direction	0	☆
F0-10	Maximum frequency	5.00 Hz to 600.00 Hz	50.00 Hz	★
F0-11	Frequency upper limit source	0: F0-12 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication 6: Multi-reference	0	★
F0-12	Frequency upper limit	F0-14 (frequency lower limit) to F0-10 (maximum frequency)	50.00 Hz	☆
F0-13	Frequency upper limit offset	0.00 Hz to F0-10 (maximum frequency)	0.00 Hz	☆
F0-14	Frequency lower limit	0.00 Hz to F0-12 (frequency upper limit)	0.00 Hz	☆
F0-15	Carrier frequency	0.8 kHz to 6.0 kHz	Model dependent	☆
F0-16	Carrier frequency change with temperature	0: Disable 1: Enable	1	☆
F0-17	Acceleration time 1	0.00s to 65000s	20.0s	☆
F0-18	Deceleration time 1	0.00s to 65000s	20.0s	☆
F0-19	Acceleration/Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s		★

Para. Code	Parameter Name	Value Range	Default	Change
F0-21	Auxiliary frequency offset upon superposition	0.00 Hz to F0-10 (maximum frequency)	0.00 Hz	☆
F0-22	Frequency reference resolution	1: 0.1 Hz 2: 0.01 Hz	2	★
F0-23	Retention of digit-set frequency upon stop	0: Non-retentive 1: Retentive	0	☆
F0-25	Base frequency for acceleration/ deceleration time	0: Maximum frequency (F0-10) 1: Frequency reference 2: 100 Hz	0	★
F0-26	Base value for frequency adjusted by UP/DOWN key during operation	0: Operating frequency 1: Frequency reference	0	★
F0-27	Main frequency coefficient	0.00% to 100.00%	10.00%	☆
F0-28	Auxiliary frequency coefficient	0.00% to 100.00%	10.00%	☆
F1: Motor 1 Parameters				
F1-00	Motor type	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Synchronous motor	0	★
F1-01	Rated motor power	0.1 kW to 1000.0 kW	Model dependent	★
F1-02	Rated motor voltage	1 V to 2000 V	Model dependent	★
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)	Model dependent	★
F1-04	Rated motor frequency	0.01 Hz to F0-10 (maximum frequency)	Model dependent	★
F1-05	Rated motor speed	1 rpm to 65535 rpm	Model dependent	★
F1-06	Stator resistance of asynchronous/ synchronous motor	0.001 Ω to 65.535 Ω (AC drive power ⩽ 55 kW) 0.0001 Ω to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-07	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω (AC drive power ⩽ 55 kW) 0.0001 Ω to 6.5535 Ω (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-08	Leakage inductive reactance of asynchronous motor	0.01 mH to 655.35 mH (AC drive power ⩽ 55 kW) 0.001 mH to 65.535 mH (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-09	Mutual inductive reactance of asynchronous motor	0.1 mH to 6553.5 mH (AC drive power ⩽ 55 kW) 0.01 mH to 655.35 mH (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-10	No-load current of asynchronous motor	0.01 A to F1-03 (AC drive power ⩽ 55 kW) 0.1 A to F1-03 (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-11	Core saturation coefficient 1 of asynchronous motor	50.0% to 100.0%	86.0%	☆
F1-12	Core saturation coefficient 2 of asynchronous motor	100.0% to 150.0%	130.0%	☆
F1-13	Core saturation coefficient 3 of asynchronous motor	100.0% to 170.0%	140.0%	☆
F1-14	Core saturation coefficient 4 of asynchronous motor	100.0% to 180.0%	150.0%	☆
F1-17	Axis D inductance of synchronous motor	0.01 mH to 655.35 mH (AC drive power > 55 kW) 0.001 to 65.535 mH (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-18	Axis Q inductance of synchronous motor	0.01 mH to 655.35 mH (AC drive power > 55 kW) 0.001 to 65.535 mH (AC drive power > 55 kW)	Auto-tuning parameter	★
F1-19	Back EMF of synchronous motor	0.1 V to 6553.5 V	Auto-tuning parameter	★
F1-23	Friction torque percentage	0.00% to 100.00%	0.00%	★
F1-24	Number of motor pole pairs	0 ms to 65535 ms	0	☆
F1-25	Encoder power supply selection	0: 15 V power supply 1: 5 V power supply Note: This parameter applies only to dual-axis models.	1	★

Para. Code	Parameter Name	Value Range	Default	Change
F1-26	Auto-tuning direction (inertia auto-tuning and synchronous motor)	0 to 1	1	★
F1-27	Encoder PPR	1 to 20000	1024	★
F1-28	Encoder type	0: ABZ incremental encoder 1: 23-bit encoder 2: Resolver	0	★
F1-29	PG signal filter	0: Non-adaptive filter 1: Adaptive filter 2: Fixed interlock 3: Auto interlock	1	★
F1-30	A/B phase sequence of the ABZ incremental encoder	0: Forward 1: Reverse	0	★
F1-31	Encoder zero position angle	0.0° to 359.9°	0.0°	★
F1-32	Numerator of motor gear ratio	1 to 65535	1	★
F1-33	Denominator of motor gear ratio	1 to 65535	1	★
F1-34	Number of resolver pole pairs	1 to 32	1	★
F1-35	Frequency-division coefficient of resolver	0 to 63	1	☆
F1-36	PG disconnection detection	0: Enable 1: Disable	0	★
F1-37	Auto-tuning selection	0: No operation 1: Static auto-tuning of asynchronous motor 2: No-load complete auto-tuning of asynchronous motor 3: Static complete auto-tuning of asynchronous motor 4: Inertia auto-tuning of asynchronous motor (only in FVC mode) 11: No-load partial auto-tuning of synchronous motor (excluding back EMF) 12: Dynamic no-load auto-tuning of synchronous motor 13: Complete static auto-tuning of synchronous motor 14: Inertia auto-tuning of synchronous motor (only in FVC mode)	0	★
Group F2: Motor 1 Vector Control Parameters				
F2-00	Low-speed speed loop Kp	1 to 200	30: Asynch-ronous motor 20: Synch-ronous motor	☆
F2-01	Low-speed speed loop Ti	0.001s to 10.000s	0.500s	☆
F2-02	Switchover frequency 1	0.00 to F2-05	5.00 Hz	☆
F2-03	High-speed speed loop Kp	1 to 200	20	☆
F2-04	High-speed speed loop Ti	0.001s to 10.000s	1.000s	☆
F2-05	Switchover frequency 2	F2-02 to the maximum frequency	10.00 Hz	☆
F2-06	VC slip compensation adjustment	50% to 200%	100%	☆
F2-07	Speed feedback filter time	0.000s to 0.100s	0.004s	☆
F2-08	VC deceleration over-excitation gain	0 to 200	64	☆

Para. Code	Parameter Name	Value Range	Default	Change
F2-09	Torque upper limit source in speed control (motoring)	0: F2-10 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) The full range of options 1 to 7 is the value of F2-10.	0	☆
F2-10	Digital setting of torque upper limit in speed control (motoring)	0.0% to 200.0%	150.0%	☆
F2-11	Torque upper limit source in speed control (generating)	0: F2-10 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) 8: F2-12	0	☆
F2-12	Digital setting of torque upper limit in speed control (generating)	0.0% to 200.0%	150.0%	☆
F2-13	Current loop Kp adjustment at low speed	0.1 to 10.0	1.0	☆
F2-14	Current loop Ki adjustment at low speed	0.1 to 10.0	1.0	☆
F2-15	Current loop Kp adjustment at high speed	0.1 to 10.0	1.0	☆
F2-16	Current loop Ki adjustment at high speed	0.1 to 10.0	1.0	☆
F2-17	Speed loop Kp upon zero speed lock	1 to 100	30	☆
F2-18	Speed loop Ti upon zero speed lock	0.001 to 10.000	0.500s	☆
F2-20	Speed loop switching frequency upon zero speed lock	0.00 to F2-02	0.05 Hz	☆
F2-21	Maximum output voltage coefficient	100 to 110	100	☆
F2-22	Output voltage filter time	0.000s to 0.010s	0.000s	☆
F2-23	Zero speed lock	0: Enable 1: Disable	0	★
F2-24	Vector overvoltage stall suppression Kp	0 to 1000	40	☆
F2-25	Acceleration compensation gain	0 to 200	0	☆
F2-26	Acceleration compensation filter	0 to 500	10	☆
F2-27	Vector overvoltage stall suppression	0: Enable 1: Disable	1	☆
F2-28	Cut-off frequency for torque reference filter	50 Hz to 1000 Hz	500 Hz	☆
F2-29	Detected current at initial position angle of synchronous motor	50% to 180%	80%	☆
F2-30	Auto-calculation of speed loop parameters	0: Enable 1: Disable	0	★
F2-31	Expected speed loop bandwidth (high speed)	1.0-200.0 Hz	10.0 Hz	☆
F2-32	Expected speed loop bandwidth (low speed)	1.0-200.0 Hz	10.0 Hz	☆
F2-33	Expected speed loop bandwidth (zero speed)	1.0-200.0 Hz	10.0 Hz	☆

Para. Code	Parameter Name	Value Range	Default	Change
F2-34	Expected speed loop damping ratio	0.100 to 65.000	1.000	☆
F2-35	System inertia (equivalent to start time, in the unit of seconds)	0.001s to 50.000s	Model dependent	★
F2-36	Single motor inertia (kg*m^2)	0.001 to 50.000	Model dependent	★
F2-43	Inertia auto-tuning and dynamic speed reference (unit: %; base value: rated motor frequency)	0% to 100%	30%	★
F2-47	Inertia auto-tuning	0: Enable 1: Disable	0	★
F2-48	Speed loop bandwidth reference in inertia auto-tuning (unit: Hz)	0.1-100.0 Hz	10.0 Hz	★
F2-50	Inertia auto-tuning mode	0: Acceleration/deceleration mode 1: Triangular wave mode	0	★
F2-51	Inertia auto-tuning acceleration/ deceleration coefficient (unit: 0.1)	0.1 to 10.0	1.0	★
F2-52	Decoupling control	0 to 1	0	★
F2-53	Generating power limit	0: Enable 1: Disable	0	★
F2-54	Generating power limit threshold	0.0% to 200.0%	Model dependent	★
Group F3: V/f Control Parameters				
F3-00	V/f curve	0: Linear V/f 1: Multi-point V/f 2: Square V/f 3: V/f (1.2th power) 4: V/f (1.4th power) 6: V/f (1.6th power) 8: V/f (1.8th power) 9: Reserved 10: V/f complete separation 11: V/f half separation	0	★
F3-01	Torque boost	0.0%: Automatic torque boost 0.1% to 30.0%	Model dependent	☆
F3-02	Cut-off frequency of torque boost	0.00 Hz to maximum frequency	50.00 Hz	★
F3-03	Multi-point V/f frequency 1	0.00 Hz to F3-05	0.00 Hz	★
F3-04	Multi-point V/f voltage 1	0.0% to 100.0%	0.0%	★
F3-05	Multi-point V/f frequency 2	F3-03 to F3-07	0.00 Hz	★
F3-06	Multi-point V/f voltage 2	0.0% to 100.0%	0.0%	★
F3-07	Multi-point V/f frequency 3	F3-05 to rated motor frequency (F1-04)	0.00 Hz	★
F3-08	Multi-point V/f voltage 3	0.0% to 100.0%	0.0%	★
F3-09	V/f slip compensation gain	0.0% to 200.0%	0.0%	☆
F3-10	V/f over-excitation gain	0 to 200	64	☆
F3-11	V/f oscillation suppression gain	0 to 100	Model dependent	☆
F3-12	Oscillation suppression gain mode	0: Invalid 3: Valid	3	★
F3-13	Voltage source for V/f separation	0: F3-14 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Multi-reference	0	☆
F3-14	Voltage digital setting for V/f separation	0 V to rated motor voltage	0 V	☆

Para. Code	Parameter Name	Value Range	Default	Change
F3-15	Voltage rise time of V/f separation	0.0s to 1000.0s Note: This parameter indicates the time that the voltage increases from 0 V to the rated motor voltage.	0.0s	☆
F3-16	Voltage decline time of V/f separation	0.0 to 1000.0 Note: This parameter indicates the time that the voltage decreases from the rated motor voltage to 0 V.	0.0s	☆
F3-17	Stop mode selection in V/f control mode	0: The frequency and voltage decline to 0 separately. 1: The frequency declines after the voltage declines to 0.	0	★
F3-18	Action current for V/f overcurrent stall	50% to 200%	150%	★
F3-19	V/f overcurrent stall selection	0: Disable 1: Enable	1	★
F3-20	V/f overcurrent stall suppression gain	0 to 100	20	☆
F3-21	Action current compensation coefficient for V/f overcurrent stall at multiplied rated frequency	50 to 200	50	★
F3-22	Action voltage for V/f overvoltage stall	650.0 V to 800.0 V	770.0 V	★
F3-23	V/f overvoltage stall selection	0: Enable 1: Disable	1	★
F3-24	Frequency gain for V/f overvoltage stall suppression	0 to 100	30	☆
F3-25	Voltage gain for V/f overvoltage stall suppression	0 to 100	30	☆
F3-26	Frequency rise threshold for overvoltage stall suppression	0 to 50	5	★
F3-27	Slip compensation time constant	0.1 to 10.0	0.5	☆
F3-28	Automatic frequency rise	0: Enable 1: Disable	0	★
F3-29	Minimum motoring torque current	10 to 100	50	★
F3-30	Maximum generating torque current	10 to 100	20	★
F3-31	Automatic frequency rise Kp	0 to 100	50	☆
F3-32	Automatic frequency rise Ki	0 to 100	50	☆
F3-33	Online torque compensation gain	80 to 150	100	★
Group F4 Input Terminals				

Para. Code	Parameter Name	Value Range		Default	Change
F4-00	DI1 function selection	0: No function 1: Forward running (FWD) 2: Reverse running (REV) 3: Three-wire motion control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Function as the UP key 7: Function as the DOWN key 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 time selection 17: Terminal 2 for acceleration/deceleration time selection 18: Frequency source switchover 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Running command switchover terminal 21: Acceleration/Deceleration prohibited 22: PID pause 23: PLC status reset 24: Wobble pause 25: Counter input (DIO1) 26: Counter reset 27: Length count input (DIO1) 28: Length reset 29: Torque control inhibition 30: Reserved	31: Reserved 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enabling 35: Opposite to the PID action direction 36: Reserved 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: Reserved 42: Position lock 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control switchover 47: Emergency stop 48: External stop terminal 2 49: Deceleration DC braking 50: Clear the current running time 51: Switchover between two-wire mode and three-wire mode 52-53: Reserved 54: Roll diameter reset 55 and 56: Initial roll diameter 57: Pre-driving 58: Switchover between winding and unwinding 59: Roll diameter calculation stop 60: Exit tension mode 61: Speed limit direction 62: Revolution count reset	1	★
F4-01	DI2 function selection			4	★
F4-02	Reserved			-	-
F4-03	DIO1 function selection			12	★
F4-04	DIO2 function selection			13	★
F4-10	DI filter time	0.000s to 1.000s		0.010s	☆
F4-11	Terminal command mode	0: Two-wire mode 1 1: Two-wire mode 2 2: Three-wire mode 1 3: Three-wire mode 2		0	★
F4-12	Step value of the terminal functioning as UP/DOWN keys	0.001 Hz/s to 65.535 Hz/s		1.000 Hz/s	☆
F4-13	Minimum input of AI curve 1	-10.00 V to F4-15		-10.00 V	☆
F4-14	Percentage corresponding to minimum input of AI curve 1	-100.0% to +100.0%		-100.0%	☆
F4-15	Maximum input of AI curve 1	F4-13 to +10.00 V		10.00 V	☆
F4-16	Percentage corresponding to maximum input of AI curve 1	-100.0% to +100.0%		100.0%	☆
F4-17	AI1 filter time	0.00 to 10.00		0.10s	☆
F4-18	Minimum input of AI curve 2	0.00 V to F4-20		0.00 V	☆
F4-19	Percentage corresponding to minimum input of AI curve 2	-100.0% to +100.0%		0.0%	☆
F4-20	Maximum input of AI curve 2	F4-18 to +10.00 V		10.00 V	☆

Para. Code	Parameter Name	Value Range	Default	Change
F4-21	Percentage corresponding to maximum input of AI curve 2	-100.0% to +100.0%	100.0%	☆
F4-22	AI2 filter time	0.00 to 10.00	0.10s	☆
F4-23	Minimum input of AI curve 3	0.00 V to F4-25	0.00 V	☆
F4-24	Percentage corresponding to minimum input of AI curve 3	-100.0% to +100.0%	0.0%	☆
F4-25	Maximum input of AI curve 3	F4-23 to +10.00 V	10.00 V	☆
F4-26	Percentage corresponding to maximum input of AI curve 3	-100.0% to +100.0%	100.0%	☆
F4-28	Pulse minimum input	0.00 kHz to F4-30	0.00 kHz	☆
F4-29	Percentage corresponding to pulse minimum input	-100.0% to 100.0%	0.0%	☆
F4-30	Pulse maximum input	F4-28 to 100.00 kHz	50.00 kHz	☆
F4-31	Percentage corresponding to pulse maximum input	-100.0% to 100.0%	100.0%	☆
F4-32	Pulse filter time	0.00s to 10.00s	0.10s	☆
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 (same as AI1 curve) Hundreds place: Reserved	321	☆
F4-34	Selection when AI value < minimum input value	Ones place: Selection when AI1 value < minimum input value 0: Corresponding to the minimum input 1: 0.0% Tens place: Selection when AI2 value < minimum input; same as the ones place Hundreds place: Reserved	0	☆
F4-35	DI rising edge delay	0.0s to 3600.0s	0.0s	☆
F4-36	DI falling edge delay	0.0s to 3600.0s	0.0s	☆
F4-37	Reserved	-	-	-
F4-38	DI active mode selection 1	0: Active high 1: Active low Ones place: DI1 Tens place: DI2 Hundreds place: Reserved Thousands: DIO1 Ten thousands: DIO2	0	★
F4-40	AI2 input type	0: Voltage input 1: Current input (input impedance 500 Ω)	0	★
F4-41	DIO type	Ones place: DIO1 type 0: DI/PulseIn 1: DO Tens place: DIO2 type 0: DI 1: DO/FMP	00	★
Group F5: Output Terminals				
F5-00	DIO2 output mode	0: Pulse output (FMP) 1: Digital output (FMR)	0	☆

Para. Code	Parameter Name	Value Range		Default	Change
F5-01	FMR output function selection	0: No output 1: Drive running 2: Fault output 1 (immediate output in coast to stop mode, output after stop in decelerate to stop mode) 3: Frequency-level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: Drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: PLC cycle completed 12: Cumulative running time reach 13: Frequency limited 14: Torque limited 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (related to operation) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (output at stop)	24: Cumulative power-on time reach 25: Frequency-level detection FDT2 output 26: 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: Drive output load lost 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: Abnormality output (direct output upon fault or warning) 39: Motor overheat warning 40: Current running time reached 41: Fault output 2 (having output after AC drive stops due to the coast to stop fault and decelerate to stop fault; no output at undervoltage) 43: Position lock enabled (deviation pulses < F6-25)	0	☆
F5-02	Relay function selection			2	☆
F5-04	DIO1 output function selection			0	☆
F5-06	FMR output function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque (100.0% corresponds to twice the rated motor torque) 4: Output power 5: Output voltage (100.0% corresponds to 1.2 times the rated drive voltage) 6: Pulse input (100.0% corresponds to 50.0 kHz) 7: AI1 8: AI2 9: Reserved 10: Length 11: Counting value 12: Communication 13: Motor speed 14: Output current (100.0% corresponds to 1000.0 A) 15: Bus voltage 16: Output torque (directional; 100.0% corresponds to twice the rated motor torque) 19: Taper output		0	☆
F5-07	AO output function selection			0	☆
F5-09	Maximum frequency of FMP output	0.01 kHz to 100.00 kHz		50.00 kHz	☆
F5-10	AO zero offset coefficient	-100.0% to +100.0%		0.0%	☆
F5-11	AO gain	-10.00 to +10.00		1.00	☆
F5-17	FMR output delay	0.0s to 3600.0s		0.0s	☆
F5-18	Relay output delay	0.0s to 3600.0s		0.0s	☆
F5-20	DIO1 output delay	0.0s to 3600.0s		0.0s	☆

Para. Code	Parameter Name	Value Range	Default	Change
F5-22	DO valid status selection	0: Positive logic 1: Negative logic Ones place: FMR (DIO2) Tens place: RELAY1 Hundreds place: Reserved Thousands place: DIO1 Ten thousands place: Reserved	0	☆
F5-23	AO mode	0: Voltage output 1: Current output	0	★
Group F6 Start/Stop Control Parameters				
F6-00	Start mode	0: Direct start 1: Flying start (asynchronous AC motor) 2: Pre-excitation startup (asynchronous AC motor)	0	☆
F6-01	Frequency for flying start mode	0: From frequency at stop 1: From 50 Hz 2: From the maximum frequency	0	★
F6-02	Flying start speed	1 to 100	20	☆
F6-03	Start frequency	0.00 Hz to 10.00 Hz	0.00 Hz	☆
F6-04	Start frequency holding time	0.0s to 100.0s	0.0s	★
F6-05	DC braking current upon start	0% to 100%	0%	★
F6-06	Start DC braking time/Pre-excitation time	0.0s to 100.0s	0.0s	★
F6-07	Acceleration/Deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	★
F6-08	Time proportion of S-curve start segment	0.0% to (100.0% - F6-09)	30.0%	★
F6-09	Time proportion of S-curve end segment	0.0% to (100.0% - F6-09)	30.0%	★
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	0	☆
F6-11	DC braking/Position lock start frequency upon stop	0.00 Hz to maximum frequency	0.00 Hz	☆
F6-12	Waiting time of DC braking for stop	0.0s to 100.0s	0.0s	☆
F6-13	DC braking current for stop	0% to 100%	0%	☆
F6-14	DC braking time for stop	0.0s to 100.0s	0.0s	☆
F6-15	Braking usage rate	0% to 100%	100%	★
F6-16	Closed-loop current Kp of flying start	0 to 1000	500	☆
F6-17	Closed-loop current Ki of flying start	0 to 1000	800	☆
F6-18	Current of flying start	30 to 200	100	☆
F6-20	Voltage rise time of flying start	0.5s to 3.0s	1.0s	☆
F6-21	Demagnetization time	00.00s to 10.00s	1.00s	☆
F6-22	Start pre-torque setting	000.0% to 200.0%	0.0%	☆
F6-23	Operation command from power supply unit	0: Stop according to the value of F6-10 1: Ignore stop command from the power supply unit	0	★
F6-24	Position lock Kp	0.0 to 100.0	10.0	☆
F6-25	Position lock end amplitude	0 to 16383	10	☆
Group F7: Operating Panel and Display				

Para. Code	Parameter Name	Value Range	Default	Change
F7-03	Parameter 1 displayed on LED operating panel during operation	0000 to FFFF Bit 00: Running frequency 1 (Hz) Bit 01: Frequency reference (Hz) Bit 02: Bus voltage (V) Bit 03: Output voltage (V) Bit 04: Output Current (A) Bit 05: Output power (kW) Bit 06: Output torque (%) Bit 07: DI input state Bit 08: DO output state Bit 09: AI1 voltage (V) Bit 10: AI2 voltage (V) Bit 11: Reserved Bit 12: Counting value Bit 13: Length value Bit 14: Load speed display Bit 15: PID reference	1F	☆
F7-04	Parameter 2 displayed on LED operating panel during operation	0000 to FFFF Bit 00: PID feedback Bit 01: PLC stage Bit 02: Pulse reference frequency (kHz) Bit 03: Running frequency 2 (Hz) Bit 04: Remaining running time Bit 05: AI1 voltage before correction (V) Bit 06: AI2 voltage before correction (V) Bit 07: Reserved Bit 08: Linear speed Bit 09: Current power-on time (hour) Bit 10: Current running time (min) Bit 11: Input pulse frequency (Hz) Bit 12: Communication setting value Bit 13: Encoder feedback speed (Hz) Bit 14: Main frequency display (Hz) Bit 15: Auxiliary frequency display (Hz)	0	☆
F7-05	Parameter displayed on the LED operating panel upon stop	0000 to FFFF Bit 00: Frequency reference (Hz) Bit 01: Bus voltage (V) Bit 02 DI input state Bit 3: DO output state Bit 04: AI1 voltage (V) Bit 05: AI2 voltage (V) Bit 06: Reserved Bit 07: Counting value Bit 08: Length value Bit 09: PLC stage Bit 10: Load speed Bit 11: PID reference Bit 12: Input pulse frequency (kHz)	33	☆
F7-06	Load speed display coefficient	0.0001 to 6.5000	1	☆
F7-07	Drive unit heatsink temperature	0.0° C to 100.0° C	-	●
F7-08	Product code	810	-	●
F7-09	Cumulative running time	0h to 65535h	-	●
F7-10	Performance software version	-	-	●
F7-11	Function software version	-	-	●

Para. Code	Parameter Name	Value Range	Default	Change
F7-12	Number of decimal places for load speed display	0: 0 decimal place 1: 1 decimal places 2: 2 decimal places 3: 3 decimal places	1	☆
F7-13	Cumulative power-on time	0 h to 65535 h	-	●
F7-14	Cumulative power consumption	0° to 65535°	-	●
Group F8: Auxiliary Functions				
F8-00	Jog frequency	0.00 Hz to maximum frequency	2.00 Hz	☆
F8-01	Acceleration time of jogging	0.0s to 6500.0s	20.0s	☆
F8-02	Deceleration time of jogging	0.0s to 6500.0s	20.0s	☆
F8-03	Acceleration time 2	0.0s to 6500.0s	Model dependent	☆
F8-04	Deceleration time 2	0.0s to 6500.0s	Model dependent	☆
F8-05	Acceleration time 3	0.0s to 6500.0s	Model dependent	☆
F8-06	Deceleration time 3	0.0s to 6500.0s	Model dependent	☆
F8-07	Acceleration time 4	0.0s to 6500.0s	Model dependent	☆
F8-08	Deceleration time 4	0.0s to 6500.0s	Model dependent	☆
F8-09	Jump frequency 1	0.00 Hz to maximum frequency	0.00 Hz	☆
F8-10	Jump frequency 2	0.00 Hz to maximum frequency	0.00 Hz	☆
F8-11	Jump frequency amplitude	0.00 Hz to maximum frequency	0.00 Hz	☆
F8-12	Dead zone time of forward/reverse run switchover	0.0s to 3000.0s	0.0s	☆
F8-13	Reverse running control	0: Enable 1: Disable	0	☆
F8-14	Running mode when set frequency < frequency lower limit	0: Run at frequency lower limit 1: Stop 2: Run at zero speed	0	☆
F8-16	Cumulative power-on time threshold	0 h to 65000 h	0h	☆
F8-17	Cumulative running time threshold	0 h to 65000 h	0h	☆
F8-18	Startup protection	0: Disable 1: Enable	0	☆
F8-19	Detection frequency (FDT1)	0.00 Hz to maximum frequency	50.00 Hz	☆
F8-20	Frequency detection hysteresis value (FDT1)	0.0% to 100.0% (FDT1 level)	5.0%	☆
F8-21	Detection frequency amplitude	0.0% to 100.0% (maximum frequency)	0.0%	☆
F8-22	Jump frequency state during acceleration/deceleration	0: Invalid 1: Valid	0	☆
F8-25	Frequency for acceleration time 1 and acceleration time 2 switchover	0.00 Hz to maximum frequency	0.00 Hz	☆
F8-26	Frequency for deceleration time 1 and deceleration time 2 switchover	0.00 Hz to maximum frequency	0.00 Hz	☆
F8-27	Jog preference	0: Invalid 1: Valid	0	☆
F8-28	Frequency detection value (FDT2)	0.00 Hz to maximum frequency	50.00 Hz	☆
F8-29	Frequency detection hysteresis (FDT2)	0.0% to 100.0% (FDT2 level)	5.0%	☆
F8-30	Detection frequency 1	0.00 Hz to maximum frequency	50.00 Hz	☆
F8-31	Detection frequency amplitude 1	0.0% to 100.0% (maximum frequency)	0.0%	☆
F8-32	Detection frequency 2	0.00 Hz to maximum frequency	50.00 Hz	☆

Para. Code	Parameter Name	Value Range	Default	Change
F8-33	Detection frequency amplitude 2	0.0% to 100.0% (maximum frequency)	0.0%	☆
F8-34	Zero current detection level	0.0% to 300.0% The value 100.0% corresponds to the rated motor current.	5.0%	☆
F8-35	Zero current detection delay	0.01s to 600.00s	0.10s	☆
F8-36	Output current overlimit threshold	0.0% (no detection) 0.1% to 300.0% (rated motor current)	200.0%	☆
F8-37	Output current overlimit detection delay	0.00s to 600.00s	0.00s	☆
F8-38	Detection current 1	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-39	Detection current amplitude 1	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-40	Detection current 2	0.0% to 300.0% (rated motor current)	100.0%	☆
F8-41	Detection current amplitude 2	0.0% to 300.0% (rated motor current)	0.0%	☆
F8-42	Timing function	0: Disable 1: Enable	0	★
F8-43	Timing operation time setting source	0: F8-44 1: AI1 2: AI2 The analog input range corresponds to the value of F8-44.	0	★
F8-44	Timing operation duration	0.0 min to 6500.0 min	0.0 min	★
F8-45	Lower limit of AI1 input voltage protection value	0.00 V to F8-46	3.10 V	☆
F8-46	Upper limit of AI1 input voltage protection value	F8-45 to 11.00 V	6.80 V	☆
F8-47	Module temperature reach	0° C to 100° C	75° C	☆
F8-48	Cooling fan control	0: The cooling fan works when the drive is running. 1: The cooling fan works always.	0	☆
F8-49	Wakeup frequency	F8-51 (Hibernation frequency) to F0-10 (Maximum frequency)	0.00 Hz	☆
F8-50	Wakeup delay	0.0s to 6500.0s	0.0s	☆
F8-51	Hibernation frequency	0.00 Hz to wakeup frequency (F8-49)	0.00 Hz	☆
F8-52	Hibernation delay	0.0s to 6500.0s	0.0s	☆
F8-53	Current running duration threshold	0.0 min to 6500.0 min	0.0 min	☆
F8-54	STO alarm status	0: STO alarm invalid 1: STO alarm valid	0	☆
F8-55	Deceleration time for emergency stop	0.0s to 6500.0s	0.0	☆
F8-56	Jog enabling on the LED keypad	0	0	☆
Group F9: Fault and Protection				
F9-00	AC drive overload suppression	0 to 1	0	☆
F9-01	Motor overload protection gain	0.20 to 10.00	1.00	☆
F9-02	Motor overload warning coefficient	50% to 100%	80%	☆
F9-04	Reserved	50% to 100%	100%	☆
F9-06	Output phase loss detection before startup	0: Invalid 1: Valid	0	☆
F9-07	Detection of software short circuit to ground	0: No detection 1: Detection before power-on 2: Detection before running 3: Detection before power-on and running	1	★
F9-08	Braking unit action start voltage	0 V to 800 V	780 V	●
F9-09	Number of automatic reset times upon fault	0 to 20	0	☆
F9-10	DO action during automatic reset upon fault	0: The DO does not act 1: The DO acts.	0	☆

Para. Code	Parameter Name	Value Range		Default	Change
F9-11	Time for automatic reset upon fault	0.1s to 100.0s		1.0s	☆
F9-14	Type of the 1st fault	0: No fault 1: Hardware fault 2: Overcurrent during acceleration 3: Overcurrent during deceleration 4: Overcurrent during operation at constant speed 5: Overvoltage during acceleration 6: Overvoltage during deceleration 7: Overvoltage during operation at constant speed 9: Undervoltage 10: Drive overload 11: Motor overload 12: Reserved 13: Output phase loss 14: Module overheating 15: External fault 16: Communication exception 17: Reserved 18: Reserved	19: Motor auto-tuning fault 20: Encoder/PG card error 21: EEPROM read/write fault 22: Abnormal motor auto-tuning result 23. Motor short circuited to ground 24: Inter-phase short circuit 25: Power supply unit fault 26: Running time reach 27: User-defined fault 1 28: User-defined fault 2 29: Power-on time reach 30: Output load loss 31: PID feedback loss during running 42: Excessive speed deviation 43: Motor overspeed 45: Motor over-temperature 80: Fan fault		●
F9-15	Type of the 2nd fault				●
F9-16	Type of the 3rd (latest) fault				●
F9-17	Frequency upon the 3rd (latest) fault	0.00 Hz to 655.35 Hz		0.00 Hz	●
F9-18	Current upon the 3rd (latest) fault	0.00 A to 655.35 A		0.00 A	●
F9-19	Bus voltage upon the 3rd (latest) fault	0.0 V to 6553.5 V		0.0 V	●
F9-20	DI state upon the 3rd (latest) fault	0 to 9999		0	●
F9-21	DO state upon the 3rd (latest) fault	0 to 9999		0	●
F9-22	AC drive status upon the 3rd fault (latest)	0 to 65535		0	●
F9-23	Power-on time upon the 3rd (latest) fault	0s to 65535s		0s	●
F9-24	Running time upon the 3rd (latest) fault	0.0s to 6553.5s		0.0s	●
F9-25	IGBT temperature upon the 3rd (latest) fault				●
F9-26	Fault subcode of the 3rd (latest) fault				●
F9-27	Frequency upon the 2nd fault	0.00 Hz to 655.35 Hz		0.00 Hz	●
F9-28	Current upon the 2nd fault	0.00 A to 655.35 A		0.00 A	●
F9-29	Bus voltage upon the second fault	0.0 V to 6553.5 V		0.0 V	●
F9-30	Input terminal state upon the 2nd fault	0 to 9999		0	●
F9-31	Output terminal state upon the 2nd fault	0 to 9999		0	●
F9-32	AC drive state upon the 2nd fault	0 to 65535		0	●
F9-33	Power-on time upon the 2nd fault	0 to 65535		0s	●
F9-34	Running time upon the 2nd fault	0.0s to 6553.5s		0.0s	●
F9-35	IGBT temperature upon the 2nd fault				●
F9-36	Fault subcode of the 2nd fault				●
F9-37	Frequency upon the 1st fault	0.00 Hz to 655.35 Hz		0.00 Hz	●
F9-38	Current upon the 1st fault	0.00 A to 655.35 A		0.00 A	●
F9-39	Bus voltage upon the 1st fault	0.0 V to 6553.5 V		0.0 V	●
F9-40	Input terminal state upon the 1st fault	0 to 9999		0	●

