INOVANCE

User Guide
HD90S Series
Medium-voltage AC Drive

User Guide

A01
Data code 19011005

Preface

Thank you for purchasing the medium voltage (MV) AC drive.

The MV AC drive with the high-performance vector control technology adopts the structure of power cells connected in series and reaches maximum output voltage of 10 kV. It has the advantage of better control performance and is highly reliable.

The MV AC drive satisfies the requirements on energy saving and speed regulating of general-purpose machinery such as large and medium-sized fan and pump. It is widely applied in electrical systems, metallurgy, mine, building materials industry, petrochemical, and municipal construction.

This guide is a guideline for selection, installation, parameter setting, commissioning, maintenance & inspection of the MV AC drive. Before using the equipment, read this guide carefully to have a thorough understanding of the equipment. Keep the guide well and forward it to end users together with the equipment.

To ensure your safety, get acquainted with the functions of the equipment by reading the guide. If you have any problem concerning the functions or performance that is not described in the guide, contact the agent or the technical support personnel to ensure correct use.

Note
◆ The 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 manual are shown for description only and may not match the product you purchased. ◆ The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the guide. ◆ Contact our agents or customer service center if you have any problem during the use.

■ Product checking

Upon unpacking, check the following items:

Item	Confirming Method
Whether the equipment is complete?	Check that no components or spare parts are missed according to the supply list.
Whether the equipment is consistent with the product you purchased?	Check the nameplate to confirm the equipment model and ratings.
Whether the equipment is damaged?	Check the appearance to see whether the product is damaged during transportation, for example, damage to cabinet appearance, deformation of cabinet doors and side panels.
Whether the equipment is moist?	Check whether the product suffered the rain during transportation. Rainwater seepage will cause component short-circuit or even damage to the product.
Whether the equipment is intact?	Open the cabinet doors and check the situations inside the cabinet. Check whether any control cable becomes loose, whether water seepage exists, and whether any component is missed or damaged.

If you find any problem with the product, or the product is not consistent with your order or it is damaged during transportation, contact your agent or our company immediately.

NOTE

The supply list includes the equipment components, spare parts, engineering drawings and the user guide.

CAUTION

If the equipment is damaged during transportation, do as follows:

- Register the damage items when unloading. The register must be signed by the representative of the transportation company. Then submit a written report including the damage degree and estimated loss to the transportation company.
- Submit a written report on the non-obvious loss within the time contracted or notify the transportation company by fax or phone.
- Keep the damaged equipment well for the transportation company to check or for legal authority to perform necessary inspection. The loss is estimated by the transportation company.

■ Terms and abbreviation

Term or Abbreviation	Meaning
d-q shaft	Synchronous rotational speed coordinate system.
Syn-transfer	Synchronous transfer
PWM	Pulse width modulation
I/O	Input/Output
AI	Analog input
AO	Analog output
DI	Digital input
DO	Digital output
EMC	Electro-magnetic compatibility
HMI	Human-machine touch screen
PID	Closed-loop: proportional-integral-differential

Revision History

Date	Version	Revision Description
May 2019	A00	First release
September 2019	A01	Updated all figures

Contents

Safety Instructions

Safety Precautions

1) Before installing, using, and maintaining this equipment, read the safety information and precautions thoroughly, and comply with them during operations.
2) To ensure the safety of humans and equipment, follow the signs on the equipment and all the safety instructions in this user guide.
3) "CAUTION", "WARNING", and "DANGER" items in the user guide do not indicate all safety precautions that need to be followed; instead, they just supplement the safety precautions.
4) Use this equipment according to the designated environment requirements. Damage caused by improper usage is not covered by warranty.
5) Our company shall take no responsibility for any personal injuries or property damage caused by improper usage.

Safety Levels and Definitions

DANGER	indicates that failure to comply with the notice will result in severe personal injuries or even death.
WARNING	indicates that failure to comply with the notice may result in severe personal injuries or even death.
CAUTION	indicates that failure to comply with the notice may result in minor personal injuries or damage to the equipment.

Safety Instructions

Unpacking
CAUTION ◆ Check whether the packing is intact and whether there is damage, water seepage, damp, and deformation. ◆ Unpack the package by following the package sequence. Do not hit the package with force. ◆ Check whether there are damage, rust, or injuries on the surface of the equipment or equipment accessories. ◆ Check whether the number of packing materials is consistent with the packing list.

WARNING

- Do not install the equipment if you find damage, rust, or indications of use on the equipment or accessories.
- Do not install the equipment if you find water seepage, component missing or damage upon unpacking.
- Do not install the equipment if you find the packing list does not conform to the equipment you received.

Storage and Transportation

CAUTION

- Store and transport this equipment based on the storage and transportation requirements for humidity and temperature.
- Avoid transporting the equipment in environments such as water splashing, rain, direct sunlight, strong electric field, strong magnetic field, and strong vibration.
- Avoid storing this equipment for more than three months. Long-term storage requires stricter protection and necessary inspections.
- Pack the equipment strictly before transportation. Use a sealed box for long-distance transportation.
- Never transport this equipment with other equipment or materials that may harm or have negative impacts on this equipment.