Para. Code	Parameter Name	Value Range	Default	Change
F9-41	Output terminal state upon the 1st fault	0 to 9999	0	●
F9-42	AC drive state upon the 1st fault	0 to 65535	0	●
F9-43	Power-on time upon the 1st fault	0s to 65535s	0s	●
F9-44	Running time upon the 1st fault	0.0s to 6553.5s	0.0s	●
F9-45	IGBT temperature upon the 1st fault			●
F9-46	Fault subcode of the 1st fault			●
F9-48	Fault protection action selection 1	Ones place: Motor overload (E11) Tens place: Reserved Hundreds place: Output phase loss (E13) Thousands place: Heatsink overtemperature (E14) Ten thousands place: External fault (E15) Note: For the output phase loss fault, "Decelerate to stop" and "Warning" are valid only in the V/f control mode.	10050 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★
F9-49	Fault protection action selection 2	Ones place: Communication timeout (E16) Tens place: External DC soft charge unit fault (E17) (only applicable for 90 kW or higher models) Hundreds place: Reserved Thousands place: Motor auto-tuning fault (E19) Ten thousands place: Encoder fault (E20)	00050 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★
F9-50	Fault protection action selection 3	Ones place: EEPROM read/write fault (E21) Tens place: Abnormal motor auto-tuning result (E22) Hundreds place: Motor short-circuited to the ground (E23) Thousands place: Inter-phase short circuit (E24) Ten thousands place: Reserved	25000 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★
F9-51	Fault protection action selection 4	Ones place: Cumulative running time reached (E26) Tens place: User-defined fault 1 (E27) Hundreds place: User-defined fault 2 (E28) Thousands position place: Cumulative power-on time reached (E29) Ten thousands place: Load loss (E30)	51111 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★
F9-52	Fault protection action selection 5	Ones place: PID feedback loss during running (E31) Tens place: Reserved Hundreds place: Reserved Thousands place: Excessive speed deviation (E42) Ten thousands place: Motor overspeed (E43)	00101 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★
F9-53	Fault protection action selection 6	Ones place: Motor overheat (E45) Tens place: Reserved Hundreds place: Reserved Thousands place: Reserved Ten thousands place: Fan fault (E80)	05500 0: Coast to stop 1: Decelerate to stop 2: Reserved 3: Reserved 4: Alarm 5: Cancel	★

Para. Code	Parameter Name	Value Range	Default	Change
F9-54	Frequency for continuing to run upon fault	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency	1	☆
F9-55	Backup frequency upon fault	0.0% to 100.0% (100.0% corresponds to the maximum frequency F0-10.)	100.0%	☆
F9-56	Motor temperature sensor type	0: No temperature sensor (AI used for analog input) 1: PT100 2: PT1000	0	☆
F9-57	Motor overtemperature protection threshold	0° C to 200° C	110° C	☆
F9-58	Motor overtemperature alarm threshold	0° C to 200° C	90° C	☆
F9-59	Action upon instantaneous power failure	0: Invalid 1: Deceleration 2: Decelerate to stop	0	★
F9-60	Voltage threshold for pausing power dip ride-through	80% to 100%	85%	☆
F9-61	Time threshold for voltage recovery from power dip ride-through	0.0s to 100.0s	0.5s	☆
F9-62	Threshold for enabling power dip ride-through	60% to 100% (standard bus voltage)	80%	☆
F9-64	Load loss detection level	0.0% to 100.0%	10.0%	☆
F9-65	Load loss detection time	0.1s to 60.0s	1.0s	☆
F9-67	Overspeed detection level	0.0% to 50.0% (maximum frequency) (Overspeed detection disabled at 0.0%)	5.0%	☆
F9-68	Overspeed detection time	0.0s to 60.0s	1.0s	☆
F9-69	Detection level for excessive speed deviation	0.0% to 50.0% (maximum frequency) (Speed error detection disabled at 0.0%)	20.0%	☆
F9-70	Detection time for excessive speed deviation	0.0 to 60.0	5.0s	☆
F9-71	Power dip ride-through gain	0 to 100	40	☆
F9-72	Power dip ride-through integral	0 to 100	30	☆
F9-73	Deceleration time of power dip ride-through	0.0s to 300.0s	20.0s	☆
Group FA: Process Control PID Function				
FA-00	PID reference source	0: FA-01 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: Multi-reference	0	☆
FA-01	PID digital setting	0.0% to 100.0%	50.0%	☆
FA-02	PID feedback source	0: AI1 1: AI2 3: AI1 - AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: AI1 + AI2 7: Max. (|AI1|, |AI2|) 8: Min. (|AI1|, |AI2|)	0	☆
FA-03	PID action direction	0: Forward 1: Reverse	0	☆
FA-04	PID reference and feedback range	0 to 65535	1000	☆

Para. Code	Parameter Name	Value Range	Default	Change
FA-05	Proportional gain Kp1	0.0 to 1000.0	20.0	☆
FA-06	Integral time Ti1	0.01s to 100.00s	2.00s	☆
FA-07	Differential time Td1	0.000s to 10.000s	0.000s	☆
FA-08	Reverse PID cut-off frequency	0.00 to maximum frequency	2.00 Hz	☆
FA-09	PID deviation limit	0.0% to 100.0%	0.0%	☆
FA-10	PID differential limit	0.00% to 100.00%	0.10%	☆
FA-11	PID reference change time	0.00s to 650.00s	0.00s	☆
FA-12	PID feedback filter time	0.00s to 60.00s	0.00s	☆
FA-13	PID error gain	0.0% to 100.0%	100.0%	☆
FA-15	Proportional gain Kp 2	0.0 to 1000.0	20.0	☆
FA-16	Integral time Ti 2	0.01s to 100.00s	2.00s	☆
FA-17	Differential time Td 2	0.000s to 10.000s	0.000s	☆
FA-18	PID parameter switchover condition	0: No switchover 1: Switchover by DI 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency 6: Automatic adjustment based on roll diameter 7: Adjustment based on the maximum roll diameter percentage	0	☆
FA-19	PID parameter switchover deviation 1	0.0% to FA-20	20.0%	☆
FA-20	PID parameter switchover deviation 2	FA-19 to 100.0%	80.0%	☆
FA-21	PID initial value	0.0% to 100.0%	0.0%	☆
FA-22	Active time of PID initial value	0.00s to 650.00s	0.00s	☆
FA-23	Maximum deviation between two outputs in forward direction	0.00% to 100.00%	1.00%	☆
FA-24	Maximum deviation between two outputs in reverse direction	0.00% to 100.00%	1.00%	☆
FA-25	PID integral	Integral pause 0: Inactive 1: Valid	0	☆
FA-26	Detection level of PID feedback loss	0.0%: No detection on feedback loss 0.1% to 100.0%	0.0%	☆
FA-27	Detection time of PID feedback loss	0.0s to 20.0s	0.0s	☆
Group Fb: Wobble Function, Fixed Length and Count				
Fb-00	Wobble setting mode	0: Relative to the central frequency 1: Relative to the maximum frequency	0	☆
Fb-01	Wobble amplitude	0.0% to 100.0%	0.0%	☆
Fb-02	Jump frequency amplitude	0.0% to 50.0%	0.0%	☆
Fb-03	Wobble cycle	0.1s to 3000.0s	10.0s	☆
Fb-04	Triangular wave rising time coefficient	0.1% to 100.0%	50.0%	☆
Fb-05	Length reference	0 m to 65535 m	1000 m	☆
Fb-06	Actual length	0 m to 65535 m	0 m	☆
Fb-07	Number of pulses per meter	0.1 to 6553.5	100.0	☆
Fb-08	Count value reference	1 to 65535	1000	☆
Fb-09	Designated count value	1 to 65535	1000	☆
Fb-10	Revolution calculation reset method	0: Edge-triggered 1: Level-triggered	0	☆
Fb-11	Revolution calculation reset signal	0: Disable 1: Reset	0	☆
Fb-12	Calculation retentive upon power failure	0: Not update 1: Update	0	☆
Fb-13	Initial value of revolution calculation	0 to 65535 (Fb-18=0) 0.0 to 6553.5 (FB-18=1)	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
Fb-14	Numerator of transmission ratio	1 to 65535	1	☆
Fb-15	Denominator of transmission ratio	1 to 65535	1	☆
Fb-16	Actual running revolution (value of FB-13 added)	0 to 65535 (Fb-18=0) 0.0 to 6553.5 (FB-18=1)	0	●
Fb-17	Number of running revolutions	0 to 65535 (FB-18=0) 0.0 to 6553.5 (FB-18=1)	0	●
Fb-18	Revolution calculation precision	0: 1 1: 0.1	0	☆
Fb-19	Revolution count direction	0: Running in the same direction 1: Running in the reverse direction	0	☆
Group FC: Multi-Reference and Simple PLC Function				
FC-00	Multi-reference 0	-100.0% to 100.0%	0.0%	☆
FC-01	Multi-reference 1	-100.0% to 100.0%	0.0%	☆
FC-02	Multi-reference 2	-100.0% to 100.0%	0.0%	☆
FC-03	Multi-reference 3	-100.0% to 100.0%	0.0%	☆
FC-04	Multi-reference 4	-100.0% to 100.0%	0.0%	☆
FC-05	Multi-reference 5	-100.0% to 100.0%	0.0%	☆
FC-06	Multi-reference 6	-100.0% to 100.0%	0.0%	☆
FC-07	Multi-reference 7	-100.0% to 100.0%	0.0%	☆
FC-08	Multi-reference 8	-100.0% to 100.0%	0.0%	☆
FC-09	Multi-reference 9	-100.0% to 100.0%	0.0%	☆
FC-10	Multi-reference 10	-100.0% to 100.0%	0.0%	☆
FC-11	Multi-reference 11	-100.0% to 100.0%	0.0%	☆
FC-12	Multi-reference 12	-100.0% to 100.0%	0.0%	☆
FC-13	Multi-reference 13	-100.0% to 100.0%	0.0%	☆
FC-14	Multi-reference 14	-100.0% to 100.0%	0.0%	☆
FC-15	Multi-reference 15	-100.0% to 100.0%	0.0%	☆
FC-16	Simple PLC running mode	0: Stop after running one cycle 1: Keep final values after running one cycle 2: Repeat after running one cycle	0	☆
FC-17	Simple PLC retention selection upon power failure	Ones: Retention selection upon power failure 0: Non-retentive upon power failure 1: Retentive upon power failure Tens: Retention selection upon stop 0: Non-retentive upon stop 1: Retentive upon stop	00	☆
FC-18	Running time of multi-reference 0 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-19	Acceleration/Deceleration time of multi-reference 0 set by simple PLC	0 to 3	0	☆
FC-20	Running time of multi-reference 1 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-21	Acceleration/Deceleration time of multi-reference 1 set by simple PLC	0 to 3	0	☆
FC-22	Running time of multi-reference 2 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-23	Acceleration/Deceleration time of multi-reference 2 set by simple PLC	0 to 3	0	☆
FC-24	Running time of multi-reference 3 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-25	Acceleration/Deceleration time of multi-reference 3 set by simple PLC	0 to 3	0	☆
FC-26	Running time of multi-reference 4 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆

Para. Code	Parameter Name	Value Range	Default	Change
FC-27	Acceleration/Deceleration time of multi-reference 4 set by simple PLC	0 to 3	0	☆
FC-28	Running time of multi-reference 5 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-29	Acceleration/Deceleration time of multi-reference 5 set by simple PLC	0 to 3	0	☆
FC-30	Running time of multi-reference 6 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-31	Acceleration/Deceleration time of multi-reference 6 set by simple PLC	0 to 3	0	☆
FC-32	Running time of multi-reference 7 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-33	Acceleration/Deceleration time of multi-reference 7 set by simple PLC	0 to 3	0	☆
FC-34	Running time of simple PLC reference 8	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-35	Acceleration/Deceleration time of multi-reference 8 set by simple PLC	0 to 3	0	☆
FC-36	Running time of multi-reference 9 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-37	Acceleration/Deceleration time of multi-reference 9 set by simple PLC	0 to 3	0	☆
FC-38	Running time of multi-reference 10 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-39	Acceleration/Deceleration time of multi-reference 10 set by simple PLC	0 to 3	0	☆
FC-40	Running time of multi-reference 11 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-41	Acceleration/Deceleration time of multi-reference 11 set by simple PLC	0 to 3	0	☆
FC-42	Running time of multi-reference 12 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-43	Acceleration/Deceleration time of multi-reference 12 set by simple PLC	0 to 3	0	☆
FC-44	Running time of multi-reference 13 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-45	Acceleration/Deceleration time of multi-reference 13 set by simple PLC	0 to 3	0	☆
FC-46	Running time of multi-reference 14 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-47	Acceleration/Deceleration time of multi-reference 14 set by simple PLC	0 to 3	0	☆
FC-48	Running time of multi-reference 15 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	☆
FC-49	Acceleration/Deceleration time of multi-reference 15 set by simple PLC	0 to 3	0	☆
FC-50	Time unit of simple PLC	0: s (second) 1: h (hour)	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
FC-51	Multi-reference 0 setting mode	0: Set by FC-00 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: PID 6: F0-08 (Preset frequency), which can be modified by UP/DOWN key	0	☆
Group FD: Communication Parameters				
Fd-00	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	☆
Fd-01	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	0	☆
Fd-02	Modbus local address	0: Broadcast address; 1 to 247	1	☆
Fd-03	Modbus response delay time	0 ms to 20 ms	2	☆
Fd-04	Modbus communication timeout time	0.1s to 60.0s 0.0: Invalid	0	☆
Fd-06	Automatic reset upon communication fault	0: Enable 1: Disable	1	☆
Fd-09	Communication status	Ones place (CANopen) 0: Stop 1: Initialization 2: Pre-operational 8: Running Tens place (CANlink) 0: Stop 1: Initialization 2: Pre-operational 8: Running Hundreds place (PROFIBUS DP) 0: Stop 1: Initialization 8: Running	0	●
Fd-10	Switchover between CANopen and CANlink	1: CANopen 2: CANlink	1	★
Fd-11	CiA 402	0: Disable 1: Disable	1	★
Fd-12	CAN baud rate	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	5	★
Fd-13	CAN station number	1 to 127 (valid for CANlink and CANopen)	1	★
Fd-14	Number of CAN frames received per unit of time			●

Para. Code	Parameter Name	Value Range	Default	Change
Fd-15	Maximum number of error frames received by node			●
Fd-16	Maximum number of error frames sent by node			●
Fd-17	Number of bus disconnection times per unit of time			●
Fd-18	Power supply unit No.	1 to 99	1	★
Fd-19	CAN communication disconnection coefficient	1 to 15	1	★
Fd-20	PROFIBUS DP communication address	0 to 125 (0: broadcast address)	0	★
Fd-21	PROFIBUS DP communication disconnection coefficient	0 to 65535	350	☆
Fd-28	Power supply unit communication	0 to 1	1	★
Fd-32	Group AF mapping mode switchover	0: Communication not saved 1: Communication saved	0	★
Fd-33	CANopen communication period	-	-	●
Fd-34	CANopen mode	0: Ordinary mode 1: Expert mode	0	★
Fd-35	CANopen inhibition time	0 to 65535 (unit: 100 us)	0	★
Fd-36	CANopen event time	0 ms to 65535 ms	0	★
Fd-94	Modbus software version	0. 00 to 655.35	0.00	●
Fd-95	CANlink software version	0. 00 to 655.35	0.00	●
Fd-96	CANopen software version	0. 00 to 655.35	0.00	●
Fd-97	PROFIBUS DP software version	0. 00 to 655.35	0.00	●
Fd-98	DP2CANOPEN software version	-	-	●
Fd-99	MODBUS2CANOPEN software version	-	-	●
Group FE: User-defined parameters				
FE-00	User-defined parameter 0	F0-00 to FP-xx A0-00 to Ax-xx U0-xx to U0-xx	F0-01	☆
FE-01	User-defined parameter 1		F0-02	☆
FE-02	User-defined parameter 2		F0-03	☆
FE-03	User-defined parameter 3		F0-07	☆
FE-04	User-defined parameter 4		F0-08	☆
FE-05	User-defined parameter 5		F0-17	☆
FE-06	User-defined parameter 6		F0-18	☆
FE-07	User-defined parameter 7		F3-00	☆
FE-08	User-defined parameter 8		F3-01	☆
FE-09	User-defined parameter 9		F4-00	☆
FE-10	User-defined parameter 10		F4-01	☆
FE-11	User-defined parameter 11		F4-02	☆
FE-12	User-defined parameter 12		F5-04	☆
FE-13	User-defined parameter 13		F5-07	☆
FE-14	User-defined parameter 14		F6-00	☆

Para. Code	Parameter Name	Value Range	Default	Change
FE-15	User-defined parameter 15	F0-00 to FP-xx A0-00 to Ax-xx U0-xx to U0-xx	F6-10	☆
FE-16	User-defined parameter 16		F0-00	☆
FE-17	User-defined parameter 17		F0-00	☆
FE-18	User-defined parameter 18		F0-00	☆
FE-19	User-defined parameter 19		F0-00	☆
FE-20	User-defined parameter 20		F0-00	☆
FE-21	User-defined parameter 21		F0-00	☆
FE-22	User-defined parameter 22		F0-00	☆
FE-23	User-defined parameter 23		F0-00	☆
FE-24	User-defined parameter 24		F0-00	☆
FE-25	User-defined parameter 25		F0-00	☆
FE-26	User-defined parameter 26		F0-00	☆
FE-27	User-defined parameter 27		F0-00	☆
FE-28	User-defined parameter 28		F0-00	☆
FE-29	User-defined parameter 29		F0-00	☆
FE-30	User-defined parameter 30		F0-00	☆
FE-31	User-defined parameter 31		F0-00	☆
Group FP: Parameter Management				
FP-00	User password	0 to 65535	0	☆
FP-01	Parameter initialization	0: Disable 01: Restore parameters except motor parameters, encoder parameters, and F0-10 (Maximum frequency) to default settings. 02: Clear records 04: Back up current user parameters 501: Restore user backup parameters	0	★
FP-02	Display of function parameter groups	Ones place: Group U 0: Hide 1: Display Tens place: Group A 0: Hide 1: Display	111	☆
FP-03	Display of user-defined parameter groups	Ones place: User-defined parameter group 0: Hide 1: Display Tens position: User-changed parameter group display 0: Hide 1: Display	11	☆
FP-04	Parameter modification	0: Parameters can be modified. 1: Parameters cannot be modified.	0	☆
Group A0: Torque Control Parameters				
A0-00	Speed/Torque control selection	0: Speed control 1: Torque control	0	★
A0-01	Torque reference source in torque control mode	0: A0-03 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) (The full range of options 1 to 7 corresponds to the value of A0-03.)	0	★

Para. Code	Parameter Name	Value Range	Default	Change
A0-03	Torque digital setting	-200.0% to 200.0%	100.0%	☆
A0-04	Torque filter time	0.000s to 5.000s	0.000s	☆
A0-05	Digital setting of speed limit	-120.0% to 120.0%	0.00%	☆
A0-07	Acceleration time (torque)	0.0s to 650.00s	1.00s	☆
A0-08	Deceleration time (torque)	0.0s to 650.00s	1.00s	☆
A0-09	Speed limit reference source	0: A0-05 1: Frequency reference	0	☆
A0-10	Speed limit offset	0 to F0-10 (maximum frequency)	5.00 Hz	☆
A0-11	Active mode of speed limit offset	0: Bi-directional offset 1: Uni-directional offset	1	★
A0-12	Acceleration time (frequency)	0.0s to 6500.0s	1.0s	☆
A0-13	Deceleration time (frequency)	0.0s to 6500.0s	1.0s	☆
A0-14	Torque mode switchover	0: No switchover 1: Switch to speed control mode at stop 2: The target torque is 0 at stop.	1	★
Group A1: Virtual I/O Parameters				
A1-00	VDI1 function selection	See F4-00 (DI1 function).	0	★
A1-01	VDI2 function selection	See F4-00 (DI1 function).	0	★
A1-02	VDI3 function selection	See F4-00 (DI1 function).	0	★
A1-03	VDI4 function selection	See F4-00 (DI1 function).	0	★
A1-04	VDI5 function selection	See F4-00 (DI1 function).	0	★
A1-05	VDI state setting mode	0: A1-06 1: DO state 2: DI state Ones: VDI1 Tens: VDI2 Hundreds: VDI3 Thousands: VDI4 Ten thousands: VDI5	00000	★
A1-06	VDI state setting	0: Invalid 1: Valid Ones: VDI1 Tens: VDI2 Hundreds: VDI3 Thousands: VDI4 Ten thousands: VDI5	00000	☆
A1-07	Function selection for AI1 used as DI	See F4-00 (DI1 function).	0	★
A1-08	Function selection for AI2 used as DI	See F4-00 (DI1 function).	0	★
A1-10	Active mode selection for AI used as DI	Ones: AI1 0: Active high 1: Active low Tens: AI2 0: Active high 1: Active low	00	★
Group A5: Control Optimization Parameters				
A5-00	Frequency upper limit for DPWM switchover	0.00 Hz to maximum frequency (F0-10)	12.00 Hz	☆
A5-01	PWM modulation mode	0: Asynchronous modulation 1: Synchronous modulation	0	☆
A5-02	Dead-zone compensation mode	0: Disable 1: Enable	1	★
A5-03	Random PWM depth	0: Random PWM inactive 1 to 10: Random PWM carrier frequency depth	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
A5-04	Fast current limit	0: Enable 1: Disable	1 0 (asynchronous motor in SVC)	☆
A5-05	Sampling delay	1 to 13	5	☆
A5-06	Undervoltage threshold	60% to 140%	100.0%	☆
Group A6: AI Curve Setting				
A6-00	Minimum input of AI curve 4	-10.00 V to A6-02	0.00 V	☆
A6-01	Percentage corresponding to minimum input of AI curve 4	-100.0% to +100.0%	0.0%	☆
A6-02	Inflection point 1 input of AI curve 4	A6-00 to A6-04	3.00 V	☆
A6-03	Percentage corresponding to inflection point 1 input of AI curve 4	-100.0% to +100.0%	30.0%	☆
A6-04	Inflection point 2 input of AI curve 4	A6-02 to A6-06	6.00 V	☆
A6-05	Percentage corresponding to inflection 2 input of AI curve 4	-100.0% to +100.0%	60.0%	☆
A6-06	Maximum input of AI curve 4	A6-06 to +10.00 V	10.00 V	☆
A6-07	Percentage corresponding to maximum input of AI curve 4	-100.0% to +100.0%	100.0%	☆
A6-08	Minimum input of AI curve 5	-10.00 V to A6-10	-10.00 V	☆
A6-09	Percentage corresponding to minimum input of AI curve 5	-100.0% to +100.0%	-100.0%	☆
A6-10	Inflection point 1 input of AI curve 5	A6-08 to A6-12	-3.00 V	☆
A6-11	Percentage corresponding to inflection point 1 input of AI curve 5	-100.0% to +100.0%	-30.0%	☆
A6-12	Inflection point 2 input of AI curve 5	A6-10 to A6-14	3.00 V	☆
A6-13	Percentage corresponding to inflection 2 input of AI curve 5	-100.0% to +100.0%	30.0%	☆
A6-14	Maximum input of AI curve 5	A6-12 to +10.00 V	10.00 V	☆
A6-15	Percentage corresponding to maximum input of AI curve 5	-100.0% to +100.0%	100.0%	☆
A6-16	AI1 gain	-10.00 to +10.00	1.00	☆
A6-17	AI1 zero offset coefficient	-100.0% to +100.0%	0.0%	☆
A6-18	AI2 gain	-10.00 to +10.00	1.00	☆
A6-19	AI2 zero offset coefficient	-100.0% to +100.0%	0.0%	☆
A6-24	AI1 jump point	-100.0% to 100.0%	0.0%	☆
A6-25	AI1 jump amplitude	0.0% to 100.0%	0.5%	☆
A6-26	AI2 jump point	-100.0% to 100.0%	0.0%	☆
A6-27	AI2 jump amplitude	0.0% to 100.0%	0.5%	☆
Group A8: Synchronization Control				
A8-00	Local address	1 to 124 0: Broadcast address	1	★
A8-01	Baud rate	6: 1 Mbps	6	★
A8-02	Synchronization control communication timeout duration	0.0s to 10.0s	1.0s	☆
A8-10	Master/Slave selection in speed and position control	0: Invalid 1: Master 2: Slave 3: Middle node	0	★
A8-11	Synchronization mode selection	0: Speed Synchronization 1: Position synchronization	0	★
A8-12	Synchronization master station number (valid for slave)	1 to 124	1	★

Para. Code	Parameter Name	Value Range	Default	Change
A8-14	Slave configuration parameter	0: The slave does not follow the master to start/stop. 1: The slave follows the master to start/stop.	1	★
A8-15	Acceleration time (valid for slave)	0.0s to 100.0s	0.0s	☆
A8-16	Deceleration time (valid for slave)	0.0s to 100.0s	0.0s	☆
A8-17	Numerator of electronic gear ratio	1 to 65535	1	☆
A8-18	Denominator of electronic gear ratio	1 to 65535	1	☆
A8-19	Speed feedforward gain coefficient	0.000 to 20.000	1.000	☆
A8-20	Position loop proportional gain switchover mode	0: Fixed at A8-21 1: Switchover based on deviation 2: Switchover based on frequency	0	☆
A8-21	Position loop proportional gain 1	0.00 to 100.00	5.00	☆
A8-22	Deviation 1 for position loop proportional gain switchover	0 to A8-24	5	☆
A8-23	Position loop proportional gain 2	0.00 to 100.00	15	☆
A8-24	Deviation 2 for position loop proportional gain switchover	A8-22 to 60000	20	☆
A8-25	Speed proportional coefficient (valid for slave) (reserved)	0.000 to 60.000	1.000	★
A8-26	Speed filter time	0.000s to 10.000s	0.000s	☆
A8-27	Acceleration compensation coefficient	0.00 to 100.00	5.00	☆
A8-28	Acceleration average value filter coefficient	0 to 50	10	☆
A8-29	Minimum pulse deviation	0 to 500	0	☆
A8-30	Maximum pulse deviation	0 to 60000	500	☆
A8-31	Position loop output limit	0.00 Hz to 600.00 Hz	2.00 Hz	☆
A8-32	Detection value of excessive position deviation	0 to 60000	600	☆
A8-33	Detection time of excessive position deviation	0.00 ms to 50.00 ms	1.00 ms	☆
A8-34	Speed/Position synchronization switchover mode	0: No switchover 1: Switchover based on frequency	0	★
A8-35	Speed/Position synchronization switchover frequency	0.00 Hz to maximum frequency	50.00 Hz	★
A8-36	Communication delay compensation mode	0: Automatic compensation 1: Calculation based on baud rate 2: Parameter setting (A8-37)	0	★
A8-37	Communication delay time setting	0 us to 300 us	156 us	★
A8-39	Switchover frequency 1 for position loop proportional gain	0.00 Hz to A8-40	5.00 Hz	☆
A8-40	Switchover frequency 2 for position loop proportional gain	A8-39 to 600.00 Hz	10.00 Hz	☆
A8-42	Frequency sent by master (active for master)	0: Feedback frequency 1: Operating frequency	0	★
A8-43	Switchover threshold for master to send frequency to slave	0.00 Hz to 600.00 Hz	5.00 Hz	★
A8-50	Master/Slave selection in load distribution	0: Invalid 1: Master 2: Slave	0	★
A8-52	Synchronize master station number (valid for slave)	1 to 124	1	★
A8-54	Slave configuration parameter (load allocation)	0: The slave does not follow the master to start/stop. 1: The slave follows the master to start/stop.	1	★
A8-55	Torque acceleration time	0.000s to 60.000s	0.000s	☆
A8-56	Torque deceleration time	0.000s to 60.000s	0.000s	☆
A8-57	Frequency gain	-10.00 to 10.00	1.00	★

Para. Code	Parameter Name	Value Range	Default	Change
A8-58	Frequency offset	-100.00% to 100.00%	0.00%	★
A8-59	Torque gain	-10.00 to 10.00	1.00	★
A8-60	Torque offset	-100.00% to 100.00%	0.00%	★
A8-61	Frequency sent by master (active for master)	0: Feedback frequency 1: Operating frequency 2: Running frequency and feedback frequency When the frequency is lower than the value of A8-62, the running frequency is selected. When the frequency is higher than or equal to the value of A8-62, the feedback frequency is selected.	0	☆
A8-62	Switchover threshold for master to send frequency to slave	0.00 Hz to 600.00 Hz	5.00 Hz	☆
A8-70	Master/Slave selection in droop control	0: Invalid 1: Master 2: Slave 3: Auto droop	0	★
A8-71	Droop control mode selection	2: Master/Slave droop	2	★
A8-72	Synchronize master station number (valid for slave)	1 to 124	1	★
A8-74	Slave configuration parameter (droop control)	Ones 0: The slave does not follow the master to start/stop. 1: The slave follows the master to start/stop.	1	★
A8-77	Droop ratio	0.00% to 15.00%	5.00%	☆
Group A9: Vector Control Supplementary Parameters				
A9-00	Online auto-tuning on rotor time constant of asynchronous motor	0: Disable 1: Enable	0	☆
A9-01	Auto-tuning on rotor resistance gain of asynchronous motor in FVC mode	0 to 100	5	☆
A9-02	Auto-tuning on rotor resistor initial frequency of asynchronous motor in FVC mode	2-100 Hz	7 Hz	☆
A9-03	Observed magnetic field coefficient of asynchronous motors in FVC mode	30 to 150	40	☆
A9-04	Maximum torque limit coefficient in field-weakening area in vector control	30 to 150	80	☆
A9-05	Speed filter of asynchronous motor in SVC mode	5-32 ms	15 ms	☆
A9-06	Speed feedback processing of asynchronous motor during speed control in SVC mode	0: No special processing 1: Limit the minimum synchronous frequency based on load change 2.3: Output the fixed current at low running speed	0	☆
A9-07	Magnetic field regulation bandwidth of asynchronous motor in SVC mode	0-8.0 Hz	2.0 Hz	☆
A9-08	Low-speed running current of asynchronous motor in SVC mode	30 to 170	100	☆
A9-09	Switchover frequency for fixed current output of asynchronous motor in SVC mode	2.0-100.0 Hz	3.0 Hz	☆
A9-10	Speed fluctuation suppression coefficient of asynchronous motor in SVC mode	0 to 6	3	☆
A9-11	Acceleration/Deceleration time of asynchronous motor in SVC mode	0.1s to 3000.0s	20.0s	☆
A9-12	Quick auto-tuning on stator resistance for asynchronous motor before startup	0: Disable 1: Enable	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
A9-13	Quick auto-tuning of stator resistance coefficient 1 for asynchronous motors	-		★
A9-14	Quick auto-tuning of stator resistance coefficient 2 for asynchronous motor	-		★
A9-15	Quick auto-tuning of stator resistance coefficient 3 for asynchronous motor	-		★
A9-17	Real-time angle of synchronous motor	-		☆
A9-18	Initial position angle detection of synchronous motor	0: Detection upon running 1: No detection 2: Detection upon initial power-on	0	☆
A9-20	Field weakening mode selection	0: Automatic field weakening 1: Adaptive field weakening for synchronous motor 2: Hybrid field weakening for synchronous motor 3: No field weakening	1	★
A9-21	Field weakening gain of synchronous motor	0 to 50	5	☆
A9-22	Margin of output voltage upper limit of synchronous motor	0% to 50%	5%	☆
A9-23	Maximum force adjustment gain of synchronous motor	20% to 300%	100%	☆
A9-24	Adjustment gain of calculated excitation current of synchronous motor	40% to 200%	100%	☆
A9-25	Integral gain for speed estimation of synchronous motor in SVC mode	5 to 1000	30	☆
A9-26	Proportional gain for speed estimation of synchronous motor in SVC mode	5 to 300	20	☆
A9-27	Estimated speed filter of synchronous motor in SVC mode	10 to 2000	100	☆
A9-28	Minimum carrier frequency of synchronous motor in SVC mode	0.8 kHz to F0-15	2.0 kHz	☆
A9-29	Synchronous motor excitation current at low speed	0% to 80%	30%	☆
Group AC: AI/AO Correction				
AC-00	AI1 measured voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-01	AI1 displayed voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-02	AI1 measured voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-03	AI1 displayed voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-04	AI2 measured voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-05	AI2 displayed voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-06	AI2 measured voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-07	AI2 displayed voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-12	AO target voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-13	AO measured voltage 1	-10.000 V to 10.000 V	Factory-calibrated	☆

Para. Code	Parameter Name	Value Range	Default	Change
AC-14	AO target voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-15	AO measured voltage 2	-10.000 V to 10.000 V	Factory-calibrated	☆
AC-20	PT100 target voltage 1	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-21	PT100 measured voltage 1	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-22	PT100 target voltage 2	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-23	PT100 measured voltage 2	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-24	PT1000 target voltage 1	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-25	PT1000 measured voltage 1	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-26	PT1000 target voltage 2	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-27	PT1000 measured voltage 2	-3.300 V to 3.300 V	Factory-calibrated	☆
AC-28	AO target current 1	0 mA to 20 mA	Factory-calibrated	☆
AC-29	AO measured current 1	0 mA to 20 mA	Factory-calibrated	☆
AC-30	AO target current 2	0 mA to 20 mA	Factory-calibrated	☆
AC-31	AO measured current 2	0 mA to 20 mA	Factory-calibrated	☆
Group AF: Process Data Address Mapping				
AF-00	RPDO1-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-01	RPDO1-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-02	RPDO1-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-03	RPDO1-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-04	RPDO1-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-05	RPDO1-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-06	RPDO1-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-07	RPDO1-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-08	RPDO2-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-09	RPDO2-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-10	RPDO2-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-11	RPDO2-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-12	RPDO2-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-13	RPDO2-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-14	RPDO2-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-15	RPDO2-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-16	RPDO3-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-17	RPDO3-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-18	RPDO3-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-19	RPDO3-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-20	RPDO3-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-21	RPDO3-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-22	RPDO3-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-23	RPDO3-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-24	RPDO4-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-25	RPDO4-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-26	RPDO4-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-27	RPDO4-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆

Para. Code	Parameter Name	Value Range	Default	Change
AF-28	RPDO4-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-29	RPDO4-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-30	RPDO4-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-31	RPDO4-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-32	TPDO1-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-33	TPDO1-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-34	TPDO1-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-35	TPDO1-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-36	TPDO1-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-37	TPDO1-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-38	TPDO1-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-39	TPDO1-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-40	TPDO2-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-41	TPDO2-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-42	TPDO2-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-43	TPDO2-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-44	TPDO2-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-45	TPDO2-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-46	TPDO2-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-47	TPDO2-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-48	TPDO3-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-49	TPDO3-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-50	TPDO3-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-51	TPDO3-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-52	TPDO3-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-53	TPDO3-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-54	TPDO3-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-55	TPDO3-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-56	TPDO4-SubIndex0-H	0x0000 to 0xFFFF	0x0000	☆
AF-57	TPDO4-SubIndex0-L	0x0000 to 0xFFFF	0x0000	☆
AF-58	TPDO4-SubIndex1-H	0x0000 to 0xFFFF	0x0000	☆
AF-59	TPDO4-SubIndex1-L	0x0000 to 0xFFFF	0x0000	☆
AF-60	TPDO4-SubIndex2-H	0x0000 to 0xFFFF	0x0000	☆
AF-61	TPDO4-SubIndex2-L	0x0000 to 0xFFFF	0x0000	☆
AF-62	TPDO4-SubIndex3-H	0x0000 to 0xFFFF	0x0000	☆
AF-63	TPDO4-SubIndex3-L	0x0000 to 0xFFFF	0x0000	☆
AF-66	Number of valid RPDOs	0x0000 to 0xFFFF	0x0000	●
AF-67	Number of valid TPDOs	0x0000 to 0xFFFF	0x0000	●
Group B0: Control Mode, Linear Speed, and Winding Diameter				
B0-00	Tension control mode	0: Invalid 1: Open-loop tension torque control 2: Closed-loop tension speed control 3: Closed-loop tension torque control 4: Constant linear speed control	0	★
B0-01	Winding mode	0: Winding 1: Unwinding	0	☆
B0-02	Unwinding reverse tightening selection	0: Disable 0.01 m/min to 50.00 m/min: linear speed of reverse tightening	0	☆
B0-03	Mechanical transmission ratio	0.01 to 300.00	1.00	☆
B0-04	Linear speed input source	0: No input 1: AI1 2: AI2 4: Pulse input 5: Communication (1000H) 6: Communication (731AH)	0	★

Para. Code	Parameter Name	Value Range	Default	Change
B0-05	Maximum linear speed	0.1 m/min to 6500.0 m/min	1000.0 m/min	☆
B0-06	Minimum linear speed for winding diameter calculation	0.1 m/min to 6500.0 m/min	20.0 m/min	☆
B0-07	Winding diameter calculation method	0: Calculated based on linear speed 1: Calculated based on cumulative thickness 2: AI1 input 3: AI2 input 5: Pulse input (DIO1)	0	★
B0-08	Maximum roll diameter	1 millimeter to 6000.0 millimeters	500.0 millimeter	☆
B0-09	Reel diameter	1 millimeter to 6000.0 millimeters	100.0 millimeter	☆
B0-10	Initial Roll Diameter Source	0: B0-11 to B0-13 1: AI1 2: AI2	0	★
B0-11	Initial roll diameter 1	1 millimeter to 6000.0 millimeters	100.0 millimeter	☆
B0-12	Initial roll diameter 2	1 millimeter to 6000.0 millimeters	100.0 millimeter	☆
B0-13	Initial roll diameter 3	1 millimeter to 6000.0 millimeters	100.0 millimeter	☆
B0-14	Current roll diameter	1 millimeter to 6000.0 millimeters	100.0 millimeter	☆
B0-15	Roll diameter filter time	0.00s to 10.00s	5.00s	☆
B0-16	Roll diameter change rate	0: Disable 0.1 millimeter to 10.0 millimeters	1.0	☆
B0-17	Roll diameter change direction limit	0: Disabled 1: Decrease inhibited during winding, and increase inhibited during unwinding	0	☆
B0-18	Roll diameter reset during running	0: Disable 1: Enable	0	☆
B0-19	Pre-drive speed gain	-100.0% to +100.0%	0.0%	☆
B0-20	Pre-charge torque limit source	0: F2-09 1: Based on tension	1	★
B0-21	Pre-charge torque correction	-100.0% to +100.0%	0.0%	☆
B0-22	Pre-drive roll diameter calculation delay	0.1s to 6500.0s	10.0s	☆
B0-23	Pre-drive acceleration time (reserved)	0.0s to 6000.0s	0.0s	☆
B0-24	Pre-drive deceleration time (reserved)	0.0s to 6000.0s	0.0s	☆
B0-25	Pre-drive roll diameter calculation	0: Disable 1: Enable	0	☆
B0-26	Closed-loop speed PID adjustment limit (B0-00 = 2) Speed limit (B0-00 ≠ 2)	0.0% to 100.0%	50.0%	☆
B0-27	Closed-loop speed PID adjustment limit offset (B0-00 = 2) Speed limit offset (B0-00 ≠ 2)	B0-00 = 2: 0.00 Hz to 100.00 Hz B0-00 ≠ 2: 0.00% to 100.00%	5.00 Hz/%	☆
B0-28	Closed-loop speed PID adjustment limit selection (B0-00 = 2) Speed limit (B0-00 ≠ 2)	B0-00 = 2: 0: Limited by B0-26 and B0-27 (limited by the frequency upper limit) 1: Limit by B0-27 B0-00 ≠ 2: 0: Unlimited (limited by frequency upper limit) 1: Limit by B0-26 and B0-27	0	☆
B0-29	Pulses per revolution	1 to 60000	1	☆
B0-30	Revolutions per layer	1 to 10000	100	☆
B0-31	Material thickness reference source (reserved)	0: Digital setting 1: AI1 2: AI2	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B0-32	Material thickness 0	0.01 millimeter to 100.00 millimeters	0.01 millimeter	☆
B0-33	Material thickness 1	0.01 millimeter to 100.00 millimeters	0.01 millimeter	☆
B0-34	Material thickness 2	0.01 millimeter to 100.00 millimeters	0.01 millimeter	☆
B0-35	Material thickness 3	0.01 millimeter to 100.00 millimeters	0.01 millimeter	☆
B0-36	Maximum thickness	0.01 millimeter to 100.00 millimeters	1.00 millimeter	☆
B0-38	Main frequency and auxiliary frequency in closed-loop tension torque mode	0: Disable 1: Enable	1	☆
B0-40	Unwinding motoring permission	0: Disable 1: Enable	0	☆
B0-41	Constant linear speed input source	0: AI1 1: AI2 3: Pulse input 4: Communication (1000H) 5: Communication (731AH)	0	★
Group B1: Tension Setting				
B1-00	Tension reference source	0: B1-01 1: AI1 2: AI2 4: Pulse reference 5: Communication (1000H)	0	★
B1-01	Tension digital setting	0 N to 65000 N	50 N	☆
B1-02	Maximum tension	0 N to 65000 N	200 N	☆
B1-03	Zero-speed threshold	0.0% to 20.0% (maximum frequency)	0.0%	☆
B1-04	Zero-speed tension rise	0.0% to 1000.0%	0.0%	☆
B1-05	Frequency acceleration time in torque control mode (reserved)	0s to 6500.0s	0.0s	☆
B1-06	Frequency deceleration time in torque control mode (reserved)	0s to 6500.0s	0.0s	☆
B1-07	Friction force compensation coefficient	0.0% to 50.0%	0.0%	☆
B1-08	Mechanical inertia compensation coefficient	0 $N \cdot m^2$ to 65535 $N \cdot m^2$	0 $N \cdot m^2$	☆
B1-09	Correction of acceleration inertia compensation	0.0% to 200.0%	100.0%	☆
B1-10	Correction of deceleration inertia compensation	0.0% to 200.0%	100.0%	☆
B1-11	Material density	0 kg/m^3 to 60000 kg/m^3	0 kg/m^3	☆
B1-12	Material width	0 millimeter to 60000 millimeters	0 millimeter	☆
B1-13	Inertia compensation exit delay	0 ms to 1000 ms	0 ms	☆
B1-16	Torque closed-loop PID adjustment limit	0.0% to 100.0%	50.0%	☆
B1-17	Friction force compensation curve	-50.0% to +50.0%	0.0%	☆
B1-18	Friction force compensation curve	0: Frequency 1: Linear speed 2: Multi-segment friction force compensation curve 1 3: Multi-segment friction force compensation curve 2	0	★
B1-19	Multi-segment friction force compensation torque 1	0.0% to 50.0%	0.0%	☆
B1-20	Multi-segment friction force compensation torque 2	0.0% to 50.0%	0.0%	☆
B1-21	Multi-segment friction force compensation torque 3	0.0% to 50.0%	0.0%	☆
B1-22	Multi-segment friction force compensation torque 4	0.0% to 50.0%	0.0%	☆
B1-23	Multi-segment friction force compensation torque 5	0.0% to 50.0%	0.0%	☆

Para. Code	Parameter Name	Value Range	Default	Change
B1-24	Multi-segment friction force compensation torque 6	0.0% to 50.0%	0.0%	☆
B1-25	Multi-segment friction force compensation inflection point 1	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-26	Multi-segment force compensation inflection point 2	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-27	Multi-segment force compensation inflection point 3	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-28	Multi-segment force compensation inflection point 4	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-29	Multi-segment force compensation inflection point 5	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-30	Multi-segment force compensation inflection point 6	0.00 Hz to maximum frequency	0.00 Hz	☆
B1-31	Tension establishment	0: Enable 1: Disable	0	★
B1-32	Tension establishment dead zone	0.0% to 100.0%	1.0%	★
B1-33	Tension establishment frequency	0.00 Hz to F0-10	0.05 Hz	★
B1-34	Tension establishment Kp (available only in speed closed-loop mode)	0.0% to 100.0%	1.0%	★
B1-35	Tension establishment Ki (available only in speed closed-loop mode)	0.00s to 20.00s	10.00s	★
B1-37	Initial winding diameter	0: Enable 1: Disable	0	★
B1-38	Rod length	1 millimeter to 65535 millimeters	300 millimeter	★
B1-39	Rod angle	1.0° to 360.0°	40.0°	★
Group B2: Tension Taper				
B2-00	Taper curve	0: Curve 1: Linear	0	★
B2-01	Setting source of tension taper	0: B2-02 1: AI1 2: AI2	0	★
B2-02	Tension taper	0.0% to 100.0%	0.0%	☆
B2-03	Correction value of taper compensation	0 millimeter to 10000 millimeters	0 millimeter	☆
B2-04	Closed-loop tension taper function	0: Invalid 1: Valid	0	★
B2-05	Setting channel of maximum external taper	0: B2-06 1: AI1 2: AI2	0	★
B2-07	Number of linear taper inflection points	0 to 5	5	☆
B2-08	Taper corresponding to minimum roll diameter	0.0% to 100.0%	100%	☆
B2-09	Linear taper switchover point 1	B0-09 to B0-08 (mm)	150.0 millimeter	☆
B2-10	Taper of switchover point 1	0.0% to 100.0%	100.0%	☆
B2-11	Linear taper switchover point 2	B2-09 to B0-08 (mm)	200.0 millimeter	☆
B2-12	Taper of switchover point 2	0.0% to 100.0%	90.0%	☆
B2-13	Linear taper switchover point 3	B2-11 to B0-08 (mm)	250.0 millimeter	☆
B2-14	Taper of switchover point 3	0.0% to 100.0%	80.0%	☆
B2-15	Linear taper switchover point 4	B2-13 to B0-08 (mm)	300.0 millimeter	☆
B2-16	Taper of switchover point 4	0.0% to 100.0%	70.0%	☆
B2-17	Linear taper switchover point 5	B2-15 to B0-08 (mm)	400.0 millimeter	☆
B2-18	Taper of switchover point 5	0.0% to 100.0%	50.0%	☆

Para. Code	Parameter Name	Value Range	Default	Change
B2-19	Taper of maximum roll diameter	0.0% to 100.0%	30.0%	☆
B2-20	Taper corresponding to maximum roll diameter	0.0% to 100.0%	30.0%	☆
Group B4: Positioning Control				
B4-00	Position control function	0: Invalid 1: Valid	0	★
B4-01	Positioning control mode	0: Incremental 1: Absolute 2: Degree 3: Fixed length degree	0	★
B4-02	Electronic gear ratio (numerator)	1 to 30000	1	★
B4-03	Electronic gear ratio (denominator)	1 to 30000	1	★
B4-05	Home signal source for positioning control	Ones place: Incremental 2: Current position Tens place: Absolute 1: DI Hundreds place: Degree 0: Encoder Z signal 1: DI Thousands place: Fixed length degree 0: Encoder Z signal 1: DI	1012	★
B4-07	DI home signal active mode	0: Active at falling edge 1: Active at rising edge	1	★
B4-08	DI home signal filter time	0s to 5.000s	0.010s	☆
B4-09	Home enabling control	0: No operation 1: Immediate home searching 2: Current position used as home 3: Clear home 4: No home, auto home searching after startup	0	☆
B4-10	Home searching mode	Ones place: Incremental 0: No operation Tens place: Absolute 0: Forward searching 1: Reverse searching 2: Forward searching, direction changed automatically in limit switch active mode 3: Reverse searching, direction changed automatically in limit switch active mode Hundreds place: Degree 0: Forward searching 1: Reverse searching Thousands place: Fixed length degree 0: Forward searching 1: Reverse searching	0020	★
B4-11	Home searching speed	0.10 Hz to 50.00 Hz	5.00 Hz	★
B4-12	Home searching acceleration time	0.10s to 600.00s	10.00s	☆
B4-13	Home searching deceleration time	0.10s to 600.00s	10.00s	☆
B4-14	Action after home searching	0: Decelerate to 0 1: Decelerate to 0 and start position control 2: Return to mechanical home 3: Return to mechanical home after relative offset	2	★
B4-15	Home offset (low-order bits)	0–65535	0	★
B4-16	Home offset (high-order bits)	0–16384	0	★
B4-17	Home offset direction	0: Forward 1: Reverse	0	★

Para. Code	Parameter Name	Value Range	Default	Change
B4-18	Home searching time limit	1.00s to 600.00s	30.00s	☆
B4-19	Home deviation threshold	4 pulses to 60000 pulses	100 pulses	☆
B4-20	Home update mode for incremental positioning	0: Update home at zero speed 1: Update home when repositioning is triggered 2: Save unexecuted position reference during running	1	★
B4-21	Judge criteria of approaching the target position	0: Deviation to the target position less than B4-22 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-23 and its output time is longer than or equal to B4-24 1: Deviation to the target position less than B4-22 (unit: determined by B5-26) for the duration longer than then time set by B4-23 and its output time is longer than or equal to B4-24 2: Deviation to the target position less than B4-22 (unit: quadrupled encoder resolution) for the duration longer than the time set by B4-23 and its output time is equal to B4-24 3: Deviation to the target position less than B4-22 (unit: determined by B5-26) for the duration longer than the time set by B4-23 and its output time is equal to B4-24	0	★
B4-22	Threshold of approaching the target position	0 to 60000	500	☆
B4-23	Judge time of approaching the target position	0s to 5.000s	0.005s	☆
B4-24	Output time of approaching the target position	0s to 600.00s	0.05s	☆
B4-25	Target position reference output for approaching the target position	0 to 24	0	★
B4-26	Judge criteria of positioning completion	0: Deviation to the target position less than B4-27 (unit: quadrupled encoder resolution) for the time set by B4-28 and its output time is longer than or equal to B4-29 1: Deviation to the target position less than B4-27 (unit: determined by B5-26) for the time set by B4-28 and its output time is longer than or equal to B4-29 2: Deviation to the target position less than B4-27 (unit: quadrupled encoder resolution) for the time set by B4-28 and its output time is equal to B4-29 3: Deviation to the target position less than B4-27 (unit: determined by B5-26) for the time set by B4-28 and its output time is equal to B4-29	0	★
B4-27	Threshold of positioning completion	0 to 60000	50	☆
B4-28	Judgment time of positioning completion	0s to 5.000s	0.005s	☆
B4-29	Output time of positioning completion	0s to 600.00s	0.05s	☆
B4-30	Target position reference output for positioning completion	0 to 24	0	★
B4-31	Degree position reference unit	0: Encoder resolution (quadrupled) 1: 0.1° (1 revolution corresponding to 360.0°)	0	★
B4-32	Degree position reference source selection	0: B4-33 1: Multi-position reference	0	★
B4-33	Degree position reference digital setting	0 to 60000	0	☆
B4-34	Positioning direction (Degree and fixed length degree)	0: Forward 1: Reverse	0	★
B4-35	Degree positioning direction setting channel	0: Set by B4-34 (Positioning direction) 1: Nearby positioning	1	★
B4-36	Nearby positioning failure speed	0.10 Hz to 10.00 Hz	2.00 Hz	★
B4-37	Speed feedforward gain	0.00% to 100.00%	100.00%	★

Para. Code	Parameter Name	Value Range	Default	Change
B4-38	Position loop proportional gain 1	0.01 to 100.00	1.50	☆
B4-39	Position loop proportional gain 2	0.01 to 100.00	8.00	☆
B4-40	Position loop proportional gain switchover condition	0: No switchover, fixed to position loop proportional gain 1 1: Switchover based on position deviation 2: Switchover based on speed	0	★
B4-41	Deviation 1 for position loop proportional gain switchover	0 to B4-42	20	☆
B4-42	Deviation 2 for position loop proportional gain switchover	B4-41 to 60000	100	☆
B4-43	Frequency 1 for position loop proportional gain switchover	0.00 Hz to B4-44	5.00 Hz	☆
B4-44	Frequency 2 for position loop proportional gain switchover	B4-43 to 500.00 Hz	20.00 Hz	☆
B4-45	Position loop output limit	0.01 Hz to 30.00 Hz	5.00 Hz	☆
B4-46	Positioning deviation threshold	0 to 500	2	☆
B4-47	Reserved	0	0	●
B4-48	Reserved	0	0	●
B4-49	Multi-position reference digital setting	1 to 24	1	☆
B4-50	Multi-position reference running mode	0: Not switched, fixed to the position reference defined by B4-49 1: Switched by DI 2: Operation in sequence for once 3: Cyclic operation 4: Communication	0	★
B4-51	Start segment No. of multi-position reference	1 to B4-52	1	★
B4-52	End segment No. of multi-position reference	B4-51 to 24	1	★
B4-53	Continue multi-position running mode	0: Restart from the start segment 1: Continue the uncompleted position reference segment	1	★
B4-54	Reserved	0	0	●
B4-55	Position control mode	0: Open-loop 1: Closed-loop	1	★
B4-56	Switchover of position control start speed during running	0.50 Hz to 100.00 Hz	10.00 Hz	☆
B4-57	Position control source selection	0: Null (valid for position control) 1: DI (DI-70) 2: Communication (731EH)	0	★
B4-58	Active mode for position control by DI	0: Active low 1: Active high	1	★
B4-59	Repositioning command source selection	0: DI 1: Communication (731EH)	0	★
B4-60	Reserved	0	0	●

Para. Code	Parameter Name	Value Range	Default	Change
B4-61	Position control function 1	Ones: Home retentive at power failure 0: Disable 1: Enable Tens: Home correction 0: Disable 1: Enable Hundreds: Nearby positioning upon startup in fixed length degree mode 0: Disable 1: Enable Thousands: Soft limit 0: Disable 1: Enable Ten thousands: CiA402 protocol 0: Invalid 1: Valid	00010	★
B4-62	Position control function 2	Ones: Whether repositioning is allowed during positioning 0: No 1: Yes Tens: Whether positioning is triggered upon startup 0: No 1: Yes	11	★
B4-63	Soft limit forward position (low-order bits)	0–65535	0	☆
B4-64	Soft limit forward position (high-order bits)	0–16384	0	☆
B4-65	Soft limit reverse position (low-order bits)	0–65535	0	☆
B4-66	Soft limit reverse position (high-order bits)	0–16384	0	☆
B4-67	Home loss threshold during home correction	0 to 1000	0	☆
B4-68	DI limit protection function	0: Coast to stop 1: Decelerate to stop 2: Lock shaft after deceleration to 0	0	★
B4-69	Minimum direction change frequency during limiting	0.10 Hz to 10.00 Hz	1.50 Hz	☆
B4-70	Direction change frequency active time	1 ms to 500 ms	1 ms	☆
B4-71	Position loop gain Kp upon position lock	0.01 to 100.00	1.50	☆
B4-72	Output limit for position loop upon position loop	0.00 Hz to 10.00 Hz	1.00 Hz	☆
B4-73	Position deviation threshold upon position lock	0 to 5000	2	☆
B4-74	Disabling output delay	0.00s to 600.00s	0.05s	☆
Group B5: Multi-position reference				
B5-00	Position control acceleration time 1	0.01s to 600.00s	10.00s	☆
B5-01	Position control deceleration time 1	0.01s to 600.00s	10.00s	☆
B5-02	Position control acceleration time 2	0.01s to 600.00s	10.00s	☆
B5-03	Position control deceleration time 2	0.01s to 600.00s	10.00s	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-04	Position control acceleration time 3	0.01s to 600.00s	10.00s	☆
B5-05	Position control deceleration time 3	0.01s to 600.00s	10.00s	☆
B5-06	Position control acceleration time 4	0.01s to 600.00s	10.00s	☆
B5-07	Position control deceleration time 4	0.01s to 600.00s	10.00s	☆
B5-08	Waiting time 1 of positioning completion	0.00s to 600.00s	0.01s	☆
B5-09	Waiting time 2 of positioning completion	0.00s to 600.00s	0.01s	☆
B5-10	Waiting time 3 of positioning completion	0.00s to 600.00s	0.01s	☆
B5-11	Waiting time 4 of positioning completion	0.00s to 600.00s	0.01s	☆
B5-12	Maximum frequency source selection in position control	0: 100.00% 1: AI1 2: AI2 3: Communication setting (7320H)	0	★
B5-13	Maximum frequency digital setting for position control	1.00 Hz to 600.00 Hz	50.00 Hz	★
B5-14	Position control frequency upper limit 1	0% to 100.00%	50.00%	★
B5-15	Position control frequency upper limit 2	0% to 100.00%	50.00%	★
B5-16	Position control frequency upper limit 3	0% to 100.00%	50.00%	★
B5-17	Position control frequency upper limit 4	0% to 100.00%	50.00%	★
B5-18	Position control frequency upper limit 5	0% to 100.00%	50.00%	★
B5-19	Position control frequency upper limit 6	0% to 100.00%	50.00%	★
B5-20	Position control frequency upper limit 7	0% to 100.00%	50.00%	★
B5-21	Position control frequency upper limit 8	0% to 100.00%	50.00%	★
B5-22	Reserved	0 to 65535	0	●
B5-23	Reserved	0 to 65535	0	●
B5-24	Reserved	0 to 65535	0	●
B5-25	Acceleration/deceleration base frequency in position control	0: F0-10 (Maximum frequency) 1: 50.00 Hz	1	★
B5-26	Position reference unit	0: Pulse (quadrupled encoder resolution) 1: mm 2: cm	0	★
B5-27	Conversion coefficient between reference unit and pulse	0 to 6553.5	1.0	★
B5-28	Multi-position reference 1 (low-order bits)	0 to 65535	0	☆
B5-29	Multi-position reference 1 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-30	Multi-position reference 1 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-31	Multi-position reference 2 (low-order bits)	0 to 65535	0	☆
B5-32	Multi-position reference 2 (high-order bits)	0 to 16384	0	☆
B5-33	Multi-position reference 2 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-34	Multi-position reference 3 (low-order bits)	0 to 65535	0	☆
B5-35	Multi-position reference 3 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-36	Multi-position reference 3 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control speed upper limit 1 2: Position control speed upper limit 2 3: Position control speed upper limit 3 4: Position control speed upper limit 4 5: Position control speed upper limit 5 6: Position control speed upper limit 6 7: Position control speed upper limit 7 8: Position control speed upper limit 8	1110	☆
B5-37	Multi-position reference 4 (low-order bits)	0 to 65535	0	☆
B5-38	Multi-position reference 4 (high-order bits)	0 to 16384	0	☆
B5-39	Multi-position reference 4 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control speed upper limit 1 2: Position control speed upper limit 2 3: Position control speed upper limit 3 4: Position control speed upper limit 4 5: Position control speed upper limit 5 6: Position control speed upper limit 6 7: Position control speed upper limit 7 8: Position control speed upper limit 8	1110	☆
B5-40	Multi-position reference 5 (low-order bits)	0 to 65535	0	☆
B5-41	Multi-position reference 5 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-42	Multi-position reference 5 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-43	Multi-position reference 6 (low-order bits)	0 to 65535	0	☆
B5-44	Multi-position reference 6 (high-order bits)	0 to 16384	0	☆
B5-45	Multi-position reference 6 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-46	Multi-position reference 7 (low-order bits)	0 to 65535	0	☆
B5-47	Multi-position reference 7 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-48	Multi-position reference 7 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-49	Multi-position reference 8 (low-order bits)	0 to 65535	0	☆
B5-50	Multi-position reference 8 (high-order bits)	0 to 16384	0	☆
B5-51	Multi-position reference 8 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-52	Multi-position reference 9 (low-order bits)	0 to 65535	0	☆
B5-53	Multi-position reference 9 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-54	Multi-position reference 9 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-55	Multi-position reference 10 (low-order bits)	0 to 65535	0	☆
B5-56	Multi-position reference 10 (high-order bits)	0 to 16384	0	☆
B5-57	Multi-position reference 10 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-58	Multi-position reference 11 (low-order bits)	0 to 65535	0	☆
B5-59	Multi-position reference 11 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-60	Multi-position reference 11 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-61	Multi-position reference 12 (low-order bits)	0 to 65535	0	☆
B5-62	Multi-position reference 12 (high-order bits)	0 to 16384	0	☆
B5-63	Multi-position reference 12 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-64	Multi-position reference 13 (low-order bits)	0 to 65535	0	☆
B5-65	Multi-position reference 13 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-66	Multi-position reference 13 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-67	Multi-position reference 14 (low-order bits)	0 to 65535	0	☆
B5-68	Multi-position reference 14 (high-order bits)	0 to 16384	0	☆
B5-69	Multi-position reference 14 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-70	Multi-position reference 15 (low-order bits)	0 to 65535	0	☆
B5-71	Multi-position reference 15 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-72	Multi-position reference 15 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-73	Multi-position reference 16 (low-order bits)	0 to 65535	0	☆
B5-74	Multi-position reference 16 (high-order bits)	0 to 16384	0	☆
B5-75	Multi-position reference 16 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-76	Multi-position reference 17 (low-order bits)	0 to 65535	0	☆
B5-77	Multi-position reference 17 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-78	Multi-position reference 17 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-79	Multi-position reference 18 (low-order bits)	0 to 65535	0	☆
B5-80	Multi-position reference 18 (high-order bits)	0 to 16384	0	☆
B5-81	Multi-position reference 18 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-82	Multi-position reference 19 (low-order bits)	0 to 65535	0	☆
B5-83	Multi-position reference 19 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-84	Multi-position reference 19 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-85	Multi-position reference 20 (low-order bits)	0 to 65535	0	☆
B5-86	Multi-position reference 20 (high-order bits)	0 to 16384	0	☆
B5-87	Multi-position reference 20 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-88	Multi-position reference 21 (low-order bits)	0 to 65535	0	☆
B5-89	Multi-position reference 21 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-90	Multi-position reference 21 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-91	Multi-position reference 22 (low-order bits)	0 to 65535	0	☆
B5-92	Multi-position reference 22 (high-order bits)	0 to 16384	0	☆
B5-93	Multi-position reference 22 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-94	Multi-position reference 23 (low-order bits)	0 to 65535	0	☆
B5-95	Multi-position reference 23 (high-order bits)	0 to 16384	0	☆

Para. Code	Parameter Name	Value Range	Default	Change
B5-96	Multi-position reference 23 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆
B5-97	Multi-position reference 24 (low-order bits)	0 to 65535	0	☆
B5-98	Multi-position reference 24 (high-order bits)	0 to 16384	0	☆
B5-99	Multi-position reference 24 setting	Ones: Position reference mark 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 1: Position control acceleration/deceleration time 1 2: Position control acceleration/deceleration time 2 3: Position control acceleration/deceleration time 3 4: Position control acceleration/deceleration time 4 Hundreds: Waiting time after positioning completion 0: No waiting 1: Waiting time 1 after positioning completion 2: Waiting time 2 after positioning completion 3: Waiting time 3 after positioning completion 4: Waiting time 4 after positioning completion Thousands: Position control speed upper limit 1: Position control frequency upper limit 1 2: Position control frequency upper limit 2 3: Position control frequency upper limit 3 4: Position control frequency upper limit 4 5: Position control frequency upper limit 5 6: Position control frequency upper limit 6 7: Position control frequency upper limit 7 8: Position control frequency upper limit 8	1110	☆

◆ Monitoring parameters

Parameter Code	Parameter Name	Minimum Unit	Communication Address
Group U0: Basic Monitoring Parameters			
U0-00	Operating frequency	0.01 Hz	7000H
U0-01	Frequency reference	0.01 Hz	7001H
U0-02	Bus voltage	0.1 V	7002H
U0-03	Output voltage	1 V	7003H
U0-04	Output current	0.1 A	7004H

Parameter Code	Parameter Name	Minimum Unit	Communication Address
U0-05	Output power	0.1 kW	7005H
U0-06	Output torque	0.1%	7006H
U0-07	DI input state	1	7007H
U0-08	DO output state	1	7008H
U0-09	AI1 voltage	0.01 V	7009H
U0-10	AI2 voltage	0.01 V	700AH
U0-11	Motor speed	1 rpm	700BH
U0-12	Counting value	1	700CH
U0-13	Length value	1	700DH
U0-14	Load speed display	1	700EH
U0-15	PID reference	1%	700FH
U0-16	PID feedback	1%	7010H
U0-17	PLC stage	1	7011H
U0-18	Input pulse frequency	0.01 kHz	7012H
U0-19	Feedback frequency	0.01 Hz	7013H
U0-20	Remaining running time	0.1 min	7014H
U0-21	AI1 voltage before correction	0.001 V	7015H
U0-22	AI2 voltage before correction	0.001 V	7016H
U0-24	Linear speed	1 m/min	7018H
U0-25	Current power-on time	1 min	7019H
U0-26	Current operating time	0.1 min	701AH
U0-27	Input pulse frequency	1 Hz	701BH
U0-28	Communication setpoint	0.01%	701CH
U0-29	Encoder feedback frequency	0.01 Hz	701DH
U0-30	Display of main frequency X	0.01 Hz	701EH
U0-31	Display of auxiliary frequency Y	0.01 Hz	701FH
U0-33	Synchronous motor rotor position	0.1°	7021H
U0-34	Motor temperature	1°C	7022H
U0-35	Target torque	0.1%	7023H
U0-37	Power factor angle	0.1°	7025H
U0-39	Target voltage upon V/f separation	1 V	7027H
U0-40	Output voltage upon V/f separation	1 V	7028H
U0-41	DI input state display	1	7029H
U0-42	DO output state display	1	702AH
U0-45	Fault subcode	1	702DH
U0-46	Heatsink temperature	1°C	702EH
U0-47	PTC channel voltage before correction (PT100 and PT1000)	0.001 V	702FH
U0-48	PTC channel voltage after correction (PT100 and PT1000)	0.001 V	7030H
U0-49	Number of position lock deviation pulses	1	7031H

Parameter Code	Parameter Name	Minimum Unit	Communication Address
U0-58	Encoder Z signal counting	1	703AH
U0-59	Frequency reference	0.01%	703BH
U0-60	Operating frequency	0.01%	703CH
U0-61	Drive state 1 (1: Forward running; 2: Reverse running; 3: Stopped; 4: Auto-tuning; 5: Faulty)	1	703DH
U0-62	Fault code	1	703EH
U0-67	Expansion card version	1	7043H
U0-68	Drive state 2	1	7044H
U0-69	Feedback frequency	0.01 Hz	7045H
U0-74	Target torque in torque control mode (after filter time A0-04)	0.1%	704AH
U0-75	Real-time target torque in torque control mode (after acceleration/deceleration time A0-07/A0-08)	0.1%	704BH
U0-76	Target torque upper limit	0.1%	704CH
U0-77	Torque upper limit in generating state	0.1%	704DH
U0-80	EtherCAT slave name (valid after power-on)	1	7050H
U0-81	EtherCAT slave alias (valid after power-on)	1	7051H
U0-82	ESM transmission error code	1	7052H
U0-83	XML file version	1	7053H
U0-84	Number of lost synchronization frames	1	7054H
U0-85	Maximum number of error frames and invalid frames of EtherCAT port 0 per unit time	1	7055H
U0-86	Maximum number of error frames and invalid frames of EtherCAT port 1 per unit time	1	7056H
U0-88	Maximum number of error frames forwarded by EtherCAT port per unit time	1	7058H
U0-89	Maximum number of error frames processed by EtherCAT data frame processing unit per unit time	1	7059H
U0-90	Maximum number of lost links over the EtherCAT port per unit time	1	705AH
U0-91	Station alias backup	1	705BH
Group U1: Tension Monitoring Parameters			
U1-00	Current linear speed	0.1 m/min	7100H
U1-01	Current roll diameter	0.1 mm	7101H
U1-02	Linear speed matching frequency	0.01 Hz	7102H
U1-03	Current tension reference	1 N	7103H
U1-04	Tension after taper calculation	1 N	7104H

Parameter Code	Parameter Name	Minimum Unit	Communication Address
U1-05	Torque calculated by tension	0.1%	7105H
U1-16	Torque set by PID reference	0.1%	7110H
U1-17	Torque set by PID feedback	0.1%	7111H
U1-18	Torque set by PID output	0.1%	7112H
U1-19	Frequency set by PID reference	0.1%	7113H
U1-20	Frequency set by PID feedback	0.1%	7114H
U1-21	Frequency set by PID output	0.01 Hz	7115H
Group U2: Position Control Monitoring Parameters			
U2-60	Real-time position deviation during position control	1	723CH
U2-61	Valid home tag	1	723DH
U2-62	Home position (low 16 bits)	1	723EH
U2-63	Home position (high 16 bits)	1	723FH
U2-64	Z signal position (low 16 bits)	1	7240H
U2-65	Z signal position (high 16 bits)	1	7241H
U2-66	Current position reference	1	7242H
U2-67	Output flag for approaching the target position	1	7243H
U2-68	Positioning completion output flag	1	7244H
U2-69	Position control mode	1	7245H
U2-70	Number of pulses per revolution of encoder	1	7246H
U2-71	Number of pulses per revolution of main shaft	1	7247H
U2-72	Number of pulses per revolution of motor	1	7248H
U2-73	Current encoder degree	1	7249H
U2-74	Current encoder degree (angle)	0.1°	724AH
U2-75	Adjacent home position deviation (low 16 bits)	1	724BH
U2-76	Adjacent home position deviation (high 16 bits)	1	724CH
U2-77	Home counter	1	724DH
U2-78	Position control status	1	724EH
U2-79	Real-time position deviation during position control	1	724FH
U2-80	Relative home position direction	1	7250H
U2-81	Relative home position deviation (low 16 bits)	1	7251H

Parameter Code	Parameter Name	Minimum Unit	Communication Address
U2-82	Relative home position deviation (high 16 bits)	1	7252H
U2-83	Position	1	7253H
U2-84	Speed	1	7254H
U2-85	Current main shaft degree	1	7255H
U2-86	Current main shaft degree (angle)	0.1°	7256H
U2-87	Position control enabling flag	1	7257H
U2-88	Position control enabling command set by communication	1	7258H
U2-89	Position lock enabling flag in position control	1	7259H
U2-90	Frequency upper limit in position control	0.01 Hz	725AH
U2-91	Main shaft static flag	1	725BH
U2-92	Home loss counting during home correction	1	725CH
U2-93	Encoder Z signal counter	1	725DH
U2-95	Number of encoder pulse counts (low 16 bits)	1	725FH
U2-96	Number of encoder pulse counts (high 16 bits)	1	7260H

B.2 Parameter List of the Drive Unit (G53X Models)

Note

- This section applies only to MD810-50M4TXXXG53X drive units.