WARNING

- Use professional loading and unloading equipment to carry large-scale or heavy equipment.
- When carrying this equipment with bare hands, hold the equipment casing firmly with care to prevent parts falling. Failure to comply may result in personal injuries.
- Handle the equipment with care during transportation and mind your step to prevent personal injuries or equipment damage.
- Never stand or stay below the equipment when the equipment is lifted by hoisting equipment.

Installation

WARNING

- Thoroughly read the safety instructions and user guide before installation.
- Do not modify this equipment.
- Do not rotate the equipment components or loosen fixed bolts (especially those marked in red) on equipment components.
- Do not install this equipment in places with strong electric or magnetic fields.
- When this equipment is installed in a cabinet or final equipment, protection measures such as a fireproof enclosure, electrical enclosure, or mechanical enclosure must be provided. The IP rating must meet IEC standards and local laws and regulations.

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Installation, wiring, maintenance, inspection, or parts replacement must be performed by only experienced personnel who have been trained with necessary electrical information.
- Installation personnel must be familiar with equipment installation requirements and relevant technical materials.
- Before installing equipment with strong electromagnetic interference, such as a transformer, install an electromagnetic shielding device for this equipment to prevent malfunctions.

Wiring

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Never perform wiring at power-on. Failure to comply will result in an electric shock.
- Before wiring, cut off all equipment power supplies. Wait at least 10 minutes before further operations because residual voltage exists after power-off.
- Make sure that the equipment is well grounded. Failure to comply will result in an electric shock.
- During wiring, follow the proper electrostatic discharge (ESD) procedures, and wear an antistatic wrist strap. Failure to comply will result in damage to internal equipment circuits.

WARNING

- Never connect the power cable to output terminals of the equipment. Failure to comply may cause equipment damage or even a fire.
- When connecting a drive with the motor, make sure that the phase sequences of the drive and motor terminals are consistent to prevent reverse motor rotation.
- Wiring cables must meet diameter and shielding requirements. The shielding layer of the shielded cable must be reliably grounded at one end.
- After wiring, make sure that no screws are fallen and cables are exposed in the equipment.

Power-on
DANGER
◆ Before power-on, make sure 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 equipment requirements to prevent equipment damage or even a fire. ◆ At power-on, unexpected operations may be triggered on the equipment. Therefore, stay away from the equipment. ◆ After power-on, do not open the cabinet door and protective cover of the equipment. Failure to comply will result in an electric shock. ◆ Do not touch any wiring terminals at power-on. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment at power-on. Failure to comply will result in an electric shock.
Operation
DANGER
◆ Do not touch any wiring terminals during operation. Failure to comply will result in an electric shock. ◆ Do not remove any part of the equipment during operation. Failure to comply will result in an electric shock. ◆ Do not touch the equipment shell, fan, or resistor for temperature detection. Failure to comply will result in heat injuries. ◆ Signal detection must be performed by only professionals during operation. Failure to comply will result in personal injuries or equipment damage.
WARNING
◆ Prevent metal or other objects from falling into the device during operation. Failure to comply may result in equipment damage. ◆ Do not start or stop the equipment using the contactor. Failure to comply may result in equipment damage.
Maintenance
DANGER
◆ Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals. ◆ Do not maintain the equipment at power-on. Failure to comply will result in an electric shock. ◆ Before maintenance, cut off all equipment power supplies and wait at least 10 minutes.

WARNING

- Perform daily and periodic inspection and maintenance for the equipment according to maintenance requirements and keep a maintenance record.

Repair

DANGER

- Equipment installation, wiring, maintenance, inspection, or parts replacement must be performed by only professionals.
- Do not repair the equipment at power-on. Failure to comply will result in an electric shock.
- Before inspection and repair, cut off all equipment power supplies and wait at least 10 minutes.

WARNING

- Require for repair services according to the product warranty agreement.
- When the equipment is faulty or damaged, require professionals to perform troubleshooting and repair by following repair instructions and keep a repair record.
- Replace quick-wear parts of the equipment according to the replacement guide.
- Do not operate damaged equipment. Failure to comply may result in worse damage.
- After the equipment is replaced, perform wiring inspection and parameter settings again.

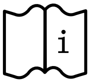
Disposal

WARNING

- Dispose of retired equipment by following local regulations or standards. Failure to comply may result in property damage, personal injuries, or even death.
- Recycle retired equipment by following industry waste disposal standards to avoid environmental pollution.

Safety Signs

■ Description of safety signs in the user guide


Read the user guide before installation and operation.

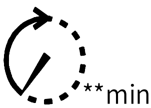

Reliably ground the system and equipment.


Danger!


High temperature!


Prevent personal injuries caused by machines.

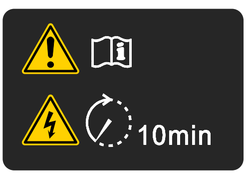

High voltage!



Wait xx minutes before further operations.

■ Description of safety signs on the equipment

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

Safety Sign	Description
	◆ Read the user guide before installation and operation. Failure to comply will result in an electric shock. ◆ Do not remove the cover at power-on or within 10 minutes after power-off. ◆ Before maintenance, inspection, and wiring, cut off input and output power, and wait at least 10 minutes until the power indicator is off.