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F0 Basic Function Parameters					
F0-00	0xF000	G/P type display	1: G type (constant torque load)	1	Unchangeable
F0-01	0xF001	Motor 1 control mode	0: Sensorless vector control (SVC) 1: Feedback vector control (FVC) 2: V/f control	0	At stop
F0-02	0xF002	Command source	0: LCD operating panel/Software 1: Terminal 2: Communication	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F0-03	0xF003	Main frequency X source	0: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, non-retentive upon power failure) 1: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, retentive upon power failure) 2: AI1 3: AI2 5: Pulse reference (DIO1) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Synchronization control	0	At stop
F0-04	0xF004	Auxiliary frequency Y source	0: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, non-retentive upon power failure) 1: Digital setting (preset frequency F0-08 that can be changed by UP or DOWN key, retentive upon power failure) 2: AI1 3: AI2 5: Pulse reference (DIO1) 6: Multi-reference 7: Simple PLC 8: PID 9: Communication 10: Synchronization control	0	At stop
F0-05	0xF005	Base value of range of auxiliary frequency source Y for superposition	0: Relative to the maximum frequency 1: Relative to main frequency X	0	At once
F0-06	0xF006	Range of auxiliary frequency source Y for superposition	0% to 150%	100%	Real time
F0-07	0xF007	Frequency source superposition	Ones: 0: Main frequency X 1: Main and auxiliary frequency operation result (based on tens place) 2: Switchover between main frequency X and auxiliary frequency Y 3: Switchover between main frequency X and the main and auxiliary frequency operation result 4: Switchover between auxiliary frequency Y and the main and auxiliary frequency operation result Tens: 0: Main frequency + auxiliary frequency 1: Main frequency - auxiliary frequency 2: Max. (main frequency, auxiliary frequency) 3: Min. (main frequency, auxiliary frequency) 4: Main frequency x Auxiliary frequency	0	At once
F0-08	0xF008	Preset frequency	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F0-09	0xF009	Running direction	0: Run in the same direction 1: Run in the opposite direction	0	At once
F0-10	0xF00A	Maximum frequency	50.00 Hz to 600.00 Hz	50.00 Hz	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F0-11	0xF00B	Frequency upper limit source	0: F0-12 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication 6: Multi-reference	0	At stop
F0-12	0xF00C	Frequency upper limit	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F0-13	0xF00D	Frequency upper limit offset	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F0-14	0xF00E	Frequency lower limit	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F0-15	0xF00F	Carrier frequency	0.8 kHz to 12.0 kHz	6.0 kHz	Real time
F0-16	0xF010	Carrier frequency change with temperature	0: Disable 1: Enable	1	At once
F0-17	0xF011	Acceleration time 1	0.0s to 6500.0s	20.0s	Real time
F0-18	0xF012	Deceleration time 1	0.0s to 6500.0s	20.0s	Real time
F0-19	0xF013	Acceleration/ Deceleration time unit	0: 1s 1: 0.1s 2: 0.01s	1	At stop
F0-21	0xF015	Auxiliary frequency offset upon superposition	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F0-22	0xF016	Frequency reference resolution	1: 0.1 Hz 2: 0.01 Hz	2	At stop
F0-23	0xF017	Retention of digit-set frequency upon stop	0: Non-retentive 1: Retentive	0	At once
F0-25	0xF019	Base frequency for acceleration/ deceleration time	0: Maximum frequency (F0-10) 1: Frequency reference 2: 100 Hz	0	At stop
F0-26	0xF01A	Base value for frequency adjusted by UP/DOWN key during operation	0: Operating frequency 1: Frequency reference	0	At stop
F0-27	0xF01B	Main frequency coefficient	0.00% to 100.00%	10.00%	Real time
F0-28	0xF01C	Auxiliary frequency coefficient	0.00% to 100.00%	10.00%	Real time
F1: Motor 1 Parameters					
F1-00	0xF100	Motor type	0: Common asynchronous motor 1: Variable frequency asynchronous motor 2: Synchronous motor	0	At stop
F1-01	0xF101	Rated motor power	0.1 kW to 1000.0 kW	3.7 kW	At stop
F1-02	0xF102	Rated motor voltage	1 V to 2000 V	380 V	At stop
F1-03	0xF103	Rated motor current	0.1 A to 6553.5 A	9.0 A	At stop
F1-04	0xF104	Rated motor frequency	0.01 Hz to 655.35 Hz	50.00 Hz	At stop
F1-05	0xF105	Rated motor speed	1 rpm to 65535 rpm	1460 rpm	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F1-06	0xF106	Asynchronous motor stator resistance	0.001 Ω to 65.535 Ω	1.204 Ω	At stop
F1-07	0xF107	Asynchronous motor rotor resistance	0.001 Ω to 65.535 Ω	0.908 Ω	At stop
F1-08	0xF108	Leakage inductive reactance of asynchronous motor	0.01 mH to 655.35 mH	5.28 mH	At stop
F1-09	0xF109	Mutual inductive reactance of asynchronous motor	0.1 mH to 6553.5 mH	158.6 mH	At stop
F1-10	0xF10A	No-load current of asynchronous motor	0.1 A to 6553.5 A	4.2 A	At stop
F1-11	0xF10B	Core saturation coefficient 1 of asynchronous motor	50.0% to 100.0%	86.0%	Real time
F1-12	0xF10C	Core saturation coefficient 2 of asynchronous motor	100.0% to 150.0%	130.0%	Real time
F1-13	0xF10D	Core saturation coefficient 3 of asynchronous motor	100.0% to 170.0%	140.0%	Real time
F1-14	0xF10E	Core saturation coefficient 4 of asynchronous motor	100.0% to 180.0%	150.0%	Real time
F1-15	0xF10F	PG2 encoder mode	0: Pulse input 1: Speed feedback	0	At stop
F1-17	0xF111	Axis D inductance of synchronous motor	0.01 mH to 655.35 mH	15.86 mH	At stop
F1-18	0xF112	Axis Q inductance of synchronous motor	0.01 mH to 655.35 mH	15.86 mH	At stop
F1-19	0xF113	Synchronous motor back EMF coefficient	0.1 V to 6553.5 V	300.0 V	At stop
F1-20	0xF114	Frequency division source	0: ABZ1 1: ABZ2 2: 23-bit encoder 3: Sin-cos encoder 4: SSI encoder	0	At stop
F1-21	0xF115	Number of waves per revolution of sin-cos encoder	1 to 65535	100	At stop
F1-22	0xF116	PG2 encoder pulses per revolution	1 to 20000	1024	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F1-23	0xF117	PG2 encoder type	0: ABZ incremental encoder 1: 23-bit encoder 2: Sin-cos encoder 3: SSI encoder 4: Reserved 5: Reserved	0	At stop
F1-26	0xF11A	Direction auto-tuning (inertia auto-tuning and synchronous motor)	0 to 1	1	At stop
F1-27	0xF11B	PG1 encoder pulses per revolution	1 to 20000	1024	At stop
F1-28	0xF11C	PG1 encoder type	0: ABZ incremental encoder 1: Reserved	0	At stop
F1-29	0xF11D	PG signal filter	0: Non-adaptive filter 1: Adaptive filter 2: Fixed interlock 3: Auto interlock	1	At stop
F1-30	0xF11E	Encoder wiring flag	Ones: Direction of AB signal or direction of rotation Tens: Reserved	0	At stop
F1-31	0xF11F	Encoder zero position angle	0.0° to 359.9°	0.0°	At stop
F1-32	0xF120	Numerator of motor gear ratio	1 to 65535	1	At stop
F1-33	0xF121	Denominator of motor gear ratio	1 to 65535	1	At stop
F1-35	0xF123	Encoder frequency division coefficient	0 to 63	1	Unchangeable
F1-36	0xF124	PG disconnection detection	0: Enable 1: Disable	1	At stop
F1-37	0xF125	Auto-tuning selection	0: No auto-tuning 1: Static auto-tuning of asynchronous motor 2: Complete auto-tuning of asynchronous motor 3: With-load complete auto-tuning of asynchronous motor 4: Inertia auto-tuning of asynchronous motor (applicable only to FVC mode) 11: No-load partial auto-tuning of synchronous motor (excluding back EMF) 12: Dynamic no-load auto-tuning of synchronous motor 13: Complete static auto-tuning of synchronous motor 14: Inertia auto-tuning of synchronous motor (applicable only to FVC mode)	0	At stop
F1-38	0xF126	SSI encoder baud rate selection	0: 2 Mbps 1: 1 Mbps 2: 500 kbps 3: 250 kbps	1	At stop
F1-39	0xF127	Number of SSI encoder single-turn bits	1 to 255	12	At stop
F1-40	0xF128	Number of SSI encoder multi-turn bits	1 to 255	12	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F1-41	0xF129	SSI encoder data format	0: Binary 1: Gray code	0	At stop
F1-42	0xF12A	PG1 signal filter	0: Non-adaptive filter 1: Adaptive filter 2: Fixed interlock 3: Auto interlock	1	At stop
F1-43	0xF12B	PG2 signal filter	0: Non-adaptive filter 1: Adaptive filter 2: Fixed interlock 3: Auto interlock	1	At stop
F1-44	0xF12C	Number of SSI encoder error bits	0 to 255	3	At stop
F1-45	0xF12D	SSI encoder full closed loop	0 to 1	0	At stop
F1-46	0xF12E	Absolute encoder frequency division coefficient	0 to 65535	1024	At stop
F1-47	0xF12F	SSI encoder type	0: Common SSI encoder 1: Laser ranging SSI encoder	0	At stop
F1-48	0xF130	SSI encoder full closed loop direction	0: Forward 1: Reverse	0	At stop
F2: Vector Control Parameters of Motor 1					
F2-00	0xF200	Low-speed speed loop Kp	1 to 200	30	At once
F2-01	0xF201	Low-speed speed loop Ti	0.001s to 10.000s	0.500s	Real time
F2-02	0xF202	Switchover frequency 1	0.00 Hz to 655.35 Hz	5.00 Hz	Real time
F2-03	0xF203	High-speed speed loop Kp	1 to 200	20	At once
F2-04	0xF204	High-speed speed loop Ti	0.001s to 10.000s	1.000s	Real time
F2-05	0xF205	Switchover frequency 2	0.00 Hz to 655.35 Hz	10.00 Hz	Real time
F2-06	0xF206	VC slip compensation adjustment	50% to 200%	100%	Real time
F2-07	0xF207	Speed feedback filter time	0.000s to 0.100s	0.004s	Real time
F2-08	0xF208	VC deceleration over-excitation gain	0 to 200	64	At once
F2-09	0xF209	Torque upper limit source in speed control (motoring)	0: F2-10 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication 6: Min. (AI1, AI2) 7: Max. (AI1, AI2)	0	At once
F2-10	0xF20A	Digital setting of torque upper limit in speed control (motoring)	0.0% to 200.0%	150.0%	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F2-11	0xF20B	Torque upper limit source in speed control (generating)	0: F2-10 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) 8: F2-12	0	At once
F2-12	0xF20C	Digital setting of torque upper limit in speed control (generating)	0.0% to 200.0%	150.0%	Real time
F2-13	0xF20D	Current loop Kp adjustment at low speed	0.1 to 10.0	1.0	At once
F2-14	0xF20E	Current loop Ki adjustment at low speed	0.1 to 10.0	1.0	At once
F2-15	0xF20F	Current loop Kp adjustment at high speed	0.1 to 10.0	1.0	At once
F2-16	0xF210	Current loop Ki adjustment at high speed	0.1 to 10.0	1.0	At once
F2-17	0xF211	Speed loop Kp upon zero speed lock	1 to 100	30	At once
F2-18	0xF212	Speed loop Ti upon zero speed lock	0.001 to 10.000	0.500s	Real time
F2-20	0xF214	Speed loop switching frequency upon zero speed lock	0.00 Hz to 655.35 Hz	0.05 Hz	Real time
F2-21	0xF215	Maximum output voltage coefficient	100 to 110	100	At once
F2-22	0xF216	Output voltage filter time	0.000s to 0.010s	0.000s	Real time
F2-23	0xF217	Zero speed lock	0: Enable 1: Disable	0	At stop
F2-24	0xF218	Vector overvoltage stall suppression Kp	0 to 1000	40	At once
F2-25	0xF219	Acceleration compensation gain	0 to 200	50	Unchangeable
F2-26	0xF21A	Acceleration compensation filter time	0 to 500	10	Unchangeable
F2-27	0xF21B	Vector overvoltage stall suppression	0: Enable 1: Disable	1	At once
F2-28	0xF21C	Cut-off frequency for torque reference filter	50 Hz to 1000 Hz	500 Hz	Real time
F2-29	0xF21D	Detected current at initial position angle of synchronous motor	50 to 180	80	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F2-30	0xF21E	Auto-calculation of speed loop parameters	0: Enable 1: Disable	0	At stop
F2-31	0xF21F	Expected speed loop bandwidth (high speed)	1.0 Hz to 200.0 Hz	10.0 Hz	Real time
F2-32	0xF220	Expected speed loop bandwidth (low speed)	1.0 Hz to 200.0 Hz	10.0 Hz	Real time
F2-33	0xF221	Expected speed loop bandwidth (zero speed)	1.0 Hz to 200.0 Hz	10.0 Hz	Real time
F2-34	0xF222	Expected speed loop damping ratio (unchanged generally)	0.100 to 65.000	1.000	At once
F2-35	0xF223	System inertia (equivalent to start time)	0.001s to 50.000s	0.001s	At stop
F2-36	0xF224	Single motor inertia ($kg*m^2$)	0.001 to 50.000	0.001	At stop
F2-43	0xF22B	Inertia auto-tuning and dynamic speed reference	0 to 100	30	At stop
F2-47	0xF22F	Inertia auto-tuning	0: Enable 1: Disable	0	At stop
F2-48	0xF230	Speed loop bandwidth reference in inertia auto-tuning	0.1 Hz to 100.0 Hz	10.0 Hz	At stop
F2-50	0xF232	Inertia auto-tuning mode	0: Acceleration/deceleration mode 1: Triangular wave mode	0	At stop
F2-51	0xF233	Acceleration/ Deceleration coefficient of inertia auto-tuning	0.1 to 10.0	1.0	At stop
F2-52	0xF234	Decoupling control	0: Enable 1: Disable	0	At stop
F2-53	0xF235	Generating power limit	0: Enable 1: Disable	0	At stop
F2-54	0xF236	Generating power limit threshold	0.0% to 200.0%	0.0%	At stop
F3 V/f Control Parameters					
F3-00	0xF300	V/f curve setting	0: Straight-line V/f curve 1: Multi-point V/f curve 2: Square V/f curve 3: V/f curve (1.2th power) 4: V/f curve (1.4th power) 6: V/f curve (1.6th power) 8: V/f curve (1.8th power) 10: V/f complete separation 11: V/f half separation	0	At stop
F3-01	0xF301	Torque boost	0.0% to 30.0%	0.0%	Real time
F3-02	0xF302	Cut-off frequency of torque boost	0.00 Hz to 655.35 Hz	50.00 Hz	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F3-03	0xF303	Frequency 1 on multi-point V/f curve	0.00 Hz to 655.35 Hz	0.00 Hz	At stop
F3-04	0xF304	Voltage 1 on multi-point V/f curve	0.0% to 100.0%	0.0%	At stop
F3-05	0xF305	Frequency 2 on multi-point V/f curve	0.00 Hz to 655.35 Hz	0.00 Hz	At stop
F3-06	0xF306	Voltage 2 on multi-point V/f curve	0.0% to 100.0%	0.0%	At stop
F3-07	0xF307	Frequency 3 on multi-point V/f curve	0.00 Hz to 655.35 Hz	0.00 Hz	At stop
F3-08	0xF308	Voltage 3 on multi-point V/f curve	0.0% to 100.0%	0.0%	At stop
F3-09	0xF309	V/f slip compensation gain	0.0% to 200.0%	0.0%	Real time
F3-10	0xF30A	V/f over-excitation gain	0 to 200	64	At once
F3-11	0xF30B	V/f oscillation suppression gain	0 to 100	0	At once
F3-12	0xF30C	Oscillation suppression gain mode	0: Invalid 3: Valid	3	At stop
F3-13	0xF30D	Voltage source for V/f separation	0: F3-14 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Multi-reference 6: Simple PLC 7: PID 8: Communication	0	At once
F3-14	0xF30E	Voltage digital setting for V/f separation	0 V to 65535 V	0 V	Real time
F3-15	0xF30F	Voltage acceleration time for V/f separation	0.0s to 1000.0s	0.0s	Real time
F3-16	0xF310	Voltage deceleration time for V/f separation	0.0s to 1000.0s	0.0s	Real time
F3-17	0xF311	Stop mode for V/f separation	0: The frequency and the voltage decline to 0 separately. 1: Te frequency declines to 0 after the voltage declines to 0.	0	At stop
F3-18	0xF312	Action current for V/f overcurrent stall	50% to 200%	150%	At stop
F3-19	0xF313	V/f overcurrent stall suppression	0: Enable 1: Disable	1	At stop
F3-20	0xF314	V/f overcurrent stall suppression gain	0 to 100	20	At once
F3-21	0xF315	Current compensation coefficient for V/f overcurrent stall action at multiplied rated frequency	50 to 200	50	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F3-22	0xF316	Action voltage for V/f overvoltage stall suppression	650.0 V to 800.0 V	770.0 V	At stop
F3-23	0xF317	V/f overvoltage stall suppression	0: Enable 1: Disable	1	At stop
F3-24	0xF318	Frequency gain for V/f overvoltage stall suppression	0 to 100	30	At once
F3-25	0xF319	Voltage gain for V/f overvoltage stall suppression	0 to 100	30	At once
F3-26	0xF31A	Frequency rise threshold for overvoltage stall suppression	0 to 50	5	At stop
F3-27	0xF31B	Slip compensation time constant	0.1 to 10.0	0.5	At once
F3-28	0xF31C	Automatic frequency rise	0: Enable 1: Disable	0	At stop
F3-29	0xF31D	Minimum motoring torque current	10 to 100	50	At stop
F3-30	0xF31E	Maximum generating torque current	10 to 100	20	At stop
F3-31	0xF31F	Automatic frequency rise Kp	0 to 100	50	At once
F3-32	0xF320	Automatic frequency rise Ki	0 to 100	50	At once
F3-33	0xF321	Online torque compensation gain	80 to 150	100	At stop
F4 Input Terminals					