1 Product Information

1.1 Nameplate

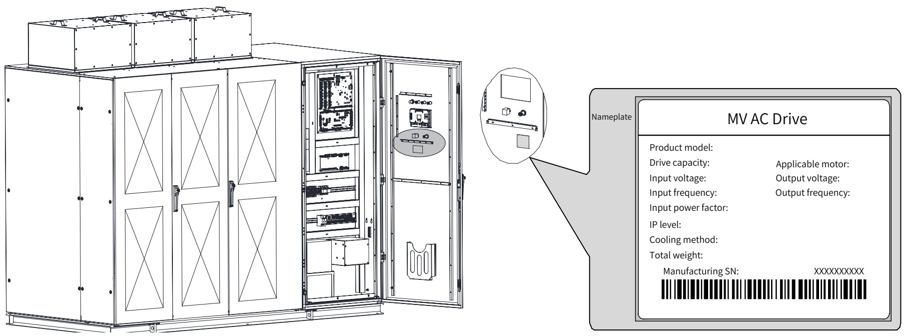


Figure 1-1 Nameplate of the MV AC drive

1.2 Operating Principle and System Composition

1.2.1 System Operating Principle

- The MV AC drive is a voltage source AC drive with power cells connected in series and direct medium voltage input and output. It contains three phase groups of power cells of the same quantity in series.
- On the input side, the power cells are supplied power by the phase-shifting transformer whose secondary winding is multiple-structure and their electric angle is staggered. Each power cell outputs voltage and frequency-variably AC power after three-phase full-bridge rectification by the diode and inverting by single-phase IGBT. Power cells in a group are connected in series, form multi-ladder PWM wave, and directly provide three-phase Y-type MV mains frequency to the motor.
- The multi-pulse rectification technology of the MV AC drive can eliminate most of the harmonic currents drawn by the individual power cells, reduce harmonic pollution to the grid, and improve the power factor on the grid side. The multi-level output is close to the sine wave, which greatly reduces the motor torque ripple.
- The main control system and power cells transmit signals using the optical fiber, thus avoiding electromagnetic interference and ensuring reliable transmission of the system control signals.

The following figure shows the topological structure of the MV AC drive.

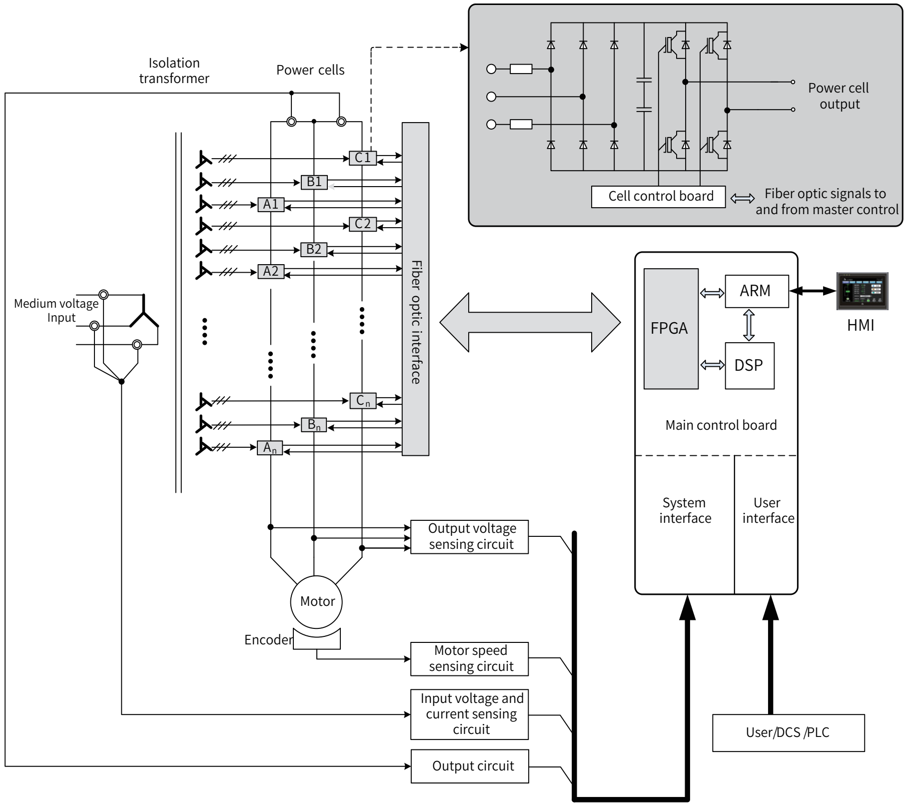


Figure 1-2 Topological structure of the MV AC drive

1.2.2 System Composition

The MV AC drive consists of a transformer cabinet, a power cell cabinet, a control panel/cabinet and a bypass cabinet (optional). Based on field requirements, you may purchase new bypass cabinets and configure the cabinet as one of the followings:

- One MV AC drive system with one manual bypass cabinet
- One MV AC drive system with one automatic bypass cabinet
- One MV AC drive system with two manual bypass cabinets
- One MV AC drive system with two automatic bypass cabinets

The following figures show three types of system composition.