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-00	0xF400	DI1 function selection	0: No function 1: Forward running (FWD) 2: Reverse running (REV) 3: Three-wire motion control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Function as the UP key 7: Function as the DOWN key 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 source switchover 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Running command switchover 21: Acceleration/deceleration inhibition 22: PID pause 23: PLC status reset 24: Wobble pause 25: Counter input (DIO1) 26: Counter reset 27: Length count input (DIO1) 28: Length reset 29: Torque control inhibition 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enabling	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-00	0xF400	DI1 function selection	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 source X and preset frequency 40: Switchover between auxiliary frequency Y and preset frequency 42: Position lock 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 (to be continued)	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-00	0xF400	DI1 function selection	(continued) 46: Speed control/Torque control switchover 47: Emergency stop 48: External STOP terminal 2 49: Deceleration DC braking 50: Clear the current running time 51: Switchover between two-wire mode and three-wire mode 54: Roll diameter reset 55: Initial roll diameter 1 56: Initial diameter diameter 2 57: Pre-driving 58: Switchover between winding and unwinding 59: Roll diameter calculation stop 60: Exit tension mode 61: Speed limit reversed 62: Revolution count reset 63: DI operation enabling 64: Position/Speed synchronization switchover 65: Pulse position increment 66: Pulse position decrement 67: Clear position synchronization deviation 68: Position control DI home input 69: Position control home search 70: Positioning control pause 71: Switch to position control 72: Switch to position control (forward run command) 73: Switch to position control (reverse run command) 74: Reserved 75: Multi-position selection 1 76: Multi-position selection 2 77: Multi-position selection 3	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-00	0xF400	DI1 function selection	78: Multi-position selection 4 79: Multi-position selection 5 80: Positive limit switch 81: Negative limit switch 82: Switch to incremental positioning 83: Switch to absolute positioning 84: Switch to degree positioning 85: Switch to degree positioning with fixed length 86: Re-positioning control command 87: Pulse synchronization switchover (pulse speed-pulse position switchover) 88: Pulse position control (with command)	1	At stop
F4-01	0xF401	DI2 function selection	Same as F4-00	4	At stop
F4-02	0xF402	DI3 function selection	Same as F4-00	9	At stop
F4-03	0xF403	DIO1 function selection	Same as F4-00	12	At stop
F4-04	0xF404	DIO2 function selection	Same as F4-00	13	At stop
F4-10	0xF40A	DI filter time	0.000s to 1.000s	0.010s	Real time
F4-11	0xF40B	Terminal command mode	0: Two-wire mode 1 1: Two-wire mode 2 2: Three-wire mode 1 3: Three-wire mode 2	0	At stop
F4-12	0xF40C	Step value of the terminal functioning as UP/DOWN keys	0.001 Hz/s to 65.535 Hz/s	1.000 Hz/s	Real time
F4-13	0xF40D	Minimum input of AI curve 1	-10.00 V to 327.67 V	-10.00 V	Real time
F4-14	0xF40E	Percentage corresponding to minimum input of AI curve 1	-100.0% to 100.0%	-100.0%	Real time
F4-15	0xF40F	Maximum input of AI curve 1	0.00 V to 10.00 V	10.00 V	Real time
F4-16	0xF410	Percentage corresponding to maximum input of AI curve 1	-100.0% to 100.0%	100.0%	Real time
F4-17	0xF411	AI1 filter time	0.00 to 10.00	0.10s	Real time
F4-18	0xF412	Minimum input of AI curve 2	0.00 V to 655.35 V	0.00 V	Real time
F4-19	0xF413	Percentage corresponding to minimum input of AI curve 2	-100.0% to 100.0%	0.0%	Real time
F4-20	0xF414	Maximum input of AI curve 2	0.00 V to 10.00 V	10.00 V	Real time
F4-21	0xF415	Percentage corresponding to maximum input of AI curve 2	-100.0% to 100.0%	100.0%	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-22	0xF416	AI2 filter time	0.00 to 10.00	0.10s	Real time
F4-23	0xF417	Minimum input of AI curve 3	0.00 V to 655.35 V	0.00 V	Real time
F4-24	0xF418	Percentage corresponding to minimum input of AI curve 3	-100.0% to 100.0%	0.0%	Real time
F4-25	0xF419	Maximum input of AI curve 3	0.00 V to 10.00 V	10.00 V	Real time
F4-26	0xF41A	Percentage corresponding to maximum input of AI curve 3	-100.0% to 100.0%	100.0%	Real time
F4-28	0xF41C	Pulse minimum input	0.00 kHz to 655.35 kHz	0.00 kHz	Real time
F4-29	0xF41D	Percentage corresponding to pulse minimum input	-100.0% to 100.0%	0.0%	Real time
F4-30	0xF41E	Pulse maximum input	0.00 kHz to 100.00 kHz	50.00 kHz	Real time
F4-31	0xF41F	Percentage corresponding to pulse maximum input	-100.0% to 100.0%	100.0%	Real time
F4-32	0xF420	Pulse filter time	0.00s to 10.00s	0.10s	Real time
F4-33	0xF421	AI curve selection	Ones: 1: Curve 1 (2 points) 2: Curve 2 (2 points) 3: Reserved 4: Curve 4 (4 points) 5: Curve 5 (4 points) Tens: 1: Curve 1 (2 points) 2: Curve 2 (2 points) 3: Reserved 4: Curve 4 (4 points) 5: Curve 5 (4 points) Hundreds: 1: Curve 1 (2 points) 2: Curve 2 (2 points) 3: Reserved 4: Curve 4 (4 points) 5: Curve 5 (4 points)	321	At once
F4-34	0xF422	Selection when AI value < minimum input value	Ones: 0: Corresponding to the minimum input 1: 0.0% Tens: 0: Corresponding to the minimum input 1: 0.0% Hundreds: 0: Corresponding to the minimum input 1: 0.0%	0	At once
F4-35	0xF423	DI1 delay time	0.0s to 3600.0s	0.0s	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F4-36	0xF424	DI2 delay time	0.0s to 3600.0s	0.0s	Real time
F4-37	0xF425	DI3 delay time	0.0s to 3600.0s	0.0s	Real time
F4-38	0xF426	DI active status setting 1	Ones: 0: Active high 1: Active low Tens: 0: Active high 1: Active low Hundreds: 0: Active high 1: Active low Thousands: 0: Active high 1: Active low Ten thousands: 0: Active high 1: Active low	0	At stop
F4-40	0xF428	AI2 input type	0: Voltage input 1: Current input (input impedance 500 Ω) 2: Current input (input impedance 250 Ω)	0	At stop
F4-41	0xF429	DIO type	Ones: DI/PULSE 1: DO Tens: 0: DI 1: DO/FMP	0	At stop
F5 Output Terminals					
F5-00	0xF500	FM terminal output mode	0: Pulse output (FMP) 1: Digital output (FMR)	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F5-01	0xF501	FMR output function selection	0: No output 1: AC Drive running 2: Fault output (stop upon fault) 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: PLC cycle completed 12: Cumulative running time reach 13: Frequency limited 14: Torque limited 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (related to operation) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (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 reach 31: AI1 input limit exceeded 32: AC drive output load loss 33: Reverse running 34: Zero current state 35: Module temperature reach (to be continued)	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F5-01	0xF501	FMR output function selection	(continued) 36: Output current limit exceeded 37: Frequency lower limit reach (output at stop) 38: Output upon abnormality (direct output upon fault or alarm) 39: Current over-temperature warning 40: Current running time reach 41: Fault output 2 42: Fault output 3 43: Position lock enabled 44: Process 1 45: Process 2 46: Process 3 47: Process 4 48: Process 5 49: Process 6 50: Process 7	0	At once
F5-02	0xF502	Relay function selection	0: No output 1: AC Drive running 2: Fault output (stop upon fault) 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: PLC cycle completed 12: Cumulative running time reach 13: Frequency limited 14: Torque limited 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (related to operation) 19: Undervoltage status output 20: Communication 23: Zero-speed running 2 (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 reach 31: AI1 input limit exceeded (to be continued)	2	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F5-02	0xF502	Relay function selection	(continued) 32: AC drive output 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: Output upon abnormality (direct output upon fault or alarm) 39: Current over-temperature warning 40: Current running time reach 41: Fault output 2 42: Fault output 3 43: Position lock enabled 44: Process 1 45: Process 2 (brake relay signal output) 46: Process 3 47: Process 4 48: Process 5 49: Process 6 50: Process 7	2	At once
F5-04	0xF504	DO1 output function selection	0: No output 1: AC Drive running 2: Fault output (stop upon fault) 3: Frequency level detection FDT1 output 4: Frequency reach 5: Zero-speed running (no output at stop) 6: Motor overload warning 7: AC drive overload warning 8: Set count value reach 9: Designated count value reach 10: Length reach 11: PLC cycle completed 12: Cumulative running time reach 13: Frequency limited 14: Torque limited 15: Ready to run 16: AI1 > AI2 17: Frequency upper limit reach 18: Frequency lower limit reach (related to operation) 19: Undervoltage output 20: Communication 23: Zero-speed running 2 (at stop) 24: Cumulative power-on time reach 25: Frequency level detection FDT2 output 26: Frequency 1 reach 27: Frequency 2 reach (to be continued)	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F5-04	0xF504	DO1 output function selection	(continued) 28: Current 1 reach 29: Current 2 reach 30: Timing reach 31: AI1 input limit exceeded 32: AC drive output 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: Output upon abnormality (direct output upon fault or alarm) 39: Current over-temperature warning 40: Current running time reach 41: Fault output 2 42: Fault output 3 43: Position lock enabled 44: Process 1 45: Process 2 46: Process 3 47: Process 4 48: Process 5 49: Process 6 50: Process 7	0	At once
F5-06	0xF506	FMR output function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Pulse input (100.0% corresponds to 50.0 kHz) 7: AI1 8: AI2 10: Length 11: Counting value 12: Communication 13: Motor speed 14: Output current (100.0% corresponds to 1000.0 A) 15: Output voltage (100.0% corresponds to 1000.0 V) 16: Output torque (directional)	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F5-07	0xF507	AO1 output function selection	0: Operating frequency 1: Frequency reference 2: Output current 3: Output torque 4: Output power 5: Output voltage 6: Pulse input (100.0% corresponds to 100.0 kHz) 7: AI1 8: AI2 10: Length 11: Counting value 12: Communication 13: Motor speed 14: Output current (100.0% corresponds to 1000.0 A) 15: Output voltage (100.0% corresponds to 1000.0 V) 16: Output torque (directional)	0	At once
F5-09	0xF509	Maximum frequency of FMP output	0.01 kHz to 100.00 kHz	50.00 kHz	Real time
F5-10	0xF50A	AO1 zero offset coefficient	-100.0% to 100.0%	0.0%	Real time
F5-11	0xF50B	AO1 gain	-10.00 to 10.00	1.00	At once
F5-17	0xF511	FMR output delay	0.0s to 3600.0s	0.0s	Real time
F5-18	0xF512	Relay output delay	0s to 65535s	0s	Real time
F5-20	0xF514	DO1 output delay	0.0s to 3600.0s	0.0s	Real time
F5-22	0xF516	DO valid status selection	Ones: 0: Positive logic 1: Negative logic Tens: 0: Positive logic 1: Negative logic Hundreds: Thousands: 0: Positive logic 1: Negative logic Ten thousands:	0	At once
F5-23	0xF517	AO1 mode selection	0: Voltage output 1: Current output	0	At stop
F6 Start/Stop Control Parameters					
F6-00	0xF600	Start mode	0: Direct start 1: Flying start (asynchronous motor) 2: Vector pre-excitation start (asynchronous motor)	0	At once
F6-01	0xF601	Frequency for flying start mode	0: From frequency at stop 1: From 50 Hz 2: From the maximum frequency	0	At stop
F6-02	0xF602	Flying start speed	1 to 100	20	At once
F6-03	0xF603	Start frequency	0.00 Hz to 10.00 Hz	0.00 Hz	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F6-04	0xF604	Start frequency holding time	0.0s to 100.0s	0.0s	At stop
F6-05	0xF605	Start DC braking current/Pre-excitation current	0% to 100%	0%	At stop
F6-06	0xF606	Start DC braking time/Pre-excitation time	0.0s to 100.0s	0.0s	At stop
F6-07	0xF607	Acceleration/Deceleration mode	0: Linear acceleration/deceleration 1: S-curve acceleration/deceleration	0	At stop
F6-08	0xF608	Time proportion of S-curve start segment	0.0% to 6553.5%	30.0%	At stop
F6-09	0xF609	Time proportion of S-curve end segment	0.0% to 6553.5%	30.0%	At stop
F6-10	0xF60A	Stop mode	0: Decelerate to stop 1: Coast to stop	0	At once
F6-11	0xF60B	DC braking/Position lock start frequency for stop	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F6-12	0xF60C	Waiting time of DC braking for stop	0.0s to 100.0s	0.0s	Real time
F6-13	0xF60D	DC braking current for stop	0% to 100%	0%	Real time
F6-14	0xF60E	DC braking time for stop	0.0s to 100.0s	0.0s	Real time
F6-15	0xF60F	Braking usage rate	0% to 100%	100%	At stop
F6-16	0xF610	Closed-loop current Kp of flying start	0 to 1000	500	At once
F6-17	0xF611	Closed-loop current Ki of flying start	0 to 1000	800	At once
F6-18	0xF612	Current of flying start	30 to 200	100	At once
F6-20	0xF614	Voltage rise time of flying start	0.5s to 3.0s	1.0s	Real time
F6-21	0xF615	Demagnetization time	0.00s to 10.00s	1.00s	Real time
F6-22	0xF616	Start pre-torque setting	0.0% to 200.0%	0.0%	Real time
F6-23	0xF617	Operation command from power supply unit	0: Stop according to the value of F6-10 1: Ignore stop command from the power supply unit	0	At stop
F6-24	0xF618	Position lock Kp	0.0 to 100.0	10.0	At once
F6-25	0xF619	Position lock end amplitude	0 to 16383	10	At once
F7: Operating Panel and Display Parameters					
F7-03	0xF703	Parameter 1 displayed on LED operating panel during operation	Bit 1: Running frequency (Hz)	31	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F7-04	0xF704	Parameter 2 displayed on LED operating panel during operation	Bit 1: PID feedback	0	At once
F7-05	0xF705	Parameter displayed on the LED operating panel upon stop	Bit 1: Frequency reference (Hz)	51	At once
F7-06	0xF706	Load speed display coefficient	0.0000 to 6.5000	1.0000	At once
F7-07	0xF707	Drive unit heatsink temperature	0° C to 100° C	0° C	Unchangeable
F7-08	0xF708	Product code	0.0 to 100.0	0.0	Unchangeable
F7-09	0xF709	Cumulative running time	0h to 65535h	0h	Unchangeable
F7-10	0xF70A	Performance software version	0.00 to 0.00	0.00	Unchangeable
F7-11	0xF70B	Function software version	0.00 to 0.00	0.00	Unchangeable
F7-12	0xF70C	Number of decimal places for load speed display	0: 0 decimal place 1: 1 decimal places 2: 2 decimal places 3: 3 decimal places	1	At once
F7-13	0xF70D	Cumulative power-on time	0 h to 65535 h	0h	Unchangeable
F7-14	0xF70E	Cumulative power consumption	0	0	Unchangeable
F7-15	0xF70F	Temporary performance software version	0.00	0.00	Unchangeable
F7-16	0xF710	Temporary function software version	0.00	0.00	Unchangeable
F8 Auxiliary Functions					
F8-00	0xF800	Jog frequency	0.00 Hz to 655.35 Hz	2.00 Hz	Real time
F8-01	0xF801	Acceleration time of jogging	0s to 65000s	200s	Real time
F8-02	0xF802	Deceleration time of jogging	0s to 65000s	200s	Real time
F8-03	0xF803	Acceleration time 2	0s to 65000s	0s	Real time
F8-04	0xF804	Deceleration time 2	0s to 65000s	0s	Real time
F8-05	0xF805	Acceleration time 3	0s to 65000s	0s	Real time
F8-06	0xF806	Deceleration time 3	0s to 65000s	0s	Real time
F8-07	0xF807	Acceleration time 4	0s to 65000s	0s	Real time
F8-08	0xF808	Deceleration time 4	0s to 65000s	0s	Real time
F8-09	0xF809	Jump frequency 1	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-10	0xF80A	Jump frequency 2	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-11	0xF80B	Jump frequency amplitude	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-12	0xF80C	Dead zone time of forward/reverse run switchover	0.0s to 3000.0s	0.0s	Real time
F8-13	0xF80D	Reverse running control	0: Reverse running allowed 1: Reverse running inhibited	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F8-14	0xF80E	Running mode when running frequency is below frequency lower limit	0: Frequency lower limit 1: Stop 2: Run at zero speed	0	At once
F8-16	0xF810	Cumulative power-on time threshold	0 h to 65000 h	0h	Real time
F8-17	0xF811	Cumulative running time threshold	0 h to 65000 h	0h	Real time
F8-18	0xF812	Startup protection	0: Disable 1: Enable	0	At once
F8-19	0xF813	Detection frequency (FDT1)	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F8-20	0xF814	Frequency detection hysteresis (FDT1)	0.0% to 100.0%	5.0%	Real time
F8-21	0xF815	Detection frequency amplitude	0.0% to 100.0%	0.0%	Real time
F8-22	0xF816	Jump frequency state during acceleration/ deceleration	0: Invalid 1: Valid	0	At once
F8-25	0xF819	Frequency for switchover between acceleration time 1 and acceleration time 2	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-26	0xF81A	Frequency for switchover between deceleration time 1 and deceleration time 2	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-27	0xF81B	Jog preference	0: Invalid 1: Valid	0	At once
F8-28	0xF81C	Detection frequency (FDT2)	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F8-29	0xF81D	Frequency detection hysteresis (FDT2)	0.0% to 100.0%	5.0%	Real time
F8-30	0xF81E	Detection frequency 1	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F8-31	0xF81F	Detection frequency amplitude 1	0.0% to 100.0%	0.0%	Real time
F8-32	0xF820	Detection frequency 2	0.00 Hz to 655.35 Hz	50.00 Hz	Real time
F8-33	0xF821	Detection frequency amplitude 2	0.0% to 100.0%	0.0%	Real time
F8-34	0xF822	Zero current detection level	0.0% to 300.0%	5.0%	Real time
F8-35	0xF823	Zero current detection delay	0.01s to 600.00s	0.10s	Real time
F8-36	0xF824	Output current overlimit threshold	0.0% to 300.0%	200.0%	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F8-37	0xF825	Software overcurrent detection delay	0.00s to 600.00s	0.00s	Real time
F8-38	0xF826	Detection current 1	0.0% to 300.0%	100.0%	Real time
F8-39	0xF827	Detection current amplitude 1	0.0% to 300.0%	0.0%	Real time
F8-40	0xF828	Detection current 2	0.0% to 300.0%	100.0%	Real time
F8-41	0xF829	Detection current amplitude 2	0.0% to 300.0%	0.0%	Real time
F8-42	0xF82A	Timing function	0: Invalid 1: Valid	0	At stop
F8-43	0xF82B	Timing operation time setting source	0: F8-44 1: AI1 2: AI2	0	At stop
F8-44	0xF82C	Timing operation duration	0.0 to 6500.0	0.0	At stop
F8-45	0xF82D	Lower limit of AI1 input voltage protection value	0.00 V to 655.35 V	3.10 V	Real time
F8-46	0xF82E	Upper limit of AI1 input voltage protection value	0.00 V to 10.00 V	6.80 V	Real time
F8-47	0xF82F	Module temperature reach	0° C to 100° C	75° C	Real time
F8-48	0xF830	Cooling fan control	0: The cooling fan works when the drive is running. 1: The cooling fan works always.	0	At once
F8-49	0xF831	Wakeup frequency	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-50	0xF832	Wakeup delay	0.0s to 6500.0s	0.0s	Real time
F8-51	0xF833	Hibernation frequency	0.00 Hz to 655.35 Hz	0.00 Hz	Real time
F8-52	0xF834	Hibernation delay	0.0s to 6500.0s	0.0s	Real time
F8-53	0xF835	Current running time threshold	0.0 to 6500.0	0.0	At once
F8-54	0xF836	STO selection	0: STO invalid 1: STO valid	0	At stop
F8-55	0xF837	Deceleration time for emergency stop	0.0s to 6500.0s	0.0s	Real time
F8-56	0xF838	Jogging through LED operating panel	0	0	Unchangeable
F9 Fault and Protection Parameters					
F9-00	0xF900	AC drive overload suppression	0 to 1	0	At once
F9-01	0xF901	Motor overload protection gain	0.20 to 10.00	1.00	At once
F9-02	0xF902	Motor overload warning coefficient	50% to 100%	80%	Real time
F9-06	0xF906	Output phase loss detection before startup	0: Invalid 1: Valid	0%	Real time
F9-07	0xF907	Detection of software short circuit to ground	0: No detection 1: Detection before power-on 2: Detection before running 3: Detection before power-on and running	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-09	0xF909	Number of automatic reset times upon fault	0 to 20	0	At once
F9-10	0xF90A	DO action during automatic reset upon fault	0: The DO does not act 1: The DO acts.	0	At once
F9-11	0xF90B	Time for automatic reset upon fault	0.1s to 100.0s	1.0s	Real time
F9-12	0xF90C	Hardware short circuit to ground	0: Enable 1: Disable	1	Unchangeable
F9-14	0xF90E	Type of the 1st fault	0 to 99	0	Unchangeable
F9-15	0xF90F	Type of the 2nd fault	0 to 99	0	Unchangeable
F9-16	0xF910	Type of the 3rd (latest) fault	0 to 99	0	Unchangeable
F9-17	0xF911	Frequency upon the 3rd (latest) fault	0.00 Hz	0.00 Hz	Unchangeable
F9-18	0xF912	Current upon the 3rd (latest) fault	0.0 A	0.0 A	Unchangeable
F9-19	0xF913	Bus voltage upon the 3rd (latest) fault	0.0 V	0.0 V	Unchangeable
F9-20	0xF914	DI state upon the 3rd (latest) fault	0	0	Unchangeable
F9-21	0xF915	DO state upon the 3rd (latest) fault	0	0	Unchangeable
F9-22	0xF916	AC drive state upon the 3rd (latest) fault	0	0	Unchangeable
F9-23	0xF917	Power-on time upon the 3rd (latest) fault	0	0	Unchangeable
F9-24	0xF918	Running time upon the 3rd (latest) fault	0	0	Unchangeable
F9-25	0xF919	IGBT temperature upon the 3rd (latest) fault	0.0°C	0.0° C	Unchangeable
F9-26	0xF91A	Fault subcode of the 3rd (latest) fault	0	0	Unchangeable
F9-27	0xF91B	Frequency upon the 2nd fault	0.00 Hz	0.00 Hz	Unchangeable
F9-28	0xF91C	Current upon the 2nd fault	0.0 A	0.0 A	Unchangeable
F9-29	0xF91D	Bus voltage upon the second fault	0.0 V	0.0 V	Unchangeable
F9-30	0xF91E	Input terminal state upon the 2nd fault	0	0	Unchangeable
F9-31	0xF91F	Output terminal state upon the 2nd fault	0	0	Unchangeable
F9-32	0xF920	AC drive state upon the 2nd fault	0	0	Unchangeable
F9-33	0xF921	Power-on time upon the 2nd fault	0	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-34	0xF922	Running time upon the 2nd fault	0	0	Unchangeable
F9-35	0xF923	IGBT temperature upon the 2nd fault	0.0°C	0.0° C	Unchangeable
F9-36	0xF924	Fault subcode of the 2nd fault	0	0	Unchangeable
F9-37	0xF925	Frequency upon the 1st fault	0.00 Hz	0.00 Hz	Unchangeable
F9-38	0xF926	Current upon the 1st fault	0.0 A	0.0 A	Unchangeable
F9-39	0xF927	Bus voltage upon the 1st fault	0.0 V	0.0 V	Unchangeable
F9-40	0xF928	Input terminal state upon the 1st fault	0	0	Unchangeable
F9-41	0xF929	Output terminal state upon the 1st fault	0	0	Unchangeable
F9-42	0xF92A	AC drive state upon the 1st fault	0	0	Unchangeable
F9-43	0xF92B	Power-on time upon the 1st fault	0	0	Unchangeable
F9-44	0xF92C	Running time upon the 1st fault	0	0	Unchangeable
F9-45	0xF92D	IGBT temperature upon the 1st fault	0.0°C	0.0° C	Unchangeable
F9-46	0xF92E	Fault subcode of the 1st fault	0	0	Unchangeable
F9-48	0xF930	Fault protection action selection 1	Ones: E11 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Tens: Reserved 5: Cancel Hundreds: E13 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Thousands: E14 0: Coast to stop Ten thousands: E15 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel	10050	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-49	0xF931	Fault protection action selection 2	Ones: E16 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Tens: Reserved 5: Cancel Hundreds: Reserved 0: Coast to stop Thousands: E19 0: Coast to stop 4: Alarm 5: Cancel Ten thousands: E20 0: Coast to stop 4: Alarm 5: Cancel	50	At stop
F9-50	0xF932	Fault protection action selection 3	Ones: E21 0: Coast to stop Tens: E22 0: Coast to stop 5: Cancel Hundreds: E23 0: Coast to stop 5: Cancel Thousands: E24 0: Coast to stop 5: Cancel Ten thousands: E25 2: Decelerate to stop	25000	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-51	0xF933	Fault protection action selection 4	Ones: E26 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Tens: E27 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Hundreds: E28 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Thousands: E29 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Ten thousands: E30 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel	51111	At stop
F9-52	0xF934	Fault protection action selection 5	Ones: E31 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Tens: Reserved 0: Coast to stop Hundreds: E41 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Thousands: E42 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Ten thousands: E43 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel	101	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-53	0xF935	Fault protection action selection 6	Ones: E45 0: Coast to stop 1: Decelerate to stop 4: Alarm 5: Cancel Tens: Reserved 0: Coast to stop Hundreds: Reserved 5: Cancel Thousands: Reserved 5: Cancel Ten thousands: Fan fault 0: Coast to stop 1: Decelerate to stop 2: Cancel	5500	At stop
F9-54	0xF936	Frequency for continuing to run upon fault	0: Current running frequency 1: Frequency reference 2: Frequency upper limit 3: Frequency lower limit 4: Backup frequency upon abnormality	1	At once
F9-55	0xF937	Backup frequency reference upon error	60.0% to 100.0%	100.0%	Real time
F9-56	0xF938	Motor temperature sensor type	0: No temperature sensor (AI1 used as AI input) 1: PT100 2: PT1000	0	At once
F9-57	0xF939	Motor over-temperature protection threshold	0° C to 200° C	110° C	Real time
F9-58	0xF93A	Motor over-temperature alarm threshold	0° C to 200° C	90° C	Real time
F9-59	0xF93B	Power dip ride-through action	0: Invalid 1: Deceleration 2: Decelerate to stop	0	At stop
F9-60	0xF93C	Voltage threshold for pausing power dip ride-through	80% to 100%	85%	Real time
F9-61	0xF93D	Time threshold for voltage recovery from power dip ride-through	0.0s to 100.0s	0.5s	Real time
F9-62	0xF93E	Threshold for enabling power dip ride-through	60% to 100%	80%	Real time
F9-64	0xF940	Load loss detection level	0.0% to 100.0%	10.0%	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F9-65	0xF941	Load loss detection time	0.0 to 60.0	1.0s	Real time
F9-67	0xF943	Overspeed detection level	0.0% to 50.0%	5.0%	Real time
F9-68	0xF944	Overspeed detection time	0.0 to 60.0	1.0	At once
F9-69	0xF945	Detection level for excessive speed deviation	0.0% to 50.0%	20.0%	Real time
F9-70	0xF946	Detection time for excessive speed deviation	0.0 to 60.0	5.0s	Real time
F9-71	0xF947	Power dip ride-through gain	0 to 100	40	At once
F9-72	0xF948	Power dip ride-through integral	0 to 100	30	At once
F9-73	0xF949	Deceleration time of power dip ride-through	0.0–300.0s	20.0s	Real time
Group FA: Process Control PID Function					
FA-00	0xFA00	PID reference source	0: FA-01 1: AI1 2: AI2 4: Pulse reference (DIO1) 5: Communication 6: Multi-reference	0	At once
FA-01	0xFA01	PID digital setting	0.0% to 100.0%	50.0%	Real time
FA-02	0xFA02	PID feedback source	0: AI1 1: AI2 3: AI1 - AI2 4: Pulse reference (DIO1) 5: Communication 6: AI1 + AI2 7: Max. (|AI1|, |AI2|) 8: Min. (|AI1|, |AI2|)	0	At once
FA-03	0xFA03	PID action direction	0: Forward 1: Reverse	0	At once
FA-04	0xFA04	PID reference and feedback range	0 to 65535	1000	At once
FA-05	0xFA05	Proportional gain Kp1	0.0 to 100.0	20.0	At once
FA-06	0xFA06	Integral time Ti1	0.01s to 10.00s	2.00s	Real time
FA-07	0xFA07	Differential time Td1	0.000s to 10.000s	0.000s	Real time
FA-08	0xFA08	PID reverse cut-off frequency	0.00 Hz to 655.35 Hz	2.00 Hz	Real time
FA-09	0xFA09	PID deviation limit	0.0% to 100.0%	0.0%	Real time
FA-10	0xFA0A	PID differential limit	0.00% to 100.00%	0.10%	Real time
FA-11	0xFA0B	PID reference change time	0.00s to 650.00s	0.00s	Real time
FA-12	0xFA0C	PID feedback filter time	0.00s to 60.00s	0.00s	Real time
FA-13	0xFA0D	PID error gain	0.00s to 10.00s	10.00s	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FA-15	0xFA0F	Proportional gain Kp 2	0.0 to 100.0	20.0	At once
FA-16	0xFA10	Integral time Ti 2	0.01s to 10.00s	2.00s	Real time
FA-17	0xFA11	Differential time Td 2	0.000s to 10.000s	0.000s	Real time
FA-18	0xFA12	PID parameter switchover condition	0: No switchover 1: DI 2: Automatic switchover based on deviation 3: Automatic switchover based on running frequency 6: Automatic adjustment based on roll diameter 7: Adjustment based on percentage of maximum roll diameter	0	At once
FA-19	0xFA13	PID parameter switchover deviation 1	0.0% to 6553.5%	20.0%	Real time
FA-20	0xFA14	PID parameter switchover deviation 2	0.0% to 100.0%	80.0%	Real time
FA-21	0xFA15	PID initial value	0.0% to 100.0%	0.0%	Real time
FA-22	0xFA16	Active time of PID initial value	0.00s to 650.00s	0.00s	Real time
FA-23	0xFA17	Maximum deviation between two outputs in forward direction	0.00% to 100.00%	1.00%	Real time
FA-24	0xFA18	Maximum deviation between two outputs in reverse direction	0.00% to 100.00%	1.00%	Real time
FA-25	0xFA19	PID integral	0: Invalid 1: Valid	0	At once
FA-26	0xFA1A	Detection level of PID feedback loss	0.0% to 100.0%	0.0%	Real time
FA-27	0xFA1B	Detection time of PID feedback loss	0.0s to 20.0s	0.0s	Real time
FB Wobble Function, Fixed Length, and Counting					
FB-00	0xFB00	Wobble setting mode	0: Relative to the central frequency 1: Relative to the maximum frequency	0	At once
FB-01	0xFB01	Wobble amplitude	0.0% to 100.0%	0.0%	Real time
FB-02	0xFB02	Jump frequency amplitude	0.0% to 50.0%	0.0%	Real time
FB-03	0xFB03	Wobble cycle	0.1s to 3000.0s	10.0s	Real time
FB-04	0xFB04	Triangular wave rising time of wobble frequency	0.1% to 100.0%	50.0%	Real time
FB-05	0xFB05	Length reference	0 m to 65535 m	1000 m	Real time
FB-06	0xFB06	Actual length	0 m to 65535 m	0 m	Real time
FB-07	0xFB07	Number of pulses per meter	0.1 to 6553.5	100.0	At once
FB-08	0xFB08	Count value reference	1 to 65535	1000	At once
FB-09	0xFB09	Designated count value	1 to 65535	1000	At once
FB-10	0xFB0A	Reset mode of number of revolutions	0: Edge-triggered 1: Level-triggered	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FB-11	0xFB0B	Reset signal of number of revolutions	0: Disable 1: Reset	0	At once
FB-12	0xFB0C	Revolution count retention upon power failure	0: Not saved 1: Saved	0	At once
FB-13	0xFB0D	Initial number of revolutions	0 to 65535	0	At once
FB-14	0xFB0E	Numerator of transmission ratio	1 to 65535	1	At once
FB-15	0xFB0F	Denominator of transmission ratio	1 to 65535	1	At once
FB-16	0xFB10	Number of actual running revolutions	0 to 65535	0	At once
FB-17	0xFB11	Number of running revolutions	0 to 65535	0	At once
FB-18	0xFB12	Running revolution accuracy	1 to 65535	1	At once
FB-19	0xFB13	Revolution count direction	0: Forward 1: Reverse	0	At once
FC Multi-reference and Simple PLC					
FC-00	0xFC00	Multi-reference 0	-100.0% to 100.0%	0.0%	Real time
FC-01	0xFC01	Multi-reference 1	-100.0% to 100.0%	0.0%	Real time
FC-02	0xFC02	Multi-reference 2	-100.0% to 100.0%	0.0%	Real time
FC-03	0xFC03	Multi-reference 3	-100.0% to 100.0%	0.0%	Real time
FC-04	0xFC04	Multi-reference 4	-100.0% to 100.0%	0.0%	Real time
FC-05	0xFC05	Multi-reference 5	-100.0% to 100.0%	0.0%	Real time
FC-06	0xFC06	Multi-reference 6	-100.0% to 100.0%	0.0%	Real time
FC-07	0xFC07	Multi-reference 7	-100.0% to 100.0%	0.0%	Real time
FC-08	0xFC08	Multi-reference 8	-100.0% to 100.0%	0.0%	Real time
FC-09	0xFC09	Multi-reference 9	-100.0% to 100.0%	0.0%	Real time
FC-10	0xFC0A	Multi-reference 10	-100.0% to 100.0%	0.0%	Real time
FC-11	0xFC0B	Multi-reference 11	-100.0% to 100.0%	0.0%	Real time
FC-12	0xFC0C	Multi-reference 12	-100.0% to 100.0%	0.0%	Real time
FC-13	0xFC0D	Multi-reference 13	-100.0% to 100.0%	0.0%	Real time
FC-14	0xFC0E	Multi-reference 14	-100.0% to 100.0%	0.0%	Real time
FC-15	0xFC0F	Multi-reference 15	-100.0% to 100.0%	0.0%	Real time
FC-16	0xFC10	Simple PLC running mode	0: Stop after running one cycle 1: Keep final values after running one cycle 2: Repeat after running one cycle	0	At once
FC-17	0xFC11	Simple PLC retention selection upon power failure	Ones: 0: Non-retentive upon power failure 1: Retentive upon power failure Tens: 0: Non-retentive upon stop 1: Retentive upon stop	0	At once
FC-18	0xFC12	Running time of multi-reference 0 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-19	0xFC13	Acceleration/ Deceleration time of multi-reference 0 set by simple PLC	0 to 3	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FC-20	0xFC14	Running time of multi-reference 1 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-21	0xFC15	Acceleration/ Deceleration time of multi-reference 1 set by simple PLC	0 to 3	0	At once
FC-22	0xFC16	Running time of multi-reference 2 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-23	0xFC17	Acceleration/ Deceleration time of multi-reference 2 set by simple PLC	0 to 3	0	At once
FC-24	0xFC18	Running time of multi-reference 3 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-25	0xFC19	Acceleration/ Deceleration time of multi-reference 3 set by simple PLC	0 to 3	0	At once
FC-26	0xFC1A	Running time of multi-reference 4 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-27	0xFC1B	Acceleration/ Deceleration time of multi-reference 4 set by simple PLC	0 to 3	0	At once
FC-28	0xFC1C	Running time of multi-reference 5 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-29	0xFC1D	Acceleration/ Deceleration time of multi-reference 5 set by simple PLC	0 to 3	0	At once
FC-30	0xFC1E	Running time of multi-reference 6 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-31	0xFC1F	Acceleration/ Deceleration time of multi-reference 6 set by simple PLC	0 to 3	0	At once
FC-32	0xFC20	Running time of multi-reference 7 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-33	0xFC21	Acceleration/ Deceleration time of multi-reference 7 set by simple PLC	0 to 3	0	At once
FC-34	0xFC22	Running time of multi-reference 8 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-35	0xFC23	Acceleration/ Deceleration time of multi-reference 8 set by simple PLC	0 to 3	0	At once
FC-36	0xFC24	Running time of multi-reference 9 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FC-37	0xFC25	Acceleration/ Deceleration time of multi-reference 9 set by simple PLC	0 to 3	0	At once
FC-38	0xFC26	Running time of multi-reference 10 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-39	0xFC27	Acceleration/ Deceleration time of multi-reference 10 set by simple PLC	0 to 3	0	At once
FC-40	0xFC28	Running time of multi-reference 11 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-41	0xFC29	Acceleration/ Deceleration time of multi-reference 11 set by simple PLC	0 to 3	0	At once
FC-42	0xFC2A	Running time of multi-reference 12 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-43	0xFC2B	Acceleration/ Deceleration time of multi-reference 12 set by simple PLC	0 to 3	0	At once
FC-44	0xFC2C	Running time of multi-reference 13 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-45	0xFC2D	Acceleration/ Deceleration time of multi-reference 13 set by simple PLC	0 to 3	0	At once
FC-46	0xFC2E	Running time of multi-reference 14 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-47	0xFC2F	Acceleration/ Deceleration time of multi-reference 14 set by simple PLC	0 to 3	0	At once
FC-48	0xFC30	Running time of multi-reference 15 set by simple PLC	0.0s (h) to 6553.5s (h)	0.0s (h)	Real time
FC-49	0xFC31	Acceleration/ Deceleration time of multi-reference 15 set by simple PLC	0 to 3	0	At once
FC-50	0xFC32	PLC operating time unit	0: s (second) 1: h (hour)	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FC-51	0xFC33	Multi-reference 0 setting mode	0: FC-00 1: AI1 2: AI2 4: Pulse setting (DIO1) 5: PID 6: F0-08 (Preset frequency), which can be modified by UP/DOWN key	0	At once
FD Communication Parameters					
FD-00	0xFD00	Baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	At once
FD-01	0xFD01	Data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	0	At once
FD-02	0xFD02	Local address	0 to 247	1	At once
FD-03	0xFD03	Response delay	0 ms to 20 ms	2 ms	Real time
FD-04	0xFD04	Comm. timeout period	0.0s to 60.0s	0.0s	Real time
FD-06	0xFD06	Comm. fault reset	0 to 1	1	At stop
FD-09	0xFD09	Comm. status	Ones: CANopen 0: Stop 1: Initialization 2: Pre-operational 8: Running Tens: CANlink 0: Stop 1: Initialization 2: Pre-operational 8: Running Hundreds: PROFIBUS DP 0: Stop 1: Initialization 2: - 8: Running	0	Unchangeable
FD-10	0xFD0A	CANopen/ CANlink switchover	1: CANopen 2: CANLINK	1	At stop
FD-11	0xFD0B	CiA 402	0: Enable 1: Disable	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FD-12	0xFD0C	CAN baud rate	0: 20 kbps 1: 50 kbps 2: 100 kbps 3: 125 kbps 4: 250 kbps 5: 500 kbps 6: 1 Mbps	5	At stop
FD-13	0xFD0D	CAN station number	1 to 127	1	At stop
FD-14	0xFD0E	Number of CAN frames received per unit of time	0 to 65535	1	Unchangeable
FD-15	0xFD0F	Maximum n umber of error frames received by node	0 to 65535	1	Unchangeable
FD-16	0xFD10	Maximum number of error frames sent by node	0 to 65535	1	Unchangeable
FD-17	0xFD11	Number of bus disconnection times per unit of time	0 to 65535	1	Unchangeable
FD-18	0xFD12	Power supply unit No.	1 to 99	1	At stop
FD-19	0xFD13	CAN comm. disconnection coefficient	1 to 15	3	At stop
FD-20	0xFD14	PROFIBUS DP comm. address	0 to 125	0	At stop
FD-21	0xFD15	PROFIBUS DP comm. disconnection coefficient	0 to 65535	0	At stop
FD-28	0xFD1C	Timeout of comm. between power supply unit and drive unit (A16.13)	0: Enable 1: Disable	1	At once
FD-30	0xFD1E	Number of RPD01 and RPDO2 mapped bytes	0 to 65535	1	Unchangeable
FD-31	0xFD1F	Number of TPDO1 and RPDO2 mapped bytes	0 to 65535	1	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FD-32	0xFD20	Mapping mode switchover of parameters in AF group	0: Non-retentive upon communication-based mode switchover 1: Retentive upon communication-based mode switchover	0	At stop
FD-34	0xFD22	CANopen mode	0: Ordinary mode 1: Expert mode	0	At stop
FD-35	0xFD23	CANopen inhibition time	0 to 65535	00.1 ms	At stop
FD-36	0xFD24	CANopen event time	0 to 65535	0 ms	At stop
FD-94	0xFD5E	Modbus software version	0 to 65535	0	Unchangeable
FD-95	0xFD5F	CANlink software version	0 to 65535	0	Unchangeable
FD-96	0xFD60	CANopen software version	0 to 65535	0	Unchangeable
FD-97	0xFD61	PROFIBUS DP software version	0 to 65535	0	Unchangeable
FD-98	0xFD62	PROFIBUS DP gateway software version	0 to 65535	0	Unchangeable
FD-99	0xFD63	Modbus gateway software version	0 to 65535	0	Unchangeable
FE User-defined Parameters					
FE-00	0xFE00	User-defined parameter 0	0	0	At once
FE-01	0xFE01	User-defined parameter 1	0	0	At once
FE-02	0xFE02	User-defined parameter 2	0	0	At once
FE-03	0xFE03	User-defined parameter 3	0	0	At once
FE-04	0xFE04	User-defined parameter 4	0	0	At once
FE-05	0xFE05	User-defined parameter 5	0	0	At once
FE-06	0xFE06	User-defined parameter 6	0	0	At once
FE-07	0xFE07	User-defined parameter 7	0	0	At once
FE-08	0xFE08	User-defined parameter 8	0	0	At once
FE-09	0xFE09	User-defined parameter 9	0	0	At once
FE-10	0xFE0A	User-defined parameter 10	0	0	At once
FE-11	0xFE0B	User-defined parameter 11	0	0	At once
FE-12	0xFE0C	User-defined parameter 12	0	0	At once
FE-13	0xFE0D	User-defined parameter 13	0	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FE-14	0xFE0E	User-defined parameter 14	0	0	At once
FE-15	0xFE0F	User-defined parameter 15	0	0	At once
FE-16	0xFE10	User-defined parameter 16	0	0	At once
FE-17	0xFE11	User-defined parameter 17	0	0	At once
FE-18	0xFE12	User-defined parameter 18	0	0	At once
FE-19	0xFE13	User-defined parameter 19	0	0	At once
FE-20	0xFE14	User-defined parameter 20	0	0	At once
FE-21	0xFE15	User-defined parameter 21	0	0	At once
FE-22	0xFE16	User-defined parameter 22	0	0	At once
FE-23	0xFE17	User-defined parameter 23	0	0	At once
FE-24	0xFE18	User-defined parameter 24	0	0	At once
FE-25	0xFE19	User-defined parameter 25	0	0	At once
FE-26	0xFE1A	User-defined parameter 26	0	0	At once
FE-27	0xFE1B	User-defined parameter 27	0	0	At once
FE-28	0xFE1C	User-defined parameter 28	0	0	At once
FE-29	0xFE1D	User-defined parameter 29	0	0	At once
FE-30	0xFE1E	User-defined parameter 30	0	0	At once
FE-31	0xFE1F	User-defined parameter 31	0	0	At once
FF: Factory Parameters					
FF-01	0xFF01	AC drive model	1 to 537	8	At stop
FF-02	0xFF02	G/P model	1	1	At stop
FF-03	0xFF03	AC drive power	0.0 kW to 6553.5 kW	0.0 kW	Unchangeable
FF-04	0xFF04	Temperature curve	1 to 2	1	At stop
FF-05	0xFF05	Phases U and V current sampling gain deviation	90.00% to 110.00%	100.00%	At stop
FF-06	0xFF06	Phases U and W current sampling gain deviation	90.0% to 110.0%	100.0%	At stop
FF-07	0xFF07	Transistor voltage drop	0.00-655.35	0.00	Unchangeable
FF-08	0xFF08	Voltage correction coefficient	85.0% to 140.0%	100.0%	Real time
FF-09	0xFF09	Current correction coefficient	85.0% to 115.0%	100.0%	Real time
FF-11	0xFF0B	AI/AO correction parameter display	0 to 273	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FF-12	0xFF0C	Comm. selection of power supply unit	0	0	At once
FF-13	0xFF0D	Setting of any memory data address	0 to 65535	0	At once
FP User Parameters					
FP-00	0x1F00	User password	0 to 65535	0	Unchangeable
FP-01	0x1F01	Parameter initialization	0: Disable 1: Restore to default settings mode 1 2: Clear records 4: Restore user parameters from backup 501: Back up current user parameters 502: Restore to default settings mode 2	1	At once
FP-02	0x1F02	Function parameter display	Ones: 0: Hidden 1: Displayed Tens: 0: Hidden 1: Displayed	1	At once
FP-03	0x1F03	Individualized parameter display	Ones: 0: Hidden 1: Displayed Tens: 0: Hidden 1: Displayed	0	At once
FP-04	0x1F04	Parameter modification function	0: Parameters can be modified. 1: Parameters cannot be modified.	0	At once
A0 Torque Control and Limit Parameters					
A0-00	0xA000	Speed/Torque control mode	0: Speed control 1: Torque control	0	At stop
A0-01	0xA001	Torque reference source	0: A0-03 1: AI1 2: AI2 4: Pulse reference 5: Communication (1000H) 6: Min. (AI1, AI2) 7: Max. (AI1, AI2)	0	At stop
A0-03	0xA003	Torque digital setting	-2.000% to 2.000%	1.000%	Real time
A0-04	0xA004	Torque filter time	0s to 5000s	0s	Real time
A0-05	0xA005	Digital setting of speed limit	-120.0% to 120.0%	0.0%	Real time
A0-07	0xA007	Torque acceleration time	0.00s to 650.00s	1.00s	Real time
A0-08	0xA008	Torque deceleration time	0.00s to 650.00s	1.00s	Real time
A0-09	0xA009	Speed limit reference source	0: A0-05 1: Frequency source	0	At once
A0-10	0xA00A	Speed limit offset	0.00 to 655.35	5.00	At once
A0-11	0xA00B	Active mode of speed limit offset	0: Bi-directional offset 1: Uni-directional offset	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A0-12	0xA00C	Frequency acceleration time	0.0s to 6500.0s	1.0s	Real time
A0-13	0xA00D	Frequency deceleration time	0.0s to 6500.0s	1.0s	Real time
A0-14	0xA00E	Torque mode switchover	0: No switchover 1: Switch to speed mode at stop 2: The target torque is 0 at stop.	1	At stop
A1 Virtual DI/DO Parameters					
A1-00	0xA100	VDI1 function selection	0: No function 1: Forward running (FWD) 2: Reverse running (REV) 3: Three-wire motion control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Function as the UP key 7: Function as the DOWN key 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 source switchover 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Running command switchover 21: Acceleration/deceleration inhibition 22: PID pause (to be continued)	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A1-00	0xA100	VDI1 function selection	(continued) 23: PLC status reset 24: Wobble pause 25: Counter input (DIO1) 26: Counter reset 27: Length count input (DIO1) 28: Length reset 29: Torque control inhibition 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enabling 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 42: Position lock 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control switchover 47: Emergency stop 48: External STOP terminal 2 49: Deceleration DC braking 50: Clear the current running time 51: Switchover between two-wire mode and three-wire mode 54: Roll diameter reset 55: Initial roll diameter 1 56: Initial roll diameter 2 57: Pre-driving 58: Switchover between winding and unwinding 59: Roll diameter calculation stop 60: Exit tension mode 61: Speed limit reversed 62: Revolution count reset 63: DI operation enabling (to be continued)	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A1-00	0xA100	VDI1 function selection	(continued) 64: Position/Speed synchronization switchover 65: Pulse position increment 66: Pulse position decrement 67: Clear position synchronization deviation 68: Position control DI home input 69: Position control home search 70: Positioning control pause 71: Switch to position control 72: Switch to position control (forward run command) 73: Switch to position control (reverse run command) 74: Reserved 75: Multi-position selection 1 76: Multi-position selection 2 77: Multi-position selection 3 78: Multi-position selection 4 79: Multi-position selection 5 80: Positive limit switch 81: Negative limit switch 82: Switch to incremental positioning 83: Switch to absolute positioning 84: Switch to degree positioning 85: Switch to degree positioning with fixed length 86: Re-positioning control command 87: Pulse synchronization switchover (pulse speed-pulse position switchover) 88: Pulse position control (with command) 89-89: Reserved	0	At stop
A1-01	0xA101	VDI2 function selection	Same as A1-00	0	At stop
A1-02	0xA102	VDI3 function selection	Same as A1-00	0	At stop
A1-03	0xA103	VDI4 function selection	Same as A1-00	0	At stop
A1-04	0xA104	VDI5 function selection	Same as A1-00	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A1-05	0xA105	VDI state setting source	Ones: 0: A1-06 1: DO state 2: DI state Tens: 0: A1-06 1: DO state 2: DI state Hundreds: 0: A1-06 1: DO state 2: DI state Thousands: 0: A1-06 1: DO state 2: DI state Ten thousands: 0: A1-06 1: DO state 2: DI state	0	At stop
A1-06	0xA106	VDI state setting	Ones: 0: Invalid 1: Valid Tens: 0: Invalid 1: Valid Hundreds: 0: Invalid 1: Valid Thousands: 0: Invalid 1: Valid Ten thousands: 0: Disabled 1: Valid	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A1-07	0xA107	AI1 function selection (used as DI)	0: No function 1: Forward running (FWD) 2: Reverse running (REV) 3: Three-wire control 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Function as the UP key 7: Function as the DOWN key 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 source switchover 19: Clear data set by UP/DOWN key or by terminal functioning as UP/DOWN key 20: Running command switchover 21: Acceleration/deceleration inhibition 22: PID pause 23: PLC status reset 24: Wobble pause 25: Counter input (DIO1) 26: Counter reset 27: Length count input (DIO1) 28: Length reset 29: Torque control inhibition 32: Immediate DC braking 33: NC input of external fault 34: Frequency modification enabling 35: Opposite to the PID action direction 36: External stop terminal 1 37: Command source switchover terminal 2 38: PID integral pause (to be continued)	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A1-07	0xA107	AI1 function selection (used as DI)	(continued) 39: Switchover between main frequency source X and preset frequency 40: Switchover between auxiliary frequency Y and preset frequency 42: Position lock selection 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control switchover 47: Emergency stop 48: External STOP terminal 2 49: Deceleration DC braking 50: Clear the current running time 51: Switchover between two-wire mode and three-wire mode 54: Roll diameter reset 55: Initial roll diameter 1 56: Initial roll diameter 2 57: Pre-driving 58: Switchover between winding and unwinding 59: Roll diameter calculation stop 60: Exit tension mode	0	At stop
A1-08	0xA108	AI2 function selection (used as DI)	Same as A1-07	0	At stop
A1-10	0xA10A	Active status of AI used as DI	Ones: 0: Active high 1: Active low Tens: 0: Active high 1: Active low	0	At stop
A5 Control Optimization Parameters					
A5-00	0xA500	Frequency upper limit for DPWM switchover	0.00 Hz to 600.00 Hz	200.00 Hz	Real time
A5-01	0xA501	PWM modulation mode	0: Asynchronous modulation 1: Synchronous modulation	0	At once
A5-02	0xA502	Dead-zone compensation mode	0: Not compensated 1: Compensated	1	At stop
A5-03	0xA503	Random PWM depth	0 to 10	0	At once
A5-04	0xA504	Fast current limit	0: Enable 1: Disable	0	At once
A5-05	0xA505	Sampling delay	1 to 13	5	At once
A5-06	0xA506	Undervoltage threshold	60.0% to 140.0%	100.0%	Real time
A5-07	0xA507	SVC optimization mode	0: No optimization 1: Optimization mode 1 2: Optimization mode 2	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A6 AI Curve Settings					
A6-00	0xA600	Minimum input of curve 4	-10.00 V to 327.67 V	0.00 V	Real time
A6-01	0xA601	Percentage corresponding to minimum input of curve 4	-100.0% to 100.0%	0.0%	Real time
A6-02	0xA602	Input of curve 4 inflection point 1	-327.68 V to 327.67 V	3.00 V	Real time
A6-03	0xA603	Percentage corresponding to input of curve 4 inflection point 1	-100.0% to 100.0%	30.0%	Real time
A6-04	0xA604	Input of curve 4 inflection point 2	-327.68 V to 327.67 V	6.00 V	Real time
A6-05	0xA605	Percentage corresponding to input of curve 4 inflection point 2	-100.0% to 100.0%	60.0%	Real time
A6-06	0xA606	Maximum input of curve 4	-327.68 V to 10.00 V	10.00 V	Real time
A6-07	0xA607	Percentage corresponding to maximum input of curve 4	-100.0% to 100.0%	100.0%	Real time
A6-08	0xA608	Curve 5 minimum input	-10.00 V to 327.67 V	-10.00 V	Real time
A6-09	0xA609	Percentage corresponding to minimum input of curve 5	-100.0% to 100.0%	-100.0%	Real time
A6-10	0xA60A	Input of curve 5 inflection point 1	-327.68 V to 327.67 V	-3.00 V	Real time
A6-11	0xA60B	Percentage corresponding to input of curve 5 inflection point 1	-100.0% to 100.0%	-30.0%	Real time
A6-12	0xA60C	Input of curve 5 inflection point 2	-327.68 V to 327.67 V	3.00 V	Real time
A6-13	0xA60D	Percentage corresponding to input of curve 5 inflection point 2	-100.0% to 100.0%	30.0%	Real time
A6-14	0xA60E	Curve 5 maximum input	-327.68 V to 10.00 V	10.00 V	Real time
A6-15	0xA60F	Percentage corresponding to maximum input of curve 5	-100.0% to 100.0%	100.0%	Real time
A6-24	0xA618	AI1 jump point	-100.0% to 100.0%	0.0%	Real time
A6-25	0xA619	AI1 jump amplitude	0.0% to 100.0%	0.5%	Real time
A6-26	0xA61A	AI2 jump point	-100.0% to 100.0%	0.0%	Real time
A6-27	0xA61B	AI2 jump amplitude	0.0% to 100.0%	0.5%	Real time
A9 Vector Control Supplementary Parameters					

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A9-00	0xA900	Online auto-tuning of rotor time constant for asynchronous motor	0: Disable 1: Enable	0	At once
A9-01	0xA901	Auto-tuning of rotor resistance gain for asynchronous motors in FVC mode	0 to 100	5	At once
A9-02	0xA902	Auto-tuning of rotor resistance starting frequency for asynchronous motors in FVC mode	2 Hz to 100 Hz	7 Hz	Real time
A9-03	0xA903	Observed magnetic field coefficient of asynchronous motors in FVC mode	30 to 150	40	At once
A9-04	0xA904	Maximum torque limit coefficient in the field-weakening range for asynchronous motors	30 to 150	80	At once
A9-05	0xA905	Speed filter of asynchronous motor in SVC mode	5 ms to 32 ms	15 ms	Real time
A9-06	0xA906	Speed feedback processing of asynchronous motor during speed control in SVC mode	0: No special processing 1: Limit the minimum synchronous frequency based on load change 2: Output the fixed current at low running speed 3: Output the fixed current at low running speed	0	At once
A9-07	0xA907	Magnetic field regulation bandwidth of asynchronous motor in SVC mode	0.0 Hz to 8.0 Hz	2.0 Hz	Real time
A9-08	0xA908	Low-speed running current of asynchronous motor in SVC mode	30 to 170	100	At once
A9-09	0xA909	Switchover frequency for fixed current output of asynchronous motor in SVC mode	2.0 Hz to 100.0 Hz	3.0 Hz	Real time
A9-10	0xA90A	Speed fluctuation suppression coefficient of asynchronous motor in SVC mode	0 to 6	3	At once
A9-11	0xA90B	Acceleration/ Deceleration time of asynchronous motor in SVC mode	0.1s to 3000.0s	20.0s	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A9-12	0xA90C	Quick auto-tuning of stator resistance before asynchronous motor start	0: Disable 1: Enable	0	At once
A9-13	0xA90D	Quick auto-tuning of stator resistance coefficient 1 for asynchronous motors	0 to 65535	0	At stop
A9-14	0xA90E	Quick auto-tuning of stator resistance coefficient 2 for asynchronous motor	0 to 65535	0	At stop
A9-15	0xA90F	Quick auto-tuning of stator resistance coefficient 3 for asynchronous motor	0 to 65535	0	At stop
A9-17	0xA911	Real-time angle of synchronous motor	0 to 65535	0	Unchangeable
A9-18	0xA912	Initial position angle detection of synchronous motor	0: Detection upon running 1: No detection 2: Detection upon initial power-on	0	At once
A9-20	0xA914	Field weakening mode selection	0: Automatic field weakening 1: Adaptive field weakening for synchronous motor 2: Hybrid field weakening for synchronous motor 3: No field weakening	1	At stop
A9-21	0xA915	Field weakening gain of synchronous motor	0 to 50	5	At once
A9-22	0xA916	Margin of output voltage upper limit of synchronous motor	0% to 50%	5%	Real time
A9-23	0xA917	Maximum force adjustment gain of synchronous motor	20% to 300%	100%	Real time
A9-24	0xA918	Adjustment gain of calculated excitation current of synchronous motor	40% to 200%	100%	Real time
A9-25	0xA919	Integral gain for speed estimation of synchronous motor in SVC mode	5 to 1000	30	At once
A9-26	0xA91A	Proportional gain for speed estimation of synchronous motor in SVC mode	5 to 300	20	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
A9-27	0xA91B	Estimated speed filter of synchronous motor in SVC mode	10 to 2000	100	At once
A9-28	0xA91C	Minimum carrier frequency of synchronous motor in SVC mode	8 to 65535	20	At once
A9-29	0xA91D	Low-speed excitation current of synchronous motor in SVC mode	0% to 80%	30%	Real time
AC AI/AO Correction					
AC-00	0xAC00	AI1 measured voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-01	0xAC01	AI1 displayed voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-02	0xAC02	AI1 measured voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-03	0xAC03	AI1 displayed voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-04	0xAC04	AI2 measured voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-05	0xAC05	AI2 displayed voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-06	0xAC06	AI2 measured voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-07	0xAC07	AI2 displayed voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-12	0xAC0C	AO1 measured voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-13	0xAC0D	AO1 target voltage 1	-10.000 V to 10.000 V	2.000 V	Real time
AC-14	0xAC0E	AO1 measured voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-15	0xAC0F	AO1 target voltage 2	-10.000 V to 10.000 V	8.000 V	Real time
AC-20	0xAC14	PT100 measured voltage 1	-3.300 V to 3.300 V	1.650 V	Real time
AC-21	0xAC15	PT100 target voltage 1	-3.300 V to 3.300 V	1.650 V	Real time
AC-22	0xAC16	PT100 measured voltage 2	-3.300 V to 3.300 V	3.062 V	Real time
AC-23	0xAC17	PT100 target voltage 2	-3.300 V to 3.300 V	3.062 V	Real time
AC-24	0xAC18	PT1000 measured voltage 1	-3.300 V to 3.300 V	1.650 V	Real time
AC-25	0xAC19	PT1000 target voltage 1	-3.300 V to 3.300 V	1.650 V	Real time
AC-26	0xAC1A	PT1000 measured voltage 2	-3.300 V to 3.300 V	2.997 V	Real time
AC-27	0xAC1B	PT1000 target voltage 2	-3.300 V to 3.300 V	2.997 V	Real time
AC-28	0xAC1C	AO1 measured current 1	0.000 mA to 20.000 mA	4.000 mA	Real time
AC-29	0xAC1D	AO1 target current 1	0.000 mA to 20.000 mA	4.000 mA	Real time
AC-30	0xAC1E	AO1 measured current 2	0.000 mA to 20.000 mA	16.000 mA	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
AC-31	0xAC1F	AO1 target current 2	0.000 mA to 20.000 mA	16.000 mA	Real time
B3 Pulse Synchronization					
B3-00	0xB300	Pulse synchronization mode	0: Speed synchronization 1: Position synchronization 2.4 Pulse positioning	0	At stop
B3-01	0xB301	Pulse mode	0: Pulse+Direction 1: Two channels of orthogonal pulse	1	At stop
B3-02	0xB302	Orthogonal pulse phase A/B sequence	0: Forward 1: Reverse	0	At stop
B3-03	0xB303	Acceleration time (position synchronization)	0.0 to 6500.0	0.0	At once
B3-04	0xB304	Deceleration time (position synchronization)	0.0 to 6500.0	0.0	At once
B3-05	0xB305	Feedforward gain (position synchronization)	0.00-2.00	1.00	At once
B3-06	0xB306	Proportional gain 1 (position synchronization)	0.00 to 100.00	1.50	At once
B3-07	0xB307	Electronic gear ratio numerator	1 to 30000	1	At once
B3-08	0xB308	Electronic gear ratio denominator	1 to 30000	1	At once
B3-09	0xB309	Pulse frequency filter time	0.00 to 10.00	0.20	At once
B3-10	0xB30A	Pulse frequency filter coefficient (average value filter)	0 to 100	0	At once
B3-11	0xB30B	Proportional gain switchover (position synchronization)	0: No switchover 1: Automatic switchover based on deviation	0	At stop
B3-12	0xB30C	Proportional gain 2 (position synchronization)	0.00 to 100.00	15.00	At once
B3-13	0xB30D	Position deviation level 1 of proportional gain switchover (position synchronization)	0 to 30000	5	At once
B3-14	0xB30E	Position deviation level 2 of proportional gain switchover (position synchronization)	0 to 30000	50	At once
B3-15	0xB30F	Acceleration compensation gain	0.00-10.00	0.00	At once
B3-16	0xB310	Maximum pulse deviation	1–10000	500	At once
B3-17	0xB311	Position lock proportional gain	0.00 to 100.00	1.50	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B3-18	0xB312	Minimum pulse deviation	0 to 1000	2	At once
B3-19	0xB313	Minimum frequency reference of pulse synchronization	0.0010 to 5.0000	0.0100	At once
B3-20	0xB314	Frequency threshold for automatic pulse speed synchronization switchover	0.00	0.00	At stop
B3-21	0xB315	Detection value for excessive pulse deviation	0 to 20000	600	At once
B3-22	0xB316	Detection time for excessive pulse deviation	0.00-10.00	1.00	At once
B3-23	0xB317	Forced speed synchronization switchover	0	0	At once
B3-24	0xB318	Forced speed synchronization frequency switchover threshold	0.00 to 100.00	50.00	At once
B3-25	0xB319	Time threshold for stop upon forced speed synchronization failure	0.00 to 5.00	0.00	At once
B3-26	0xB31A	Start point of frequency limit	0.00 to 600.00	50.00	At once
B3-27	0xB31B	Maximum overshoot of frequency	0.00 to 50.00	0.00	At once
B3-28	0xB31C	Reference pulse step rate	0 to 60000	1000	At once
B3-35	0xB323	Pulse output frequency filter	0 to 65535	4	At once
Group B4: Positioning Control					
B4-00	0xB400	Position control function	0: Invalid 1: Valid	0	At stop
B4-01	0xB401	Positioning control mode	0: Incremental mode 1: Absolute mode 2: Degree mode 3: Fixed length degree mode	0	At stop
B4-02	0xB402	Electronic gear ratio (numerator)	1 to 30000	1	At stop
B4-03	0xB403	Electronic gear ratio (denominator)	1 to 30000	1	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B4-05	0xB405	Home signal source for positioning control	Ones: Incremental 2: Current position Tens: Absolute 1: DI Hundreds: Degree 0: Encoder Z signal 1: DI Thousands: Fixed length degree 0: Encoder Z signal 1: DI	1012	At stop
B4-07	0xB407	DI home signal active mode	0: Valid at the falling edge 1: Valid at the rising edge	1	At stop
B4-08	0xB408	DI home signal filter time	0.000s to 5.000s	0.010s	Real time
B4-09	0xB409	Home enabling control	0: Disable 1: Immediate home searching 2: Current position as the home 3: Clear home 4: No home, auto home searching after startup	0	At once
B4-10	0xB40A	Home searching mode	Ones: Incremental 0: Disable Tens: Absolute 0: Forward search 1: Reverse search 2: Forward search. When the limit switch is active, automatic direction change search is performed. 3: Reverse search. When the limit switch is active, automatic direction change search is performed. Hundreds: Degree 0: Forward search 1: Reverse search Thousands: Fixed length degree 0: Forward search 1: Reverse search	20	At stop
B4-11	0xB40B	Home searching speed	0.10 Hz to 50.00 Hz	5.00 Hz	At stop
B4-12	0xB40C	Home searching acceleration time	0.10s to 600.00s	10.00s	Real time
B4-13	0xB40D	Home searching deceleration time	0.10s to 600.00s	10.00s	Real time
B4-14	0xB40E	Action after home searching	0: Decelerate to 0 1: Position control started after deceleration to 0 2: Back to mechanical home 3: Back to mechanical home relative offset	2	At stop
B4-15	0xB40F	Home offset (low-order bits)	0 to 65535	0	At stop
B4-16	0xB410	Home offset (high-order bits)	0 to 16384	0	At stop
B4-17	0xB411	Home offset direction	0: Forward 1: Reverse	0	At stop
B4-18	0xB412	Home searching time limit	1.00s to 600.00s	30.00s	Real time

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B4-19	0xB413	Home deviation threshold	4 to 60000	100	At once
B4-20	0xB414	Home update mode for incremental positioning	0: Update home at zero speed 1: Update home when repositioning is triggered 2: Save unexecuted position reference during running	1	At stop
B4-21	0xB415	Judge criteria of approaching the target position	0: Method 1 1: Method 2 2: Method 3 3: Method 4	0	At stop
B4-22	0xB416	Threshold of approaching the target position	0 to 60000	500	At once
B4-23	0xB417	Judge time of approaching the target position	0.000s to 5.000s	0.005s	Real time
B4-24	0xB418	Output time of approaching the target position	0.00s to 600.00s	0.05s	Real time
B4-25	0xB419	Target position reference output for approaching the target position	0 to 24	0	At stop
B4-26	0xB41A	Judge criteria of positioning completion	0 to 3	0	At stop
B4-27	0xB41B	Threshold of positioning completion	0 to 60000	50	At once
B4-28	0xB41C	Judgment time of positioning completion	0.000s to 5.000s	0.005s	Real time
B4-29	0xB41D	Output time of positioning completion	0.00s to 600.00s	0.05s	Real time
B4-30	0xB41E	Target position reference output for positioning completion	0 to 24	0	At stop
B4-31	0xB41F	Degree position reference unit	0: Encoder resolution 1: 0.1°	0	At stop
B4-32	0xB420	Degree position reference source selection	0: B4-33 1: Multi-position reference	0	At stop
B4-33	0xB421	Degree position command digital setting	0 to 60000	0	At once
B4-34	0xB422	Positioning direction	0: Forward run 1: Reverse run	0	At stop
B4-35	0xB423	Degree positioning direction setting channel	0: B4-34 1: Nearby positioning	1	At stop
B4-36	0xB424	Nearby positioning failure speed	0.10 Hz to 10.00 Hz	2.00 Hz	At stop
B4-37	0xB425	Speed feedforward gain	0.00% to 100.00%	100.00%	At stop
B4-38	0xB426	Position loop proportional gain 1	0.01 to 100.00	1.50	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B4-39	0xB427	Position loop proportional gain 2	0.00 to 100.00	8.00	At once
B4-40	0xB428	Position loop proportional gain switchover condition	0: Switchover disabled; fixed to position loop proportional gain 1 1: Switchover based on position deviation 2: Switchover based on speed	0	At stop
B4-41	0xB429	Deviation 1 for position loop proportional gain switchover	0 to 60000	20	At once
B4-42	0xB42A	Deviation 2 for position loop proportional gain switchover	0 to 60000	100	At once
B4-43	0xB42B	Switchover frequency 1 for position loop proportional gain	0.00 Hz to 500.00 Hz	5.00 Hz	Real time
B4-44	0xB42C	Switchover frequency 2 for position loop proportional gain	0.00 Hz to 500.00 Hz	20.00 Hz	Real time
B4-45	0xB42D	Position loop output limit	0.01 Hz to 30.00 Hz	5.00 Hz	Real time
B4-46	0xB42E	Positioning deviation threshold	0 to 500	2	At once
B4-49	0xB431	Multi-position reference setting	1 to 24	1	At once
B4-50	0xB432	Multi-position reference running mode	0: Not switched; fixed to the position reference defined by B4-49 1: Switchover by DI 2: Operation in sequence once 3: Cyclic operation	0	At stop
B4-51	0xB433	Start segment No. of multi-position reference	1–24	1	At stop
B4-52	0xB434	End segment No. of multi-position reference	0 to 24	1	At stop
B4-53	0xB435	Continue multi-position running mode	0: Start from the start segment 1: Continue uncompleted position reference segment	1	At stop
B4-55	0xB437	Position control mode	0: Position open loop control 1: Position closed loop control	1	At stop
B4-56	0xB438	Switchover of position control start speed during running	0.50 Hz to 100.00 Hz	10.00 Hz	Real time
B4-57	0xB439	Position control source selection	0: Position control enabled 1: DI 2: Communication (7318H)	0	At stop
B4-58	0xB43A	Active mode for position control by DI	0: Active low 1: Active high	1	At stop
B4-59	0xB43B	Repositioning command source selection	0: DI 1: Communication (7319H)	0	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B4-61	0xB43D	Position control function	Ones: Home retentive at power failure 0: Invalid 1: Valid Tens: Home correction 0: Invalid 1: Valid Hundreds: Nearby positioning upon startup in fixed length degree mode 0: Invalid 1: Valid Thousands: Soft limit 0: Invalid 1: Valid Ten thousands: CiA 402 protocol 0: Valid 1: Invalid	10	At stop
B4-63	0xB43F	Soft limit forward position (low-order bits)	0 to 65535	0	At once
B4-64	0xB440	Soft limit forward position (high-order bits)	0 to 16384	0	At once
B4-65	0xB441	Soft limit reverse position (low-order bits)	0 to 65535	0	At once
B4-66	0xB442	Soft limit reverse position (high-order bits)	0 to 16384	0	At once
B4-67	0xB443	Home loss threshold during home correction	0 to 1000	0	At once
B4-68	0xB444	DI limit protection function	0: Coast to stop 1: Decelerate to stop 2: Lock shaft after deceleration to 0	0	At stop
B4-69	0xB445	Minimum direction change frequency during limiting	0.10 Hz to 10.00 Hz	1.50 Hz	Real time
B4-70	0xB446	Direction change frequency active time	1 ms to 500 ms	1 ms	Real time
B4-71	0xB447	DI-based operation enabling Kp	0.01 to 100.00	1.50	At once
B4-72	0xB448	Output limit for DI-based operation enabling	0.00 Hz to 10.00 Hz	1.00 Hz	Real time
B4-73	0xB449	Allowable limit deviation for DI-based operation enabling	0 to 5000	2	At once
B4-74	0xB450	Output delay for DI-based operation enabling	0.00s to 600.00s	1.00s	Real time
B4-75	0xB451	Minimum value of positioning upper limit speed change	0.1 to 10.0	1.0	At once
B4-76	0xB452	Brake release pre-torque value	-200.0% to 200.0%	10.0%	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B4-77	0xB453	Brake release torque acceleration time	0.00s to 65.00s	1.00s	At stop
B4-78	0xB454	Brake release torque deceleration time	0.00s to 65.00s	1.00s	At stop
B4-79	0xB455	Brake release torque holding time	0.00s to 65.00s	0.50s	At stop
B5: Multi-position Reference					
B5-00	0xB500	Position control acceleration time 1	0.01s to 600.00s	10.00s	Real time
B5-01	0xB501	Position control deceleration time 1	0.01s to 600.00s	10.00s	Real time
B5-02	0xB502	Position control acceleration time 2	0.01s to 600.00s	10.00s	Real time
B5-03	0xB503	Position control deceleration time 2	0.01s to 600.00s	10.00s	Real time
B5-04	0xB504	Position control acceleration time 3	0.01s to 600.00s	10.00s	Real time
B5-05	0xB505	Position control deceleration time 3	0.01s to 600.00s	10.00s	Real time
B5-06	0xB506	Position control acceleration time 4	0.01s to 600.00s	10.00s	Real time
B5-07	0xB507	Position control deceleration time 4	0.01s to 600.00s	10.00s	Real time
B5-08	0xB508	Waiting time 1 for positioning completion	0.01s to 600.00s	0.01s	Real time
B5-09	0xB509	Waiting time 2 for positioning completion	0.01s to 600.00s	0.01s	Real time
B5-10	0xB50A	Waiting time 3 for positioning completion	0.01s to 600.00s	0.01s	Real time
B5-11	0xB50B	Waiting time 4 for positioning completion	0.01s to 600.00s	0.01s	Real time
B5-12	0xB50C	Maximum frequency source selection in position control	0: 100.00% 1: AI1 2: AI2 3: Communication (2005H)	0	At stop
B5-13	0xB50D	Maximum frequency digital setting for position control	1.00 Hz to 600.00 Hz	50.00 Hz	At stop
B5-14	0xB50E	Frequency upper limit 1 in position control	0.00% to 100.00%	50.00%	At stop
B5-15	0xB50F	Frequency upper limit 2 in position control	0.00% to 100.00%	50.00%	At stop
B5-16	0xB510	Frequency upper limit 3 in position control	0.00% to 100.00%	50.00%	At stop
B5-17	0xB511	Frequency upper limit 4 in position control	0.00% to 100.00%	50.00%	At stop

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-18	0xB512	Frequency upper limit 5 in position control	0.00% to 100.00%	50.00%	At stop
B5-19	0xB513	Frequency upper limit 6 in position control	0.00% to 100.00%	50.00%	At stop
B5-20	0xB514	Frequency upper limit 7 in position control	0.00% to 100.00%	50.00%	At stop
B5-21	0xB515	Frequency upper limit 8 in position control	0.00% to 100.00%	50.00%	At stop
B5-25	0xB519	Acceleration/deceleration base frequency in position control	0: F0-10 (Maximum frequency) 1: 50.00 Hz	1	At stop
B5-26	0xB51A	Position reference unit	0: Pulse (quadrupled encoder resolution) 1: 0.1 mm 2: 1 mm 3: 1 cm	0	At stop
B5-27	0xB51B	Conversion coefficient between reference unit and pulse	0.0 to 6553.5	1.0	At stop
B5-28	0xB51C	Multi-position reference 1 (low bits)	0 to 65535	0	At once
B5-29	0xB51D	Multi-position reference 1 (high bits)	0 to 16384	0	At once
B5-30	0xB51E	Multi-position reference 1 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-31	0xB51F	Multi-position reference 2 (low bits)	0 to 65535	0	At once
B5-32	0xB520	Multi-position reference 2 (high bits)	0 to 16384	0	At once
B5-33	0xB521	Multi-position reference 2 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-34	0xB522	Multi-position reference 3 (low bits)	0 to 65535	0	At once
B5-35	0xB523	Multi-position reference 3 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-36	0xB524	Multi-position reference 3 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-37	0xB525	Multi-position reference 4 (low bits)	0 to 65535	0	At once
B5-38	0xB526	Multi-position reference 4 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-39	0xB527	Multi-position reference 4 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-40	0xB528	Multi-position reference 5 (low bits)	0 to 65535	0	At once
B5-41	0xB529	Multi-position reference 5 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-42	0xB52A	Multi-position reference 5 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-43	0xB52B	Multi-position reference 6 (low bits)	0 to 65535	0	At once
B5-44	0xB52C	Multi-position reference 6 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-45	0xB52D	Multi-position reference 6 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-46	0xB52E	Multi-position reference 7 (low bits)	0 to 65535	0	At once
B5-47	0xB52F	Multi-position reference 7 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-48	0xB530	Multi-position reference 7 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-49	0xB531	Multi-position reference 8 (low bits)	0 to 65535	0	At once
B5-50	0xB532	Multi-position reference 8 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-51	0xB533	Multi-position reference 8 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-52	0xB534	Multi-position reference 9 (low bits)	0 to 65535	0	At once
B5-53	0xB535	Multi-position reference 9 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-54	0xB536	Multi-position reference 9 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-55	0xB537	Multi-position reference 10 (low bits)	0 to 65535	0	At once
B5-56	0xB538	Multi-position reference 10 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-57	0xB539	Multi-position reference 10 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-58	0xB53A	Multi-position reference 11 (low bits)	0 to 65535	0	At once
B5-59	0xB53B	Multi-position reference 11 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-60	0xB53C	Multi-position reference 11 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-61	0xB53D	Multi-position reference 12 (low bits)	0 to 65535	0	At once
B5-62	0xB53E	Multi-position reference 12 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-63	0xB53F	Multi-position reference 12 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-64	0xB540	Multi-position reference 13 (low bits)	0 to 65535	0	At once
B5-65	0xB541	Multi-position reference 13 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-66	0xB542	Multi-position reference 13 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-67	0xB543	Multi-position reference 14 (low bits)	0 to 65535	0	At once
B5-68	0xB544	Multi-position reference 14 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-69	0xB545	Multi-position reference 14 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-70	0xB546	Multi-position reference 15 (low bits)	0 to 65535	0	At once
B5-71	0xB547	Multi-position reference 15 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-72	0xB548	Multi-position reference 15 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-73	0xB549	Multi-position reference 16 (low bits)	0 to 65535	0	At once
B5-74	0xB54A	Multi-position reference 16 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-75	0xB54B	Multi-position reference 16 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-76	0xB54C	Multi-position reference 17 (low bits)	0 to 65535	0	At once
B5-77	0xB54D	Multi-position reference 17 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-78	0xB54E	Multi-position reference 17 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-79	0xB54F	Multi-position reference 18 (low bits)	0 to 65535	0	At once
B5-80	0xB550	Multi-position reference 18 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-81	0xB551	Multi-position reference 18 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-82	0xB552	Multi-position reference 19 (low bits)	0 to 65535	0	At once
B5-83	0xB553	Multi-position reference 19 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-84	0xB554	Multi-position reference 19 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-85	0xB555	Multi-position reference 20 (low bits)	0 to 65535	0	At once
B5-86	0xB556	Multi-position reference 20 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-87	0xB557	Multi-position reference 20 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-88	0xB558	Multi-position reference 21 (low bits)	0 to 65535	0	At once
B5-89	0xB559	Multi-position reference 21 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-90	0xB55A	Multi-position reference 21 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-91	0xB55B	Multi-position reference 22 (low bits)	0 to 65535	0	At once
B5-92	0xB55C	Multi-position reference 22 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-93	0xB55D	Multi-position reference 22 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-94	0xB55E	Multi-position reference 23 (low bits)	0 to 65535	0	At once
B5-95	0xB55F	Multi-position reference 23 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-96	0xB560	Multi-position reference 23 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
B5-97	0xB561	Multi-position reference 24 (low bits)	0 to 65535	0	At once
B5-98	0xB562	Multi-position reference 24 (high bits)	0 to 16384	0	At once

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
B5-99	0xB563	Multi-position reference 24 setting	Ones: Position reference sign 0: Positive 1: Negative Tens: Acceleration/Deceleration time selection 0: Acceleration/deceleration time 1 in position control 1: Acceleration/deceleration time 2 in position control 2: Acceleration/deceleration time 3 in position control 3: Acceleration/deceleration time 4 in position control Hundreds: Waiting time for positioning completion 0: No waiting 1: Waiting time 1 for positioning completion 2: Waiting time 2 for positioning completion 3: Waiting time 3 for positioning completion 4: Waiting time 4 for positioning completion Thousands: Speed upper limit in positioning control 0: Frequency upper limit 1 in position control 1: Frequency upper limit 2 in position control 2: Frequency upper limit 3 in position control 3: Frequency upper limit 4 in position control 4: Frequency upper limit 5 in position control 5: Frequency upper limit 6 in position control 6: Frequency upper limit 7 in position control 7: Frequency upper limit 8 in position control	1110	At once
Group B6: Crane Function Parameters					
B6-00	0xB600	Braking curve	0: No braking curve 1: Open loop braking curve 2: Closed loop braking curve	0	At stop
B6-01	0xB601	Startup direction	0: Brake release torque in the same direction as operation 1: Brake release torque always in the forward direction	0	At stop
B6-02	0xB602	Brake release frequency	0.00 Hz to 20.00 Hz	2.00 Hz	At stop
B6-03	0xB603	Brake release current	0.00% to 15.00%	3.00%	At stop
B6-04	0xB604	Brake release time	0.00s to 5.00s	0.20s	At stop
B6-05	0xB605	Brake applying frequency	0.00 Hz to 20.00 Hz	2.00 Hz	At stop
B6-06	0xB606	Brake applying time	0.00s to 5.00s	0.20s	At stop
B6-09	0xB609	Command reverse control	0: Direct direction reversal not allowed during operation 1: Reversal allowed during operation	0	At stop
B6-10	0xB60A	DC braking current	0% to 120%	0%	At stop
B6-11	0xB60B	DC braking frequency	0.00 Hz to 50.00 Hz	0.00 Hz	At stop
B6-12	0xB60C	Restart during braking	0: Restart not allowed during braking 1: Restart allowed during braking	0	At stop
B6-13	0xB60D	Restart waiting time	0.0s to 15.0s	0.3s	At stop
B6-14	0xB60E	Zero-crossing jump frequency	0.00 Hz to 20.00 Hz	2.00 Hz	At stop
B6-15	0xB60F	Mechanism selection	0: Hoisting mechanism 1: Translation mechanism	0	At stop
FP group					