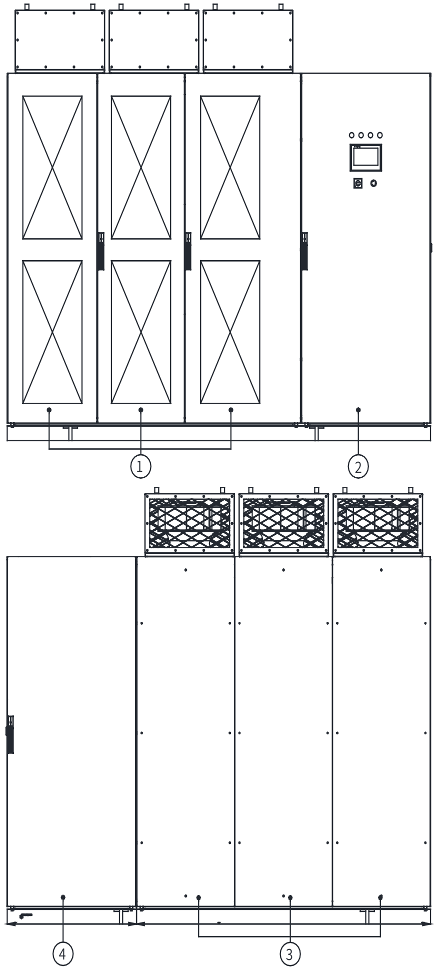


Figure 1-3 System composition (10 kV series - models of 2500 kVA and below)

Number	Component Name
1	Power cell cabinet
2	Control cabinet
3	Transformer cabinet
4	Input-output cabinet/Manual bypass cabinet/Automatic bypass cabinet

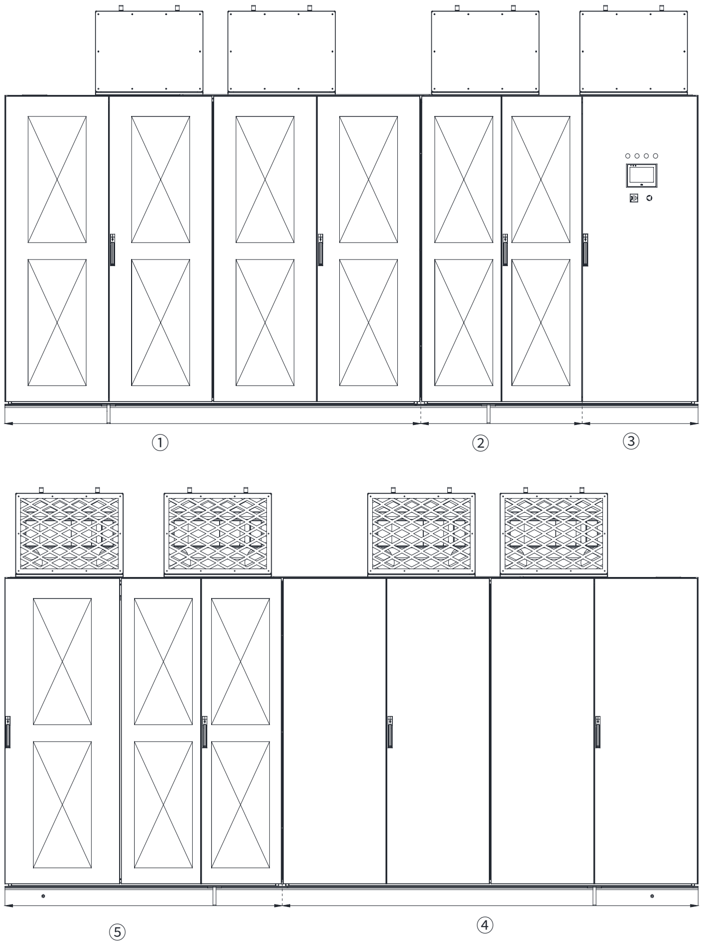
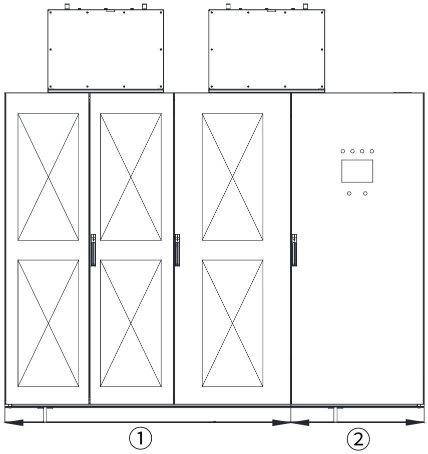


Figure 1-4 System composition (10 kV series - models of 2800 kVA and above)

Number	Component Name
①	Transformer cabinet
②	Power cell cabinet
③	Control cabinet
④	Transformer cabinet
⑤	Power cell cabinet



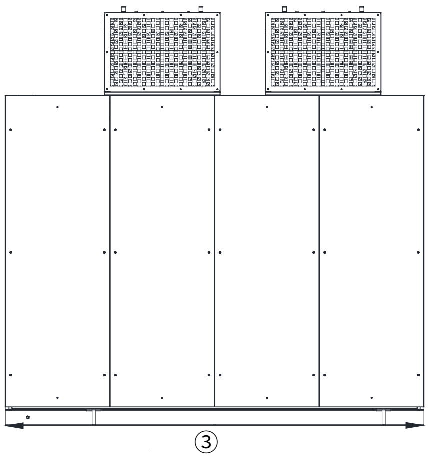


Figure 1-5 System composition (6 kV series - models of 2800 kVA and below)

Number	Component Name
①	Power cell cabinet
②	Control cabinet
③	Wiring cabinet/Transformer cabinet

1) Transformer cabinet

The phase-shifting transformer with class H insulation adopts the dry-type structure. Its base is fixed by screws to the cabinet base. A centrifugal fan is installed on the cabinet roof to cool down the transformer and power cells.

The transformer receives the three-phase medium voltage on the primary side (through the line-voltage bypass cabinet or MV inlet cabinet) and outputs three-phase low voltage on the secondary side to the power cells.

2) Power cell cabinet

The cabinet consists of 9, 15 or 24 power cells (3, 5 or 8 power cells in series per phase) to achieve output voltage of 3 kV, 6 kV and 10 kV, respectively. A centrifugal fan is installed on the cabinet roof to cool down the power cells. Each power cell is configured with a pair of fiber optics to communicate with the main control system.

3) Control cabinet

The cabinet contains a main control module, low-voltage power supply, and interface components.

- The main control module has the function of system control and state sampling.
- The low-voltage power supply and interface components provide you with the low-voltage power interface, system fan control, and user signal interfaces.

The cabinet door contains the touchscreen HMI, indicators, the remote/local switch and the emergency stop button.

4) Input-output cabinet/Wiring cabinet

The input-output cabinet or wiring cabinet is used for wiring of power inlet and outlet cables.

5) Manual bypass cabinet

The manual bypass cabinet provides the motor with the mains frequency circuit when the AC drive suffers from a failure, which guarantees a consecutive AC drive operation. You can switch the motor back to the AC drive control when the repair is complete. There are three knife switches (QS1, QS2-a and QS2-b) inside the manual bypass cabinet for the operator to perform manual switchover.

The physical appearance of the manual bypass cabinets are shown in the following figures:

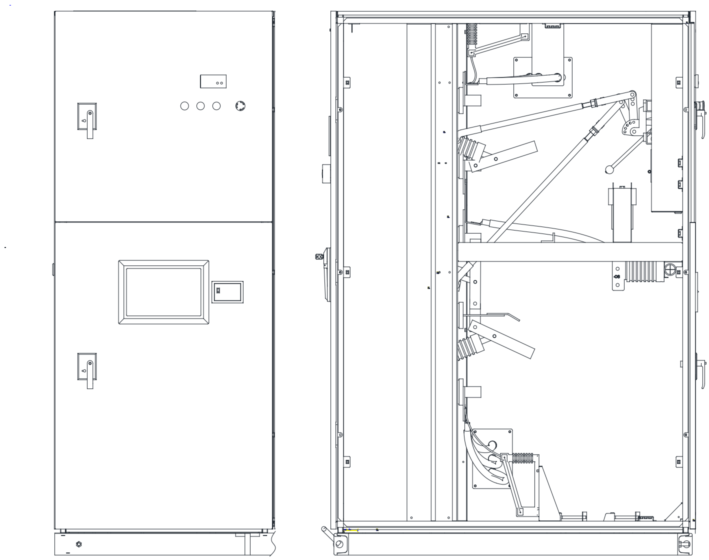


Figure 1-6 Physical appearance of the manual bypass cabinet (10 kV series - models of 2500 kVA and below)

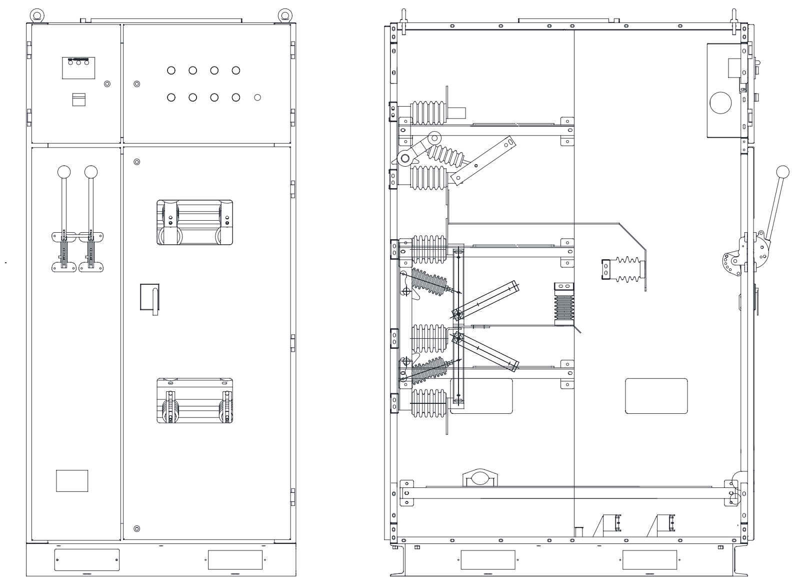


Figure 1-7 Physical appearance of the manual bypass cabinet (10 kV series - models of 2800 kVA and above, 6 kV series - models of 2800 kVA and below)

The main circuit of the manual bypass cabinet is shown in the following figure, including the isolator switches (QS1, QS2-a, and QS2-b) and user MV switchgear (QF).