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
FP-07	0x1F07	FP-07	0 to 65535	0	At once
FP-08	0x1F08	FP-08	0 to 65535	0	At once
FP-30	0x1F1E	FP-30	0 to 65535	0	At once
FP-31	0x1F1F	FP-31	0 to 65535	0	At once
FP-11	0x1F0B	FP-11	0 to 65535	0	At once
FP-12	0x1F0C	FP-12	0 to 65535	0	At once
C0 to CF Group					
C0-04	0xC004	C0-04	0 to 65535	0	At once
C0-05	0xC005	C0-05	0 to 65535	0	At once
C0-15	0xC00F	C0-15	0 to 65535	0	At once
C1-00	0xC100	C1-00	0 to 65535	0	At once
C1-01	0xC101	C1-01	0 to 65535	0	At once
C2-02	0xC202	C2-02	0 to 65535	0	At once
CF-00	0xCF00	Factory parameter	0 to 65535	0	Unchangeable
CF-01	0xCF01	Factory parameter	0 to 65535	0	Unchangeable
CF-02	0xCF02	Factory parameter	0 to 65535	0	Unchangeable
CF-03	0xCF03	Factory parameter	0 to 65535	0	Unchangeable
CF-04	0xCF04	Factory parameter	0 to 65535	0	Unchangeable
CF-05	0xCF05	Factory parameter	0 to 65535	0	Unchangeable
CF-06	0xCF06	Factory parameter	0 to 65535	0	Unchangeable
CF-07	0xCF07	Factory parameter	0 to 65535	0	Unchangeable
CF-08	0xCF08	Factory parameter	0 to 65535	0	Unchangeable
CF-09	0xCF09	Factory parameter	0 to 65535	0	Unchangeable
CF-10	0xCF0A	Factory parameter	0 to 65535	0	Unchangeable
CF-11	0xCF0B	Factory parameter	0 to 65535	0	Unchangeable
CF-12	0xCF0C	Factory parameter	0 to 65535	0	Unchangeable
CF-13	0xCF0D	Factory parameter	0 to 65535	0	Unchangeable
CF-14	0xCF0E	Factory parameter	0 to 65535	0	Unchangeable
CF-15	0xCF0F	Factory parameter	0 to 65535	0	Unchangeable
CF-16	0xCF10	Factory parameter	0 to 65535	0	Unchangeable
CF-17	0xCF11	Factory parameter	0 to 65535	0	Unchangeable
CF-18	0xCF12	Factory parameter	0 to 65535	0	Unchangeable
CF-19	0xCF13	Factory parameter	0 to 65535	0	Unchangeable
CF-20	0xCF14	Factory parameter	0 to 65535	0	Unchangeable
CF-21	0xCF15	Factory parameter	0 to 65535	0	Unchangeable
CF-22	0xCF16	Factory parameter	0 to 65535	0	Unchangeable
CF-23	0xCF17	Factory parameter	0 to 65535	0	Unchangeable
CF-24	0xCF18	Factory parameter	0 to 65535	0	Unchangeable
CF-25	0xCF19	Factory parameter	0 to 65535	0	Unchangeable
CF-26	0xCF1A	Factory parameter	0 to 65535	0	Unchangeable
CF-27	0xCF1B	Factory parameter	0 to 65535	0	Unchangeable
CF-28	0xCF1C	Factory parameter	0 to 65535	0	Unchangeable
CF-29	0xCF1D	Factory parameter	0 to 65535	0	Unchangeable
CF-30	0xCF1E	Factory parameter	0 to 65535	0	Unchangeable
CF-31	0xCF1F	Factory parameter	0 to 65535	0	Unchangeable
CF-32	0xCF20	Factory parameter	0 to 65535	0	Unchangeable
CF-33	0xCF21	Factory parameter	0 to 65535	0	Unchangeable
CF-34	0xCF22	Factory parameter	0 to 65535	0	Unchangeable
CF-35	0xCF23	Factory parameter	0 to 65535	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
CF-36	0xCF24	Factory parameter	0 to 65535	0	Unchangeable
CF-37	0xCF25	Factory parameter	0 to 65535	0	Unchangeable
CF-38	0xCF26	Factory parameter	0 to 65535	0	Unchangeable
CF-39	0xCF27	Factory parameter	0 to 65535	0	Unchangeable
CF-40	0xCF28	Factory parameter	0 to 65535	0	Unchangeable
CF-41	0xCF29	Factory parameter	0 to 65535	0	Unchangeable
CF-42	0xCF2A	Factory parameter	0 to 65535	0	Unchangeable
CF-43	0xCF2B	Factory parameter	0 to 65535	0	Unchangeable
CF-44	0xCF2C	Factory parameter	0 to 65535	0	Unchangeable
CF-45	0xCF2D	Factory parameter	0 to 65535	0	Unchangeable
CF-46	0xCF2E	Factory parameter	0 to 65535	0	Unchangeable
CF-47	0xCF2F	Factory parameter	0 to 65535	0	Unchangeable
CF-48	0xCF30	Factory parameter	0 to 65535	0	Unchangeable
CF-49	0xCF31	Factory parameter	0 to 65535	0	Unchangeable
CF-50	0xCF32	Factory parameter	0 to 65535	0	Unchangeable
CF-51	0xCF33	Factory parameter	0 to 65535	0	Unchangeable
CF-52	0xCF34	Factory parameter	0 to 65535	0	Unchangeable
CF-53	0xCF35	Factory parameter	0 to 65535	0	Unchangeable
CF-54	0xCF36	Factory parameter	0 to 65535	0	Unchangeable
CF-55	0xCF37	Factory parameter	0 to 65535	0	Unchangeable
CF-56	0xCF38	Factory parameter	0 to 65535	0	Unchangeable
CF-57	0xCF39	Factory parameter	0 to 65535	0	Unchangeable
CF-58	0xCF3A	Factory parameter	0 to 65535	0	Unchangeable
CF-59	0xCF3B	Factory parameter	0 to 65535	0	Unchangeable
CF-60	0xCF3C	Factory parameter	0 to 65535	0	Unchangeable
CF-61	0xCF3D	Factory parameter	0 to 65535	0	Unchangeable
CF-62	0xCF3E	Factory parameter	0 to 65535	0	Unchangeable
CF-63	0xCF3F	Factory parameter	0 to 65535	0	Unchangeable
CF-64	0xCF40	Factory parameter	0 to 65535	0	Unchangeable
CF-65	0xCF41	Factory parameter	0 to 65535	0	Unchangeable
CF-66	0xCF42	Factory parameter	0 to 65535	0	Unchangeable
CF-67	0xCF43	Factory parameter	0 to 65535	0	Unchangeable
CF-68	0xCF44	Factory parameter	0 to 65535	0	Unchangeable
CF-69	0xCF45	Factory parameter	0 to 65535	0	Unchangeable
CF-70	0xCF46	Factory parameter	0 to 65535	0	Unchangeable
CF-71	0xCF47	Factory parameter	0 to 65535	0	Unchangeable
CF-72	0xCF48	Factory parameter	0 to 65535	0	Unchangeable
CF-73	0xCF49	Factory parameter	0 to 65535	0	Unchangeable
CF-74	0xCF4A	Factory parameter	0 to 65535	0	Unchangeable
CF-75	0xCF4B	Factory parameter	0 to 65535	0	Unchangeable
CF-76	0xCF4C	Factory parameter	0 to 65535	0	Unchangeable
CF-77	0xCF4D	Factory parameter	0 to 65535	0	Unchangeable
CF-78	0xCF4E	Factory parameter	0 to 65535	0	Unchangeable
CF-79	0xCF4F	Factory parameter	0 to 65535	0	Unchangeable
CF-80	0xCF50	Factory parameter	0 to 65535	0	Unchangeable
CF-81	0xCF51	Factory parameter	0 to 65535	0	Unchangeable
CF-82	0xCF52	Factory parameter	0 to 65535	0	Unchangeable
CF-83	0xCF53	Factory parameter	0 to 65535	0	Unchangeable
CF-84	0xCF54	Factory parameter	0 to 65535	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
CF-85	0xCF55	Factory parameter	0 to 65535	0	Unchangeable
CF-86	0xCF56	Factory parameter	0 to 65535	0	Unchangeable
CF-87	0xCF57	Factory parameter	0 to 65535	0	Unchangeable
CF-88	0xCF58	Factory parameter	0 to 65535	0	Unchangeable
CF-89	0xCF59	Factory parameter	0 to 65535	0	Unchangeable
CF-90	0xCF5A	Factory parameter	0 to 65535	0	Unchangeable
CF-91	0xCF5B	Factory parameter	0 to 65535	0	Unchangeable
CF-92	0xCF5C	Factory parameter	0 to 65535	0	Unchangeable
CF-93	0xCF5D	Factory parameter	0 to 65535	0	Unchangeable
CF-94	0xCF5E	Factory parameter	0 to 65535	0	Unchangeable
CF-95	0xCF5F	Factory parameter	0 to 65535	0	Unchangeable
CF-96	0xCF60	Factory parameter	0 to 65535	0	Unchangeable
CF-97	0xCF61	Factory parameter	0 to 65535	0	Unchangeable
CF-98	0xCF62	Factory parameter	0 to 65535	0	Unchangeable
CF-99	0xCF63	Factory parameter	0 to 65535	0	Unchangeable
U0 General Monitoring Parameters					
U0-00	0x7000	Operating frequency	0.00 Hz	0.00 Hz	Unchangeable
U0-01	0x7001	Frequency reference	0.00 Hz	0.00 Hz	Unchangeable
U0-02	0x7002	Bus voltage	0.0 V	0.0 V	Unchangeable
U0-03	0x7003	Output voltage	0 V	0 V	Unchangeable
U0-04	0x7004	Output current	0.0 A	0.0 A	Unchangeable
U0-05	0x7005	Output power	0.0 kW	0.0 kW	Unchangeable
U0-06	0x7006	Output torque	0.0%	0.0%	Unchangeable
U0-07	0x7007	DI input state	0	0	Unchangeable
U0-08	0x7008	DO output state	0	0	Unchangeable
U0-09	0x7009	AI1 voltage	0.00 V	0.00 V	Unchangeable
U0-10	0x700A	AI2 voltage	0.00 V	0.00 V	Unchangeable
U0-11	0x700B	Motor speed	0	0	Unchangeable
U0-12	0x700C	Counting value	0	0	Unchangeable
U0-13	0x700D	Length value	0	0	Unchangeable
U0-14	0x700E	Load speed display	0	0	Unchangeable
U0-15	0x700F	PID reference	0	0	Unchangeable
U0-16	0x7010	PID feedback	0	0	Unchangeable
U0-17	0x7011	PLC stage	0	0	Unchangeable
U0-18	0x7012	(High-speed I/O) Pulse input frequency	0.00 kHz	0.00 kHz	Unchangeable
U0-19	0x7013	Feedback speed	0.00 Hz	0.00 Hz	Unchangeable
U0-20	0x7014	Remaining running time	0.0	0.0	Unchangeable
U0-21	0x7015	AI1 voltage before correction	0.000 V	0.000 V	Unchangeable
U0-22	0x7016	AI2 voltage before correction	0.000 V	0.000 V	Unchangeable
U0-23	0x7017	AI3 voltage before correction	0.000 V	0.000 V	Unchangeable
U0-24	0x7018	Linear speed	0	0	Unchangeable
U0-25	0x7019	Current power-on time	0	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U0-26	0x701A	Current operating time	0.0	0.0	Unchangeable
U0-27	0x701B	Pulse input frequency	0 Hz	0 Hz	Unchangeable
U0-28	0x701C	Communication setpoint	0.00%	0.00%	Unchangeable
U0-29	0x701D	Encoder feedback speed	0.00 Hz	0.00 Hz	Unchangeable
U0-30	0x701E	Display of main frequency X	0.00 Hz	0.00 Hz	Unchangeable
U0-31	0x701F	Display of auxiliary frequency Y	0.00 Hz	0.00 Hz	Unchangeable
U0-32	0x7020	Memory address view	0	0	Unchangeable
U0-33	0x7021	Synchronous motor rotor position	0.0°	0.0°	Unchangeable
U0-34	0x7022	Motor temperature	0° C	0° C	Unchangeable
U0-35	0x7023	Target torque	0.0%	0.0%	Unchangeable
U0-36	0x7024	Real-time position of synchronous motor rotor	0	0	Unchangeable
U0-37	0x7025	Power factor angle	0.0	0.0	Unchangeable
U0-38	0x7026	ABZ position	0	0	Unchangeable
U0-39	0x7027	Target voltage for V/f separation	0 V	0 V	Unchangeable
U0-40	0x7028	Output voltage for V/f separation	0 V	0 V	Unchangeable
U0-41	0x7029	Braking curve DC braking command	0	0	Unchangeable
U0-42	0x702A	Braking curve running command	0	0	Unchangeable
U0-43	0x702B	Braking curve running frequency	0	0	Unchangeable
U0-44	0x702C	Brake DO signal	0	0	Unchangeable
U0-45	0x702D	Fault subcode	0	0	Unchangeable
U0-46	0x702E	Drive unit temperature	0° C	0° C	Unchangeable
U0-47	0x702F	PTC channel voltage before correction	0.000	0.000	Unchangeable
U0-48	0x7030	PTC channel voltage after correction	0.000	0.000	Unchangeable
U0-49	0x7031	Number of position lock deviation pulses	0	0	Unchangeable
U0-50	0x7032	High 16 bits of 2nd encoder position	0.0	0.0	Unchangeable
U0-51	0x7033	Low 16 bits of 2nd encoder position	0.0	0.0	Unchangeable
U0-52	0x7034	Feedback speed of 2nd encoder	0.0	0.0	Unchangeable
U0-53	0x7035	Low 16 bits of 2nd (multiplexing) encoder port pulse capture value	0.0	0.0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U0-54	0x7036	High 16 bits of 2nd (multiplexing) encoder port pulse capture value	0.0	0.0	Unchangeable
U0-55	0x7037	Pulse synchronization feedforward frequency	0.0	0.0	Unchangeable
U0-56	0x7038	SSI encoder distance display (unit defined by B5-26 as basis)	0.0	0.0	Unchangeable
U0-57	0x7039	FPGA software version	0.0	0.0	Unchangeable
U0-58	0x703A	Z signal counter	0	0	Unchangeable
U0-59	0x703B	Frequency setpoint read by PLC programming card	0	0	Unchangeable
U0-60	0x703C	Operating frequency read by PLC programming card	0	0	Unchangeable
U0-61	0x703D	AC drive running status	0	0	Unchangeable
U0-62	0x703E	Fault code state display	0	0	Unchangeable
U0-63	0x703F	Operating frequency after droop	0.00	0.00	Unchangeable
U0-64	0x7040	Operating frequency before droop	0	0	Unchangeable
U0-65	0x7041	Arm software version	0	0	Unchangeable
U0-66	0x7042	Communication expansion card model	0	0	Unchangeable
U0-67	0x7043	Communication expansion card version	0	0	Unchangeable
U0-68	0x7044	AC drive state	0	0	Unchangeable
U0-69	0x7045	Feedback frequency	0 to 0	0	Unchangeable
U0-70	0x7046	Speed feedback	0	0	Unchangeable
U0-71	0x7047	Communication card-specific current display	0.0 A	0.0 A	Unchangeable
U0-72	0x7048	Communication card error state	0	0	Unchangeable
U0-73	0x7049	Unfiltered target torque in torque mode	-200.0 to 200.0	0.0%	Unchangeable
U0-74	0x704A	Filtered target torque in torque mode	-200.0 to 200.0	0.0%	Unchangeable
U0-75	0x704B	Torque reference in torque mode (after acceleration/deceleration)	-200.0 to 200.0	0.0%	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U0-76	0x704C	Torque upper limit in motoring state	0.0 to 200.0	0.0%	Unchangeable
U0-77	0x704D	Torque upper limit in generating state	0.0 to 200.00	0.0%	Unchangeable
U0-78	0x704E	AC drive rated current	0.0 A	0.0 A	Unchangeable
U0-79	0x704F	AC drive power	0.0 kW	0.0 kW	Unchangeable
U0-80	0x7050	EtherCAT slave name (valid upon power-on)	0 to 65535	0	Unchangeable
U0-81	0x7051	EtherCAT slave alias (valid upon power-on)	0 to 65535	0	Unchangeable
U0-82	0x7052	ESM transmission error code	0 to 65535	0	Unchangeable
U0-83	0x7053	XML file version	0 to 65535	0	Unchangeable
U0-84	0x7054	Number of lost synchronization frames	0 to 65535	0	Unchangeable
U0-85	0x7055	Maximum number of error frames and invalid frames of EtherCAT port 0 per unit time 2: Max. (main frequency, auxiliary frequency)	0 to 65535	0	Unchangeable
U0-86	0x7056	Maximum number of error frames and invalid frames of EtherCAT port 1 per unit time 2: Max. (main frequency, auxiliary frequency)	0 to 65535	0	Unchangeable
U0-88	0x7058	Maximum number of error frames forwarded by EtherCAT port per unit time	0 to 65535	0	Unchangeable
U0-89	0x7059	Maximum number of error frames processed by EtherCAT data frame processing unit per unit time 数最大值	0 to 65535	0	Unchangeable
U0-90	0x705A	Maximum number of lost links over the EtherCAT port per unit time	0 to 65535	0	Unchangeable
U0-91	0x705B	Station alias backup	0 to 65535	0	Unchangeable
U1 Tension Control Monitoring Parameters					
U1-00	0x7100	Linear speed	0.0	0.0	Unchangeable
U1-01	0x7101	Current roll diameter	0.0 millimeter	0.0 millimeter	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U1-02	0x7102	Roll diameter conversion frequency	0.00 Hz	0.00 Hz	Unchangeable
U1-03	0x7103	Tension reference	0	0	Unchangeable
U1-04	0x7104	Tension reference after taper	0	0	Unchangeable
U1-05	0x7105	Torque reference	0.0%	0.0%	Unchangeable
U1-07	0x7107	Acceleration rate of linear speed	0	0	Unchangeable
U1-08	0x7108	Inertia	0	0	Unchangeable
U1-09	0x7109	Taper output	0.00	0.00	Unchangeable
U1-11	0x710B	Current actual roll diameter	0.0 millimeter	0.0 millimeter	Unchangeable
U1-12	0x710C	Frequency acceleration rate	0.00	0.00	Unchangeable
U1-13	0x710D	Flywheel torque	0.00	0.00	Unchangeable
U1-14	0x710E	Frequency deviation	0.0	0.0	Unchangeable
U1-15	0x710F	Material inertia	0	0	Unchangeable
U1-16	0x7110	Torque set by PID reference	0.0%	0.0%	Unchangeable
U1-17	0x7111	Torque set by PID feedback	0.0%	0.0%	Unchangeable
U1-18	0x7112	Torque PID output (actual torque adjustment)	0.0%	0.0%	Unchangeable
U1-19	0x7113	Frequency set by PID reference	0.0%	0.0%	Unchangeable
U1-20	0x7114	Frequency set by PID feedback	0.0%	0.0%	Unchangeable
U1-21	0x7115	Frequency PID output (actual frequency adjustment)	0.00 Hz	0.00 Hz	Unchangeable
U2: Synchronization/Positioning Control Monitoring Parameters					
U2-00	0x7200	Position deviation	0 to 65535	0	Unchangeable
U2-01	0x7201	Valid slave frequency reference	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-02	0x7202	Slave frequency correction value	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-03	0x7203	Slave position synchronization state	0 to 65535	0	Unchangeable
U2-04	0x7204	Slave position compensation	0 to 65535	0	Unchangeable
U2-05	0x7205	Pulse synchronization reference variation	0 to 65535	0	Unchangeable
U2-06	0x7206	Pulse synchronization feedback variation	0 to 65535	0	Unchangeable
U2-07	0x7207	Pulse increment received by slave from master	0 to 65535	0	Unchangeable
U2-08	0x7208	Slave pulse increment	0 to 65535	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U2-09	0x7209	Slave time compensation	0 to 65535	0	Unchangeable
U2-10	0x720A	Acceleration rate after filter	0 to 65535	0	Unchangeable
U2-11	0x720B	Frequency received by slave from master	0 to 65535	0	Unchangeable
U2-12	0x720C	Frequency sent by master	0 to 65535	0	Unchangeable
U2-13	0x720D	Position increment sent by master	0 to 65535	0	Unchangeable
U2-14	0x720E	Master transmission interval	0 to 65535	0	Unchangeable
U2-15	0x720F	Operation command word received by slave	0 to 65535	0	Unchangeable
U2-16	0x7210	Current position	0 to 65535	0	Unchangeable
U2-17	0x7211	Master position	0 to 65535	0	Unchangeable
U2-18	0x7212	Feedback position variation in position control	0 to 65535	0	Unchangeable
U2-19	0x7213	Set position variable in position control	0 to 65535	0	Unchangeable
U2-21	0x7215	Value set by 1000H	0 to 65535	0	Unchangeable
U2-22	0x7216	Command set by 2000H	0 to 65535	0	Unchangeable
U2-23	0x7217	Synchronization mode setting	0 to 65535	0	Unchangeable
U2-24	0x7218	Actual synchronization mode	0 to 65535	0	Unchangeable
U2-25	0x7219	Direction change flag	0 to 65535	0	Unchangeable
U2-26	0x721A	Target frequency	0.00 to 655.35	0.00	Unchangeable
U2-27	0x721B	Frequency after being increased/ decreased by electronic gear ratio	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-28	0x721C	Frequency after filtering and being increased/ decreased by electronic gear ratio	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-57	0x7239	Operation enabling flag	0 to 65535	0	Unchangeable
U2-58	0x723A	Position lock position deviation during operation	0 to 65535	0	Unchangeable
U2-59	0x723B	Position lock procedure during operation	0 to 65535	0	Unchangeable
U2-60	0x723C	Real-time position deviation during position control	0 to 65535	0	Unchangeable
U2-61	0x723D	Valid home tag	0 to 65535	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U2-62	0x723E	Home position (low 16 bits)	0 to 65535	0	Unchangeable
U2-63	0x723F	Home position (high 16 bits)	0 to 65535	0	Unchangeable
U2-64	0x7240	Z signal position (low 16 bits)	0 to 65535	0	Unchangeable
U2-65	0x7241	Z signal position (high 16 bits)	0 to 65535	0	Unchangeable
U2-66	0x7242	Current position reference	0 to 65535	0	Unchangeable
U2-67	0x7243	Output flag for approaching the target position	0 to 65535	0	Unchangeable
U2-68	0x7244	Positioning completion output flag	0 to 65535	0	Unchangeable
U2-69	0x7245	Position control mode	0 to 65535	0	Unchangeable
U2-70	0x7246	Number of pulses per revolution of encoder	0 to 65535	0	Unchangeable
U2-71	0x7247	Number of pulses per revolution of main shaft	0 to 65535	0	Unchangeable
U2-72	0x7248	Number of pulses per revolution of motor	0 to 65535	0	Unchangeable
U2-73	0x7249	Current encoder degree	0 to 65535	0	Unchangeable
U2-74	0x724A	Current encoder degree (angle)	0 to 65535	0	Unchangeable
U2-75	0x724B	Adjacent home position deviation (low 16 bits)	0 to 65535	0	Unchangeable
U2-76	0x724C	Adjacent home position deviation (high 16 bits)	0 to 65535	0	Unchangeable
U2-77	0x724D	Home counter	0 to 65535	0	Unchangeable
U2-78	0x724E	Position control status	0 to 65535	0	Unchangeable
U2-79	0x724F	Real-time position deviation during position control	0 to 65535	0	Unchangeable
U2-80	0x7250	Relative home position direction	0 to 65535	0	Unchangeable
U2-81	0x7251	Relative home position deviation (low 16 bits)	0 to 65535	0	Unchangeable
U2-82	0x7252	Relative home position deviation (high 16 bits)	0 to 65535	0	Unchangeable
U2-83	0x7253	Position	0 to 65535	0	Unchangeable
U2-84	0x7254	Speed	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-85	0x7255	Current main shaft degree	0 to 65535	0	Unchangeable
U2-86	0x7256	Current main shaft degree (angle)	0 to 65535	0	Unchangeable
U2-87	0x7257	Position control enabling flag	0 to 65535	0	Unchangeable

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
U2-88	0x7258	Position control enabling command set by communication	0 to 65535	0	Unchangeable
U2-89	0x7259	Position lock enabling flag in position control	0 to 65535	0	Unchangeable
U2-90	0x725A	Frequency upper limit in position control	0.00 Hz to 655.35 Hz	0.00 Hz	Unchangeable
U2-91	0x725B	Main shaft static flag	0 to 65535	0	Unchangeable
U2-92	0x725C	Home loss counting during home correction	0 to 65535	0	Unchangeable
U2-93	0x725D	Encoder Z signal counter	0 to 65535	0	Unchangeable
U2-95	0x725F	Low 16 bits of encoder feedback pulse in position control	0 to 65535	0	Unchangeable
U2-96	0x7260	High 16 bits of encoder feedback pulse in position control	0 to 65535	0	Unchangeable
U2-97	0x7261	Position control state branch	0 to 65535	0	Unchangeable
U2-99	0x7263	Position control target frequency	0 to 65535	0	Unchangeable

Appendix C Parameter List of the Power Supply Unit

If FP-00 is set to a non-zero value (password protection enabled), the parameter menu is accessible in parameter mode and user-modification mode only after the correct password is entered. To disable password protection, set FP-00 to 0.

The password is only used for locking the operating panel. After the password is set, you need to enter the password each time you access the operating panel for parameter reading and writing. However, reading and writing of parameters (except parameters in groups FP and FF) is not password-protected during communication.

The parameter menu in the user-defined parameter mode is not protected by password.

Groups F and A include standard function parameters. Group U includes the monitoring function parameters.

Table C-1 Parameter list of the power supply unit

Parameter Code	Communication Address	Parameter Name	Value	Default	Change Mode
F0: Basic Parameters of Power Supply Unit					
F0-00	0xF000	Module Type	1: Drive unit 2: Power supply unit	2	Unchangeable
F0-01	0xF001	Product code	810	810	Unchangeable
F0-02	0xF002	Software version	0.00 to 655.35	0.00	Unchangeable
F0-03	0xF003	Temporary software version	0.00 to 655.35	0.00	Unchangeable
F0-04	0xF004	Customized software version	0 to 9999	0	Unchangeable
Group F1: Standard Parameters					
F1-00	0xF100	Bus undervoltage threshold	300 V to 500 V	350 V	Real time
F1-01	0xF101	Bus overvoltage threshold	700 V to 850 V	820 V	Real time
F1-02	0xF102	Braking unit action start voltage	700 V to 800 V	760 V	Real time
F1-03	0xF103	Reserved	0	0	Unchangeable
F1-04	0xF104	Reserved	0	0	Unchangeable
F1-05	0xF105	Reserved	0	0	Unchangeable
F1-06	0xF106	Usr correction coefficient	80.0% to 140.0%	100.0%	Real time
F1-07	0xF107	Ust correction coefficient	80.0% to 140.0%	100.0%	Real time
F1-08	0xF108	Utr correction coefficient	80.0% to 140.0%	100.0%	Real time

F1-09	0xF109	Fan control mode	0: The fan operates automatically. 0: The fan starts when the temperature is above 45°C . 0: The fan stops when the temperature is below or equal to 40°C . 1: Always running	1	At once
F1-10	0xF10A	Braking unit fault protection	Ones: Shoot through 0: Disable 1: Enable Tens: Overcurrent 0: Disable 1: Enable Hundreds: Overload 0: Disable 1: Enable	111	Unchangeable
F1-11	0xF10B	Three-phase input exception protection	Ones: Input phase loss 0: Disable 1: Enable Tens: High input voltage 0: Disable 1: Enable Hundreds: Input unbalance 0: Disable 1: Enable	111	At once
F1-12	0xF10C	Reserved	0	0	Unchangeable
F1-13	0xF10D	Communication exception protection	Ones: Communication fault 0: Disable 1: Enable	1	Unchangeable
F1-14	0xF10E	Module over-temperature protection	Ones: Module overheat 0: Disable 1: Enable Tens: Module overheat warning 0: Disable 1: Enable	11	Unchangeable
F1-15	0xF10F	EEPROM exception protection	Ones: EEPROM fault 0: Disable 1: Enable	1	Unchangeable
F1-16	0xF110	Reserved	0	0	Unchangeable
F1-17	0xF111	Protection of abnormal communication between power supply unit and drive unit	Ones: Communication timeout 0: Disable 1: Enable	1	At once
F1-18	0xF112	Timeout time of communication between power supply unit and drive unit	1.00s to 20.00s	5.00s	Real time
F1-19	0xF113	Input disconnection protection	0: Coast to stop 1: Stop in configured mode 2: Not responding	0	At once
F1-20	0xF114	Input disconnection protection time	200 to 30000	400	At once
Group F2: Information Exchange Between Power Supply Unit and Drive Unit					

F2-00	0xF200	Drive unit protection upon high grid voltage	1: Able to run 2: Coast to stop 3: Stop in configured mode	2	Unchangeable
F2-01	0xF201	Drive unit protection upon low grid voltage	1: Able to run 2: Coast to stop 3: Stop in configured mode	1	Unchangeable
F2-02	0xF202	Drive unit protection upon three-phase unbalance	1: Able to run 2: Coast to stop 3: Stop in configured mode	3	Unchangeable
F2-03	0xF203	Drive unit protection upon input phase loss	1: Able to run 2: Coast to stop 3: Stop in configured mode	3	Unchangeable
F2-04	0xF204	Drive unit protection upon braking unit shoot through	1: Able to run 2: Coast to stop 3: Stop in configured mode	2	Unchangeable
F2-05	0xF205	Drive unit protection upon braking unit overcurrent	1: Able to run 2: Coast to stop 3: Stop in configured mode	1	Unchangeable
F2-06	0xF206	Drive unit protection upon braking unit overload	1: Able to run 2: Coast to stop 3: Stop in configured mode	1	Unchangeable
F2-07	0xF207	Reserved	0	0	Unchangeable
F2-08	0xF208	Reserved	0	0	Unchangeable
F2-09	0xF209	Drive unit protection upon communication fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	1	Unchangeable
F2-10	0xF20A	Reserved	0	0	Unchangeable
F2-11	0xF20B	Drive unit protection upon EEPROM fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	3	Unchangeable
F2-12	0xF20C	Drive unit protection upon module overheat	1: Able to run 2: Coast to stop 3: Stop in configured mode	2	Unchangeable
F2-13	0xF20D	Drive unit protection upon module overheat warning	1: Able to run 2: Coast to stop 3: Stop in configured mode	3	At once
F2-14	0xF20E	Power supply unit protection upon high grid voltage	0: Able to run 1: Stop	1	At once
F4: Input Terminals					
F4-00	0xF400	DI1 function selection	0: No function 1: Running enabling 2: Incoming circuit breaker feedback 3: Auxiliary circuit breaker feedback 4: Leakage protection switch feedback 5: Reset upon fault 6: Operation forbidden (drive unit) 7: Coast to stop (drive unit) 8: Stop in configured mode (drive unit) 9: Running enabling (power supply unit)	5	At once

F4-01	0xF401	DI2 function selection	0: No function 1: Running enabling 2: Incoming circuit breaker feedback 3: Auxiliary circuit breaker feedback 4: Leakage protection switch feedback 5: Reset upon fault 6: Operation forbidden (drive unit) 7: Coast to stop (drive unit) 8: Stop in configured mode (drive unit) 9: Running enabling (power supply unit)	0	At once
F4-02	0xF402	DI3 function selection	0: No function 1: Running enabling 2: Incoming circuit breaker feedback 3: Auxiliary circuit breaker feedback 4: Leakage protection switch feedback 5: Reset upon fault 6: Operation forbidden (drive unit) 7: Coast to stop (drive unit) 8: Stop in configured mode (drive unit) 9: Running enabling (power supply unit)	0	At once
F4-03	0xF403	DI4 function selection	0: No function 1: Running enabling 2: Incoming circuit breaker feedback 3: Auxiliary circuit breaker feedback 4: Leakage protection switch feedback 5: Reset upon fault 6: Operation forbidden (drive unit) 7: Coast to stop (drive unit) 8: Stop in configured mode (drive unit) 9: Running enabling (power supply unit)	0	At once
F4-04	0xF404	DI5 function selection	0: No function 1: Running enabling 2: Incoming circuit breaker feedback 3: Auxiliary circuit breaker feedback 4: Leakage protection switch feedback 5: Reset upon fault 6: Operation forbidden (drive unit) 7: Coast to stop (drive unit) 8: Stop in configured mode (drive unit) 9: Running enabling (power supply unit)	0	At once
F4-05	0xF405	DI1 filter time	0.000s to 5.000s	0.010s	Real time
F4-06	0xF406	DI2 filter time	0.000s to 5.000s	0.010s	Real time
F4-07	0xF407	DI3 filter time	0.000s to 5.000s	0.010s	Real time
F4-08	0xF408	DI4 filter time	0.000s to 5.000s	0.010s	Real time
F4-09	0xF409	DI5 filter time	0.000s to 5.000s	0.010s	Real time
F4-10	0xF40A	DI1 valid delay	0.00s to 600.00s	0.00s	Real time
F4-11	0xF40B	DI2 valid delay	0.00s to 600.00s	0.00s	Real time

F4-12	0xF40C	DI3 valid delay	0.00s to 600.00s	0.00s	Real time
F4-13	0xF40D	DI4 valid delay	0.00s to 600.00s	0.00s	Real time
F4-14	0xF40E	DI5 valid delay	0.00s to 600.00s	0.00s	Real time
F4-15	0xF40F	DI1 invalid delay	0.00s to 600.00s	0.00s	Real time
F4-16	0xF410	DI2 inactive delay	0.00s to 600.00s	0.00s	Real time
F4-17	0xF411	DI3 invalid delay	0.00s to 600.00s	0.00s	Real time
F4-18	0xF412	DI4 invalid delay	0.00s to 600.00s	0.00s	Real time
F4-19	0xF413	DI5 invalid delay	0.00s to 600.00s	0.00s	Real time
F4-20	0xF414	DI active mode selection	Ones: 0: Active low 1: Active high Tens: 0: Active low 1: Active high Hundreds: 0: Active low 1: Active high Thousands: 0: Active low 1: Active high Ten thousands: 0: Active low 1: Active high	0	At once
F5: Output Terminals					
F5-00	0xF500	RO1 output function selection	0: No function 1: Able to run 2: Fault 3: Alarm 4: Switch-off 5: Bus undervoltage 6: Bus overvoltage 7: Normal bus voltage 11: Abnormal bus voltage 12: Abnormal three-phase input 13: Normal three-phase input 14: Module over-temperature 15: Module over-temperature warning	0	At once
F5-03	0xF503	RO1 valid delay	0.00s to 600.00s	0.00s	Real time
F5-04	0xF504	RO2 valid delay	0.00s to 600.00s	0.00s	Real time
F5-05	0xF505	RO3 valid delay	0.00s to 600.00s	0.00s	Real time
F5-06	0xF506	RO1 invalid delay	0.00s to 600.00s	0.00s	Real time