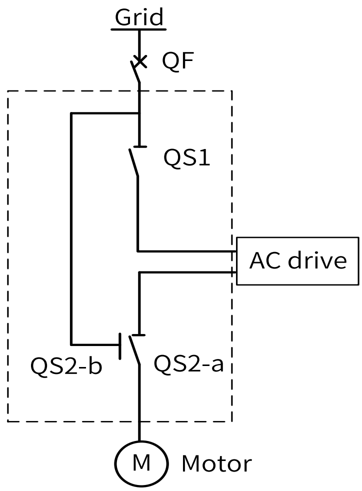


Figure 1-8 Main circuit of the manual bypass cabinet

6) Automatic bypass cabinet

The automatic bypass cabinet provides the motor with the mains frequency circuit when the AC drive suffers from a failure, which guarantees a consecutive AC drive operation. You can switch the motor back to the AC drive control when the repair is complete.

There are three vacuum contactors (KM1, KM2 and KM3) inside the automatic bypass cabinet to implement automatic switchover through the electrical control circuit.

The physical appearance of the automatic bypass cabinets are shown in the following figures:

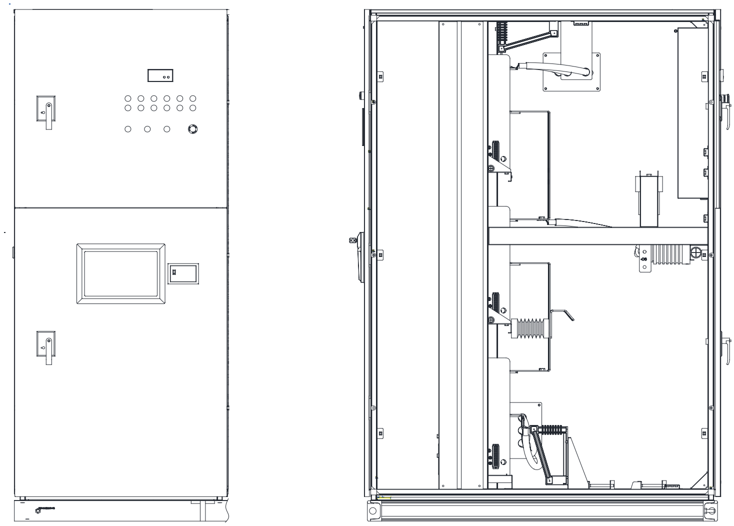


Figure 1-9 Physical appearance of the automatic bypass cabinet (10 kV series - models of 2500 kVA and below)

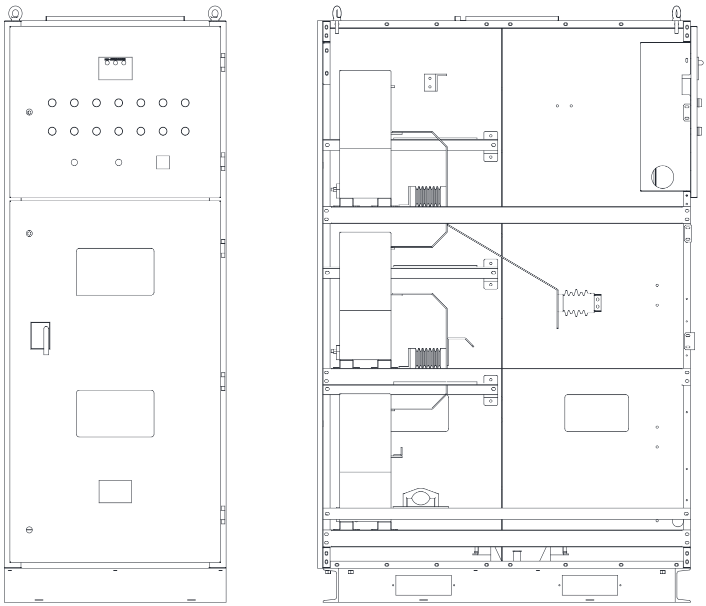


Figure 1-10 Physical appearance of the automatic bypass cabinet (10 kV series - models of 2800 kVA and above, 6 kV series - models of 2800 kVA and below)

The main circuit of the automatic bypass cabinet is shown in the following figure, including the vacuum contactors (KM1, KM2 and KM3) and user MV switchgear (QF).

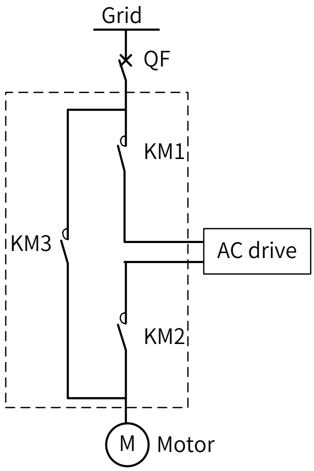


Figure 1-11 Main circuit diagram of the automatic bypass cabinet

7) Automatic bypass cabinet with isolator switches

There are three vacuum contactors (KM1, KM2 and KM3) and two isolator switches (QS1 and QS2) inside the automatic bypass cabinet to implement automatic switchover through the electrical control circuit.

The physical appearance of the automatic bypass cabinet with isolator switches is shown in the following figure:

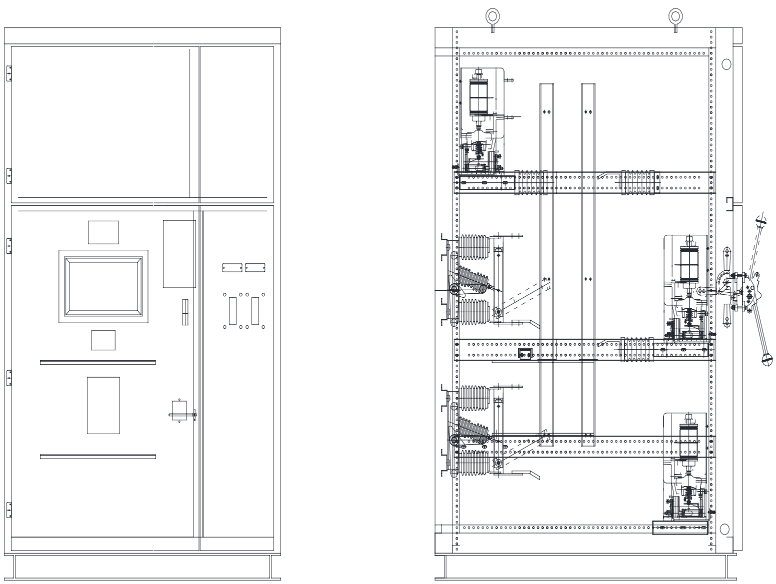


Figure 1-12 Physical appearance of the automatic bypass cabinet (10 kV series - models of 2800 kVA and above, 6 kV series - models of 2800 kVA and below)

The main circuit of the automatic bypass cabinet with isolator switches is shown in the following figure, including the vacuum contactors (KM1, KM2 and KM3) and user MV switchgear (QF).

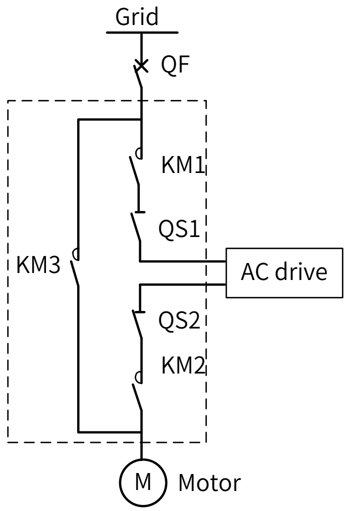


Figure 1-13 Main circuit diagram of the automatic bypass cabinet with isolator switches

NOTE

- ◆ If the output current of the AC drive is larger than 400 A, add a pre-charge cabinet to suppress the magnetizing inrush current at power-on of the transformer, minimize the impact on the grid and reduce damage to capacitors of the power cells.
- ◆ Detailed scheme: Connect a current-limiting resistor of proper resistance in series in the primary three phases of the transformer, add corresponding vacuum contactor in the resistor connected circuit, and meanwhile add the bypass vacuum contactor. When pre-charging starts, close the vacuum contactor in the resistor connected circuit. At this moment the current-limiting resistor is input into the main circuit to suppress the magnetizing inrush current at power-on of the transformer. After pre-charging completes, the bypass vacuum contactor closes automatically, and the current-limiting resistor is bypassed in the main circuit. Then open the vacuum contactor in the resistor connected circuit. The whole AC drive power-on process is completed.
- ◆ For other information about the pre-charge cabinet, contact our company.

1.3 Technical Specifications

Table 1-1 Technical specification

Voltage	3 kV Series	6 kV Series	10 kV Series
Input			
Rated input voltage	Three-phase 3 kV	Three-phase 6 kV	Three-phase 10 kV
Input voltage range	3 kV/6 kV/10 kV±10%: full-load running -10% to -35%: long-time de-rating running allowed		
Rated input frequency	50/60 Hz		
Cell input voltage	690 V		
Input power factor	> 0.95 (20% to 100% of load)		
Input current harmonics	Complying with the IEEE519-2014 and GBT14549-93 standards		
Output			
Output voltage range	0 to 3 kV	0 to 6 kV	0 to 10 kV
Output capacity range [1]	230 to 3700 kVA	230 to 8000 kVA	250 to 13750 kVA
Output frequency range [2]	0 to 50/60 Hz Maximum 120 Hz (120 to 700 Hz can be customized)		
Control mode	SVC1, CLVC, SVC2		
Speed range	40:1 (SVC2) 100:1 (SVC) 1000:1 (CLVC)		
Speed accuracy	±0.5% (SVC) ± 0.02% (CLVC)		
Acceleration/Deceleration time	0.1s to 6500.0s		
Start/Stop control	Local/Remote		
Control system	ARM, DSP, FPGA, HMI		
Display	Touchscreen, Simplified Chinese/English		
Overload capacity	One minute for 120% of the rated current		
Equipment efficiency	⩾ 96%		
Protections	Motor overload, output overload, output short circuit, output grounded, output overcurrent, input overvoltage, fan alarm, door switch interlock, transformer overtemperature alarm, transformer overtemperature trip		
Mean time between failures (MTBF)	50000 h		
Communication interfaces	Modbus-RTU or Modbus-TCP (optional), PROFIBUS-DP (optional)		
DI	7 channels, relay dry contacts		
DO	8 channels, relay dry contacts		
AI	2 channels, 4 to 20 mA		
AO	2 channels, 4 to 20 mA		
Working environment	Indoors		

Voltage	3 kV Series	6 kV Series	10 kV Series
Ambient temperature	-10°C to +40°C (de-rated when above 40°C, preheated when below 0°C)		
Humidity	5% to 95%, no condensation		
Altitude	⩽ 1000 m (de-rated when above 1000 m) Specify it in your order.		
Total equipment noise	About 80 dB		
Cooling mode	Forced air cooling		
IP level	IP30		
Inlet and outlet mode [3]	Down inlet and down outlet		
Control power	380 VAC±10%, three-phase four-wire		
Encoder type [4]	15 VDC OC encoder and 5 VDC differential encoder (optional)		

NOTE

[1] to [4]: Contact our company if you have special requirements.