F5-07	0xF507	RO2 invalid delay	0.00s to 600.00s	0.00s	Real time
F5-08	0xF508	RO3 invalid delay	0.00s to 600.00s	0.00s	Real time
F5-09	0xF509	RO active mode	Ones: 0: Active high 1: Active low Tens: 0: Active high 1: Active low Hundreds: 0: Active high 1: Active low	0	At once
Group FA: Fault Record					
FA-00	0xFA00	Fault code of the 5th fault (latest)	0 to 99	0	Unchangeable
FA-01	0xFA01	Fault subcode of the 5th fault	0 to 99	0	Unchangeable
FA-02	0xFA02	Bus voltage upon the 5th fault	0.0 V to 6553.5 V	0.0 V	Unchangeable
FA-03	0xFA03	Heatsink temperature upon the 5th fault	-20° C to 999° C	0° C	Unchangeable
FA-04	0xFA04	Ambient temperature upon the 5th fault	-20° C to 999° C	0° C	Unchangeable
FA-05	0xFA05	Braking circuit current upon the 5th fault	0.00 A to 655.35 A	0.00 A	Unchangeable
FA-06	0xFA06	Grid voltage (Usr) upon the 5th fault	0 V to 9999 V	0 V	Unchangeable
FA-07	0xFA07	Grid voltage (Ust) upon the 5th fault	0 V to 9999 V	0 V	Unchangeable
FA-08	0xFA08	Grid voltage (Utr) upon the 5th fault	0 V to 9999 V	0 V	Unchangeable
FA-09	0xFA09	Three-phase imbalance degree upon the 5th fault	0.00% to 655.35%	0.00%	Unchangeable
FA-10	0xFA0A	DI status upon the 5th fault	0 to 65535	0	Unchangeable
FA-11	0xFA0B	RO status upon the 5th fault	0 to 65535	0	Unchangeable
FA-12	0xFA0C	Stop command sent by the power supply unit upon the 5th fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
FA-13	0xFA0D	Total power-on time (in hours) upon the 5th fault	0h to 65535h	0h	Unchangeable
FA-14	0xFA0E	Total power-on time (in minutes) upon the 5th fault	0 min to 65535 min	0 min	Unchangeable
FA-15	0xFA0F	Total power-on time (in seconds) upon the 5th fault	0s to 65535s	0s	Unchangeable
FA-20	0xFA14	Fault code of the 4th fault (the second most recent fault)	0 to 99	0	Unchangeable
FA-21	0xFA15	Fault subcode of the 4th fault	0 to 99	0	Unchangeable
FA-22	0xFA16	Bus voltage upon the 4th fault	0.0 V to 6553.5 V	0.0 V	Unchangeable
FA-23	0xFA17	Heatsink temperature upon the 4th fault	0° C to 999° C	0° C	Unchangeable

FA-24	0xFA18	Ambient temperature upon the 4th fault	0° C to 999° C	0° C	Unchangeable
FA-25	0xFA19	Braking circuit current upon the 4th fault	0.00 A to 655.35 A	0.00 A	Unchangeable
FA-26	0xFA1A	Grid voltage (Usr) upon the 4th fault	0 V to 9999 V	0 V	Unchangeable
FA-27	0xFA1B	Grid voltage (Ust) upon the 4th fault	0 V to 9999 V	0 V	Unchangeable
FA-28	0xFA1C	Grid voltage (Utr) upon the 4th fault	0 V to 9999 V	0 V	Unchangeable
FA-29	0xFA1D	Three-phase imbalance degree upon the 4th fault	0.00% to 655.35%	0.00%	Unchangeable
FA-30	0xFA1E	DI status upon the 4th fault	0 to 65535	0	Unchangeable
FA-31	0xFA1F	RO status upon the 4th fault	0 to 65535	0	Unchangeable
FA-32	0xFA20	Stop command sent by the power supply unit upon the 4th fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
FA-33	0xFA21	Total power-on time (in hours) upon the 4th fault	0h to 65535h	0h	Unchangeable
FA-34	0xFA22	Total power-on time (in minutes) upon the 4th fault	0 min to 65535 min	0 min	Unchangeable
FA-35	0xFA23	Total power-on time (in seconds) upon the 4th fault	0s to 65535s	0s	Unchangeable
FA-40	0xFA28	Fault code of the 3rd fault (the third most recent fault)	0 to 99	0	Unchangeable
FA-41	0xFA29	Fault subcode of the 3rd fault	0 to 99	0	Unchangeable
FA-42	0xFA2A	Bus voltage upon the 3rd fault	0.0 V to 6553.5 V	0.0 V	Unchangeable
FA-43	0xFA2B	Heatsink temperature upon the 3rd fault	0° C to 999° C	0° C	Unchangeable
FA-44	0xFA2C	Ambient temperature upon the 3rd fault	0° C to 999° C	0° C	Unchangeable
FA-45	0xFA2D	Braking circuit current upon the 3rd fault	0.00 A to 655.35 A	0.00 A	Unchangeable
FA-46	0xFA2E	Grid voltage (Usr) upon the 3rd fault	0 V to 9999 V	0 V	Unchangeable
FA-47	0xFA2F	Grid voltage (Ust) upon the 3rd fault	0 V to 9999 V	0 V	Unchangeable
FA-48	0xFA30	Grid voltage (Utr) upon the 3rd fault	0 V to 9999 V	0 V	Unchangeable
FA-49	0xFA31	Three-phase imbalance degree upon the 3rd fault	0.00% to 655.35%	0.00%	Unchangeable
FA-50	0xFA32	DI status upon the 3rd fault	0 to 65535	0	Unchangeable
FA-51	0xFA33	RO status upon the 3rd fault	0 to 65535	0	Unchangeable
FA-52	0xFA34	Stop command sent by the power supply unit upon the 3rd fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
FA-53	0xFA35	Total power-on time (in hours) upon the 3rd fault	0h to 65535h	0h	Unchangeable
FA-54	0xFA36	Total power-on time (minute) upon the 3rd fault	0 min to 65535 min	0 min	Unchangeable

FA-55	0xFA37	Total power-on time (in seconds) upon the 3rd fault	0s to 65535s	0s	Unchangeable
FA-60	0xFA3C	Fault code upon the 2nd fault (the fourth most recent fault)	0 to 99	0	Unchangeable
FA-61	0xFA3D	Fault subcode of the 2nd fault	0 to 99	0	Unchangeable
FA-62	0xFA3E	Bus voltage upon the second fault	0.0 V to 6553.5 V	0.0 V	Unchangeable
FA-63	0xFA3F	Heatsink temperature upon the 2nd fault	0° C to 999° C	0° C	Unchangeable
FA-64	0xFA40	Ambient temperature upon the 2nd fault	0° C to 999° C	0° C	Unchangeable
FA-65	0xFA41	Braking circuit current upon the 2nd fault	0.00 A to 655.35 A	0.00 A	Unchangeable
FA-66	0xFA42	Grid voltage (Usr) upon the 2nd fault	0 V to 9999 V	0 V	Unchangeable
FA-67	0xFA43	Grid voltage (Ust) upon the 2nd fault	0 V to 9999 V	0 V	Unchangeable
FA-68	0xFA44	Grid voltage (Utr) upon the 2nd fault	0 V to 9999 V	0 V	Unchangeable
FA-69	0xFA45	Three-phase imbalance degree upon the 2nd fault	0.00% to 655.35%	0.00%	Unchangeable
FA-70	0xFA46	DI status upon the 2nd fault	0 to 65535	0	Unchangeable
FA-71	0xFA47	RO status upon the 2nd fault	0 to 65535	0	Unchangeable
FA-72	0xFA48	Stop command sent by the power supply unit upon the 2nd fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
FA-73	0xFA49	Total power-on time (in hours) upon the 2nd fault	0h to 65535h	0h	Unchangeable
FA-74	0xFA4A	Power-on duration (in minutes) upon 2nd fault	0 min to 65535 min	0 min	Unchangeable
FA-75	0xFA4B	Total power-on time (in seconds) upon the 2nd fault	0s to 65535s	0s	Unchangeable
FA-80	0xFA50	Fault code upon the 1st fault (the fifth most recent fault)	0 to 99	0	Unchangeable
FA-81	0xFA51	Fault subcode of the 1st fault	0 to 99	0	Unchangeable
FA-82	0xFA52	Bus voltage upon the 1st fault	0.0 V to 6553.5 V	0.0 V	Unchangeable
FA-83	0xFA53	Heatsink temperature upon the 1st fault	0° C to 999° C	0° C	Unchangeable
FA-84	0xFA54	Ambient temperature upon the 1st fault	0° C to 999° C	0° C	Unchangeable
FA-85	0xFA55	Braking circuit current upon the 1st fault	0.00 A to 655.35 A	0.00 A	Unchangeable
FA-86	0xFA56	Grid voltage (Usr) upon the 1st fault	0 V to 9999 V	0 V	Unchangeable
FA-87	0xFA57	Grid voltage (Ust) upon the 1st fault	0 V to 9999 V	0 V	Unchangeable
FA-88	0xFA58	Grid voltage (Utr) upon the 1st fault	0 V to 9999 V	0 V	Unchangeable
FA-89	0xFA59	Three-phase imbalance degree upon the 1st fault	0.00% to 655.35%	0.00%	Unchangeable

FA-90	0xFA5A	DI status upon the 1st fault	0 to 65535	0	Unchangeable
FA-91	0xFA5B	RO status upon the first fault	0 to 65535	0	Unchangeable
FA-92	0xFA5C	Stop command sent by the power supply unit upon the first fault	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
FA-93	0xFA5D	Power-on duration (in hours) upon the 1st fault	0h to 65535h	0h	Unchangeable
FA-94	0xFA5E	Power-on duration (in minutes) upon the 1st fault	0 min to 65535 min	0 min	Unchangeable
FA-95	0xFA5F	Total power-on time (in seconds) upon the 1st fault	0s to 65535s	0s	Unchangeable
FD: Communication Parameters					
FD-00	0xFD00	Modbus baud rate	0: 300 bps 1: 600 bps 2: 1200 bps 3: 2400 bps 4: 4800 bps 5: 9600 bps 6: 19200 bps 7: 38400 bps 8: 57600 bps 9: 115200 bps	5	At once
FD-01	0xFD01	Modbus data format	0: No check (8-N-2) 1: Even parity check (8-E-1) 2: Odd parity check (8-O-1) 3: 8-N-1	0	At once
FD-02	0xFD02	Modbus local address	1 to 247	1	At once
FD-03	0xFD03	Modbus response delay time	0 ms to 20 ms	2 ms	Real time
FD-04	0xFD04	Modbus communication timeout time	0.0s to 60.0s	0.0s	Real time
FD-05	0xFD05	Reserved	0 to 65535	0	Unchangeable
FD-06	0xFD06	Automatic reset for RS485 communication faults	0: Enable 1: Disable	0	At once
FD-07	0xFD07	Reserved	0 to 65535	0	Unchangeable
FD-08	0xFD08	Reserved	0 to 65535	0	Unchangeable

FD-09	0xFD09	Communication status	0: CANopen 0: Stop 1: Initialization 2: Pre-operational 8: Running 0: CANlink 0: Stop 1: Initialization 2: Pre-operational 8: Running 0: DP 0: Stop 1: Initialization 8: Running	0	Unchangeable
FD-10	0xFD0A	Communication protocol	1: CANopen 2: CANlink 3: PROFIBUS DP-to-CANopen bridge 5: PROFINET-to-CANopen bridge	1	At once
FD-11	0xFD0B	CiA 402 selection	0: Invalid 1: Valid	0	At once
FD-12	0xFD0C	CAN baud rate	0: 20 kpbs 1: 50 kpbs 2: 100 kpbs 3: 125 kpbs 4: 250 kpbs 5: 500 kpbs 6: 1 Mpbs	5	At once
FD-13	0xFD0D	CAN station number	1 to 127	1	At once
FD-14	0xFD0E	Number of CAN frames received per unit time (real time)	0 to 65535	0	Unchangeable
FD-15	0xFD0F	Maximum number of error frames received by node (real time)	0 to 65535	0	Unchangeable
FD-16	0xFD10	Maximum number of error frames sent by node (real time)	0 to 65535	0	Unchangeable
FD-17	0xFD11	Number of bus disconnection times per unit of time	0 to 65535	0	Unchangeable
FD-18	0xFD12	Power supply unit number	1 to 99	1	At once
FD-19	0xFD13	CAN communication disconnection coefficient	1 to 15	3	At once
FD-20	0xFD14	PROFIBUS DP communication address	0 to 125	0	At once
FD-21	0xFD15	PROFIBUS DP communication disconnection coefficient	1 to 65535	350	At once
FD-22	0xFD16	PROFIBUS DP-to-CANopen mode	0: A communication error is reported when the number of slave stations configured for the PLC is inconsistent with the actual number of slave stations in the network. 1: No communication error is reported when the number of slave stations configured for the PLC is inconsistent with the actual number of slave stations in the network.	0	At once

FD-23	0xFD17	Number of online slaves	0 to 65535	0	Unchangeable
FD-24	0xFD18	Power-on delay of PROFIBUS DP-to-CANopen slave	0 to 65535	8s	Real time
FD-25	0xFD19	Online status of PROFIBUS DP-to-CANopen slaves 1-15	Bit 1: Station 1	0	Unchangeable
FD-26	0xFD1A	Online status of PROFIBUS DP-to-CANopen slaves 16-30	Bit 1: Station 16	0	Unchangeable
FD-29	0xFD1D	Oscilloscope baud rate	0 to 65535	0	Unchangeable
FD-30	0xFD1E	Number of RPDO1 and RPDO2 mapped bytes	0 to 65535	0	Unchangeable
FD-31	0xFD1F	Number of TPDO1 and RPDO2 mapped bytes	0 to 65535	0	Unchangeable
FD-32	0xFD20	Mapping mode switchover of parameters in AF group	0	1	At once
FD-34	0xFD22	CANopen mode	0 to 65535	0	Unchangeable
FD-35	0xFD23	CANopen inhibition time	0 to 65535	0	Unchangeable
FD-36	0xFD24	CANopen event time	0 to 65535	0	Unchangeable
FD-94	0xFD5E	Modbus software version	0.00 to 655.35	0.00	Unchangeable
FD-95	0xFD5F	CANlink software version	0.00 to 655.35	0.00	Unchangeable
FD-96	0xFD60	CANopen software version	0.00 to 655.35	0.00	Unchangeable
FD-97	0xFD61	PROFIBUS DP software version	0.00 to 655.35	0.00	Unchangeable
FD-98	0xFD62	PROFIBUS DP gateway software version	0.00 to 655.35	0.00	Unchangeable
FD-99	0xFD63	Modbus gateway software version	0.00 to 655.35	0.00	Unchangeable
FF: Factory Parameters					
FF-00	0xFF00	Manufacturer password	0 to 65535	0	At once
FF-01	0xFF01	Model	17 to 999	20	At once
FF-02	0xFF02	Power rating	0.0–999.9 kW	45.0 kW	Real time
FF-03	0xFF03	Voltage class	0 V to 999 V	380 V	Real time
FF-04	0xFF04	Bus voltage corresponding to full range	800.0 V to 2000.0 V	1000.0 V	Real time
FF-05	0xFF05	Bus voltage correction coefficient	80.0% to 140.0%	100.0%	Real time
FF-06	0xFF06	Temperature sensor selection	0: Invalid 1: Valid heatsink temperature detection 2: Valid ambient temperature detection 3: Enable	3	At once
FF-07	0xFF07	Heatsink temperature curve selection	1 to 2	2	At once
FF-08	0xFF08	Ambient temperature curve	1 to 2	2	At once

FF-10	0xFF0A	Memory address view	0 to 65535	0	At once
FF-11	0xFF0B	Parameter group display setting 1	0 to 11	0	At once
FF-14	0xFF0E	Three-phase input imbalance detection threshold	3.00 to 10.00	10.00	At once
FP: User Password Parameters					
FP-00	0x1F00	User password	0 to 65535	0	At once
FP-01	0x1F01	Parameter initialization	0: Disable 1: Restore parameters excluding motor parameters to default settings 2: Clear records 4: Restore user parameters from backup 501: Back up current user parameters	1	At once
FP-02	0x1F02	Parameter modification function	0: Parameters can be modified. 1: Parameters cannot be modified.	0	At once
FP-03	0x1F03	Monitoring parameter display setting 1	Bit 0: Bus voltage Bit 01: Heatsink temperature Bit 02: Ambient temperature Bit 03: Braking circuit current Bit 04: Usr cable voltage Bit 05: Ust cable voltage Bit 06: Utr cable voltage Bit 07: Degree of three-phase input voltage unbalance Bit 8: DI status Bit 9: RO status Bit 10: DI function state 1 Bit 11: DI function state 2 Bit 12: Current fault code Bit 13: Current fault subcode Bit 14: Reserved Bit 15: Reserved	251	At once
FP-04	0x1F04	Monitoring parameter display setting 2	Bit 00: Any memory address value Bit 1: Reserved	0	At once
AF: Process Data Address Mapping Parameters					
AF-00	0xAF00	RPDO1-SubIndex0-H	0 to 65535	0	At once
AF-01	0xAF01	RPDO1-SubIndex0-L	0 to 65535	0	At once
AF-02	0xAF02	RPDO1-SubIndex1-H	0 to 65535	0	At once
AF-03	0xAF03	RPDO1-SubIndex1-L	0 to 65535	0	At once
AF-04	0xAF04	RPDO1-SubIndex2-H	0 to 65535	0	At once
AF-05	0xAF05	RPDO1-SubIndex2-L	0 to 65535	0	At once
AF-06	0xAF06	RPDO1-SubIndex3-H	0 to 65535	0	At once
AF-07	0xAF07	RPDO1-SubIndex3-L	0 to 65535	0	At once

AF-08	0xAF08	RPDO2-SubIndex0-H	0 to 65535	0	At once
AF-09	0xAF09	RPDO2-SubIndex0-L	0 to 65535	0	At once
AF-10	0xAF0A	RPDO2-SubIndex1-H	0 to 65535	0	At once
AF-11	0xAF0B	RPDO2-SubIndex1-L	0 to 65535	0	At once
AF-12	0xAF0C	RPDO2-SubIndex2-H	0 to 65535	0	At once
AF-13	0xAF0D	RPDO2-SubIndex2-L	0 to 65535	0	At once
AF-14	0xAF0E	RPDO2-SubIndex3-H	0 to 65535	0	At once
AF-15	0xAF0F	RPDO2-SubIndex3-L	0 to 65535	0	At once
AF-16	0xAF10	RPDO3-SubIndex0-H	0 to 65535	0	At once
AF-17	0xAF11	RPDO3-SubIndex0-L	0 to 65535	0	At once
AF-18	0xAF12	RPDO3-SubIndex1-H	0 to 65535	0	At once
AF-19	0xAF13	RPDO3-SubIndex1-L	0 to 65535	0	At once
AF-20	0xAF14	RPDO3-SubIndex2-H	0 to 65535	0	At once
AF-21	0xAF15	RPDO3-SubIndex2-L	0 to 65535	0	At once
AF-22	0xAF16	RPDO3-SubIndex3-H	0 to 65535	0	At once
AF-23	0xAF17	RPDO3-SubIndex3-L	0 to 65535	0	At once
AF-24	0xAF18	RPDO4-SubIndex0-H	0 to 65535	0	At once
AF-25	0xAF19	RPDO4-SubIndex0-L	0 to 65535	0	At once
AF-26	0xAF1A	RPDO4-SubIndex1-H	0 to 65535	0	At once
AF-27	0xAF1B	RPDO4-SubIndex1-L	0 to 65535	0	At once
AF-28	0xAF1C	RPDO4-SubIndex2-H	0 to 65535	0	At once
AF-29	0xAF1D	RPDO4-SubIndex2-L	0 to 65535	0	At once
AF-30	0xAF1E	RPDO4-SubIndex3-H	0 to 65535	0	At once
AF-31	0xAF1F	RPDO4-SubIndex3-L	0 to 65535	0	At once
AF-32	0xAF20	TPDO1-SubIndex0-H	0 to 65535	0	At once
AF-33	0xAF21	TPDO1-SubIndex0-L	0 to 65535	0	At once
AF-34	0xAF22	TPDO1-SubIndex1-H	0 to 65535	0	At once
AF-35	0xAF23	TPDO1-SubIndex1-L	0 to 65535	0	At once
AF-36	0xAF24	TPDO1-SubIndex2-H	0 to 65535	0	At once

AF-37	0xAF25	TPDO1-SubIndex2-L	0 to 65535	0	At once
AF-38	0xAF26	TPDO1-SubIndex3-H	0 to 65535	0	At once
AF-39	0xAF27	TPDO1-SubIndex3-L	0 to 65535	0	At once
AF-40	0xAF28	TPDO2-SubIndex0-H	0 to 65535	0	At once
AF-41	0xAF29	TPDO2-SubIndex0-L	0 to 65535	0	At once
AF-42	0xAF2A	TPDO2-SubIndex1-H	0 to 65535	0	At once
AF-43	0xAF2B	TPDO2-SubIndex1-L	0 to 65535	0	At once
AF-44	0xAF2C	TPDO2-SubIndex2-H	0 to 65535	0	At once
AF-45	0xAF2D	TPDO2-SubIndex2-L	0 to 65535	0	At once
AF-46	0xAF2E	TPDO2-SubIndex3-H	0 to 65535	0	At once
AF-47	0xAF2F	TPDO2-SubIndex3-L	0 to 65535	0	At once
AF-48	0xAF30	TPDO3-SubIndex0-H	0 to 65535	0	At once
AF-49	0xAF31	TPDO3-SubIndex0-L	0 to 65535	0	At once
AF-50	0xAF32	TPDO3-SubIndex1-H	0 to 65535	0	At once
AF-51	0xAF33	TPDO3-SubIndex1-L	0 to 65535	0	At once
AF-52	0xAF34	TPDO3-SubIndex2-H	0 to 65535	0	At once
AF-53	0xAF35	TPDO3-SubIndex2-L	0 to 65535	0	At once
AF-54	0xAF36	TPDO3-SubIndex3-H	0 to 65535	0	At once
AF-55	0xAF37	TPDO3-SubIndex3-L	0 to 65535	0	At once
AF-56	0xAF38	TPDO4-SubIndex0-H	0 to 65535	0	At once
AF-57	0xAF39	TPDO4-SubIndex0-L	0 to 65535	0	At once
AF-58	0xAF3A	TPDO4-SubIndex1-H	0 to 65535	0	At once
AF-59	0xAF3B	TPDO4-SubIndex1-L	0 to 65535	0	At once
AF-60	0xAF3C	TPDO4-SubIndex2-H	0 to 65535	0	At once
AF-61	0xAF3D	TPDO4-SubIndex2-L	0 to 65535	0	At once
AF-62	0xAF3E	TPDO4-SubIndex3-H	0 to 65535	0	At once
AF-63	0xAF3F	TPDO4-SubIndex3-L	0 to 65535	0	At once
AF-66	0xAF42	Number of valid RPDOs	0 to 65535	0	Unchangeable
AF-67	0xAF43	Number of valid TPDOs	0 to 65535	0	Unchangeable

CF: Factory Parameters					
CF-00	0xCF00	Factory parameter	0 to 65535	0	Unchangeable
CF-01	0xCF01	Factory parameter	0 to 65535	0	Unchangeable
CF-02	0xCF02	Factory parameter	0 to 65535	0	Unchangeable
CF-03	0xCF03	Factory parameter	0 to 65535	0	Unchangeable
CF-04	0xCF04	Factory parameter	0 to 65535	0	Unchangeable
CF-05	0xCF05	Factory parameter	0 to 65535	0	Unchangeable
CF-06	0xCF06	Factory parameter	0 to 65535	0	Unchangeable
CF-07	0xCF07	Factory parameter	0 to 65535	0	Unchangeable
CF-08	0xCF08	Factory parameter	0 to 65535	0	Unchangeable
CF-09	0xCF09	Factory parameter	0 to 65535	0	Unchangeable
CF-10	0xCF0A	Factory parameter	0 to 65535	0	Unchangeable
CF-11	0xCF0B	Factory parameter	0 to 65535	0	Unchangeable
CF-12	0xCF0C	Factory parameter	0 to 65535	0	Unchangeable
CF-13	0xCF0D	Factory parameter	0 to 65535	0	Unchangeable
CF-14	0xCF0E	Factory parameter	0 to 65535	0	Unchangeable
CF-15	0xCF0F	Factory parameter	0 to 65535	0	Unchangeable
CF-16	0xCF10	Factory parameter	0 to 65535	0	Unchangeable
CF-17	0xCF11	Factory parameter	0 to 65535	0	Unchangeable
CF-18	0xCF12	Factory parameter	0 to 65535	0	Unchangeable
CF-19	0xCF13	Factory parameter	0 to 65535	0	Unchangeable
CF-20	0xCF14	Factory parameter	0 to 65535	0	Unchangeable
CF-21	0xCF15	Factory parameter	0 to 65535	0	Unchangeable
CF-22	0xCF16	Factory parameter	0 to 65535	0	Unchangeable
CF-23	0xCF17	Factory parameter	0 to 65535	0	Unchangeable
CF-24	0xCF18	Factory parameter	0 to 65535	0	Unchangeable
CF-25	0xCF19	Factory parameter	0 to 65535	0	Unchangeable
CF-26	0xCF1A	Factory parameter	0 to 65535	0	Unchangeable
CF-27	0xCF1B	Factory parameter	0 to 65535	0	Unchangeable

CF-28	0xCF1C	Factory parameter	0 to 65535	0	Unchangeable
CF-29	0xCF1D	Factory parameter	0 to 65535	0	Unchangeable
CF-30	0xCF1E	Factory parameter	0 to 65535	0	Unchangeable
CF-31	0xCF1F	Factory parameter	0 to 65535	0	Unchangeable
CF-32	0xCF20	Factory parameter	0 to 65535	0	Unchangeable
CF-33	0xCF21	Factory parameter	0 to 65535	0	Unchangeable
CF-34	0xCF22	Factory parameter	0 to 65535	0	Unchangeable
CF-35	0xCF23	Factory parameter	0 to 65535	0	Unchangeable
CF-36	0xCF24	Factory parameter	0 to 65535	0	Unchangeable
CF-37	0xCF25	Factory parameter	0 to 65535	0	Unchangeable
CF-38	0xCF26	Factory parameter	0 to 65535	0	Unchangeable
CF-39	0xCF27	Factory parameter	0 to 65535	0	Unchangeable
CF-40	0xCF28	Factory parameter	0 to 65535	0	Unchangeable
CF-41	0xCF29	Factory parameter	0 to 65535	0	Unchangeable
CF-42	0xCF2A	Factory parameter	0 to 65535	0	Unchangeable
CF-43	0xCF2B	Factory parameter	0 to 65535	0	Unchangeable
CF-44	0xCF2C	Factory parameter	0 to 65535	0	Unchangeable
CF-45	0xCF2D	Factory parameter	0 to 65535	0	Unchangeable
CF-46	0xCF2E	Factory parameter	0 to 65535	0	Unchangeable
CF-47	0xCF2F	Factory parameter	0 to 65535	0	Unchangeable
CF-48	0xCF30	Factory parameter	0 to 65535	0	Unchangeable
CF-49	0xCF31	Factory parameter	0 to 65535	0	Unchangeable
CF-50	0xCF32	Factory parameter	0 to 65535	0	Unchangeable
CF-51	0xCF33	Factory parameter	0 to 65535	0	Unchangeable
CF-52	0xCF34	Factory parameter	0 to 65535	0	Unchangeable
CF-53	0xCF35	Factory parameter	0 to 65535	0	Unchangeable
CF-54	0xCF36	Factory parameter	0 to 65535	0	Unchangeable
CF-55	0xCF37	Factory parameter	0 to 65535	0	Unchangeable
CF-56	0xCF38	Factory parameter	0 to 65535	0	Unchangeable

CF-57	0xCF39	Factory parameter	0 to 65535	0	Unchangeable
CF-58	0xCF3A	Factory parameter	0 to 65535	0	Unchangeable
CF-59	0xCF3B	Factory parameter	0 to 65535	0	Unchangeable
CF-60	0xCF3C	Factory parameter	0 to 65535	0	Unchangeable
CF-61	0xCF3D	Factory parameter	0 to 65535	0	Unchangeable
CF-62	0xCF3E	Factory parameter	0 to 65535	0	Unchangeable
CF-63	0xCF3F	Factory parameter	0 to 65535	0	Unchangeable
CF-64	0xCF40	Factory parameter	0 to 65535	0	Unchangeable
CF-65	0xCF41	Factory parameter	0 to 65535	0	Unchangeable
CF-66	0xCF42	Factory parameter	0 to 65535	0	Unchangeable
CF-67	0xCF43	Factory parameter	0 to 65535	0	Unchangeable
CF-68	0xCF44	Factory parameter	0 to 65535	0	Unchangeable
CF-69	0xCF45	Factory parameter	0 to 65535	0	Unchangeable
CF-70	0xCF46	Factory parameter	0 to 65535	0	Unchangeable
CF-71	0xCF47	Factory parameter	0 to 65535	0	Unchangeable
CF-72	0xCF48	Factory parameter	0 to 65535	0	Unchangeable
CF-73	0xCF49	Factory parameter	0 to 65535	0	Unchangeable
CF-74	0xCF4A	Factory parameter	0 to 65535	0	Unchangeable
CF-75	0xCF4B	Factory parameter	0 to 65535	0	Unchangeable
CF-76	0xCF4C	Factory parameter	0 to 65535	0	Unchangeable
CF-77	0xCF4D	Factory parameter	0 to 65535	0	Unchangeable
CF-78	0xCF4E	Factory parameter	0 to 65535	0	Unchangeable
CF-79	0xCF4F	Factory parameter	0 to 65535	0	Unchangeable
CF-80	0xCF50	Factory parameter	0 to 65535	0	Unchangeable
CF-81	0xCF51	Factory parameter	0 to 65535	0	Unchangeable
CF-82	0xCF52	Factory parameter	0 to 65535	0	Unchangeable
CF-83	0xCF53	Factory parameter	0 to 65535	0	Unchangeable
CF-84	0xCF54	Factory parameter	0 to 65535	0	Unchangeable
CF-85	0xCF55	Factory parameter	0 to 65535	0	Unchangeable

CF-86	0xCF56	Factory parameter	0 to 65535	0	Unchangeable
CF-87	0xCF57	Factory parameter	0 to 65535	0	Unchangeable
CF-88	0xCF58	Factory parameter	0 to 65535	0	Unchangeable
CF-89	0xCF59	Factory parameter	0 to 65535	0	Unchangeable
CF-90	0xCF5A	Factory parameter	0 to 65535	0	Unchangeable
CF-91	0xCF5B	Factory parameter	0 to 65535	0	Unchangeable
CF-92	0xCF5C	Factory parameter	0 to 65535	0	Unchangeable
CF-93	0xCF5D	Factory parameter	0 to 65535	0	Unchangeable
CF-94	0xCF5E	Factory parameter	0 to 65535	0	Unchangeable
CF-95	0xCF5F	Factory parameter	0 to 65535	0	Unchangeable
CF-96	0xCF60	Factory parameter	0 to 65535	0	Unchangeable
CF-97	0xCF61	Factory parameter	0 to 65535	0	Unchangeable
CF-98	0xCF62	Factory parameter	0 to 65535	0	Unchangeable
CF-99	0xCF63	Factory parameter	0 to 65535	0	Unchangeable
U0: Monitoring Parameters					
U0-00	0x7000	Bus voltage (V)	0.0 V to 6553.5 V	0.0 V	Unchangeable
U0-01	0x7001	Heatsink temperature (° C)	0° C to 65535° C	0° C	Unchangeable
U0-02	0x7002	Braking transistor temperature (° C)	0° C to 65535° C	0° C	Unchangeable
U0-03	0x7003	Braking circuit current (A)	0.00 A to 655.35 A	0.00 A	Unchangeable
U0-04	0x7004	Input voltage Usr (V)	0 V to 65535 V	0 V	Unchangeable
U0-05	0x7005	Input voltage Ust (V)	0 V to 65535 V	0 V	Unchangeable
U0-06	0x7006	Input voltage Utr (V)	0 V to 65535 V	0 V	Unchangeable
U0-07	0x7007	Three-phase unbalance degree (%)	0.00% to 655.35%	0.00%	Unchangeable
U0-08	0x7008	DI state	0 to 65535	0	Unchangeable
U0-09	0x7009	RO state	0 to 65535	0	Unchangeable
U0-12	0x700C	Current fault code	0 to 65535	0	Unchangeable
U0-13	0x700D	Subcode of current fault	0 to 65535	0	Unchangeable
U0-14	0x700E	DI status after delay	0 to 65535	0	Unchangeable
U0-15	0x700F	DI status after positive and negative logic judgment	0 to 65535	0	Unchangeable

U0-16	0x7010	Any memory address value (FF-10)	0 to 65535	0	Unchangeable
U0-17	0x7011	RO status after delay	0 to 65535	0	Unchangeable
U0-18	0x7012	RO status after positive and negative logic judgment	0 to 65535	0	Unchangeable
U0-19	0x7013	Running state of power supply unit	0 to 65535	0	Unchangeable
U0-20	0x7014	Current power-on time (h)	0h to 65535h	0h	Unchangeable
U0-21	0x7015	Current power-on time (min)	0 min to 65535 min	0 min	Unchangeable
U0-22	0x7016	Current power-on time (s)	0s to 65535s	0s	Unchangeable
U0-23	0x7017	Current power-on time (ms)	0 ms to 65535 ms	0 ms	Unchangeable
U0-24	0x7018	Fan control command word	0: Turn off the fan. 1: Turn on the fan.	0	Unchangeable
U0-25	0x7019	Control command word of braking unit	0: Turn off the braking transistor. 1: turn on the braking transistor.	0	Unchangeable
U0-26	0x701A	Reserved	0 to 65535	0	Unchangeable
U0-27	0x701B	Non-operational flag of the power supply unit	1: Able to run 2: Coast to stop 3: Stop in configured mode	0	Unchangeable
U0-28	0x701C	Reserved	0 to 65535	0	Unchangeable
U0-29	0x701D	Reserved	0 to 65535	0	Unchangeable
U0-30	0x701E	Total power-on time (in hours)	0 to 65535	0	Unchangeable
U0-31	0x701F	Total power-on time (in minutes)	0 to 65535	0	Unchangeable
U0-32	0x7020	Total power-on time (in seconds)	0 to 65535	0	Unchangeable
U0-33	0x7021	Total power-on time (in milliseconds)	0 to 65535	0	Unchangeable

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