1.4 Physical Appearance and Overall Dimensions

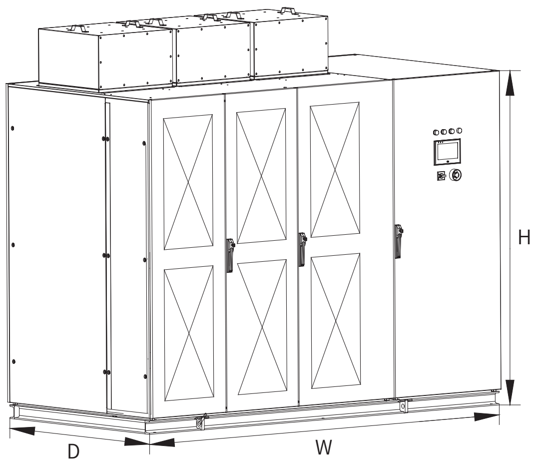


Figure 1-14 Physical appearance of the MV AC drive (10 kV series - models of 2500 kVA and below)

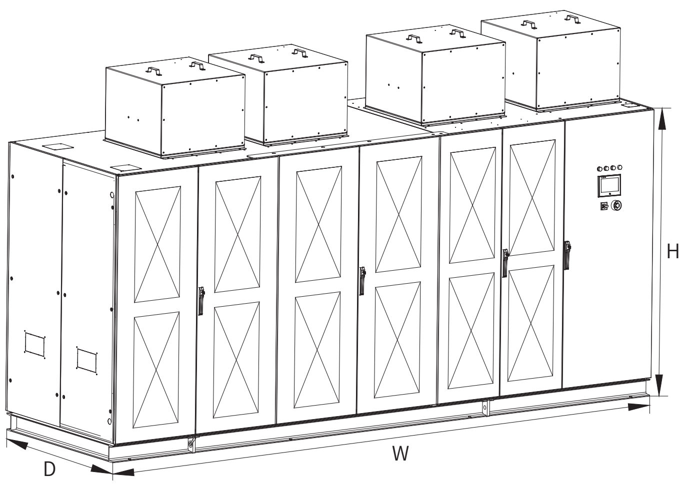


Figure 1-15 Physical appearance of the MV AC drive (10 kV series - models of 2800 kVA and above)

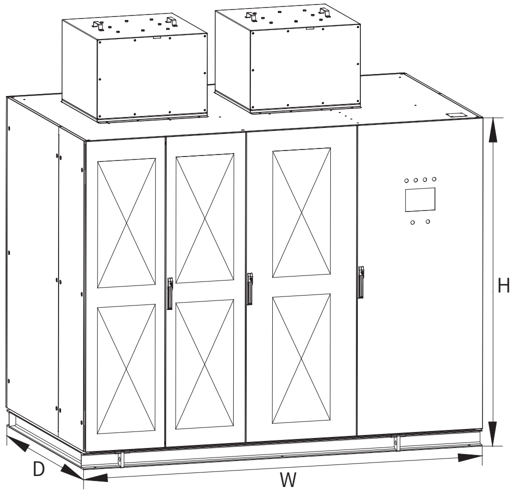


Figure 1-16 Physical appearance of the MV AC drive (6 kV series - models of 2800 kVA and below)

The overall system dimensions, as listed in the following table, are for reference only and may slightly differ from the actual dimensions. For actual dimensions, contact the salesperson of our company.

Table 1-2 Overall dimensions of the MV AC drive

Output Capacity (kVA)	Adaptable Motor Power (kW)	Overall Dimensions (W x D x H: mm)
Voltage class: 6 kV		
315	250	2000x1225x1900
355	280	2000x1225x1900
400	315	2000x1225x1900
450	355	2000x1225x1900
500	400	2000x1225x1900
560	450	2000x1225x1900
630	500	2000x1225x1900
710	560	2000x1225x1900
800	630	2300x1475x2000
900	710	2300x1475x2000
1000	800	2300x1475x2000
1120	900	2300x1475x2000
1250	1000	2300x1475x2000
1400	1120	2300x1475x2000
1600	1250	2300x1475x2000
1800	1400	2600x1525x2050

Output Capacity (kVA)	Adaptable Motor Power (kW)	Overall Dimensions (W x D x H: mm)
2000	1600	2600x1525x2050
2250	1800	2600x1525x2050
2500	2000	2600x1525x2050
2800	2240	2600x1525x2050
Voltage class: 10 kV		
250	200	2700x1325x2000
280	220	2700x1325x2000
315	250	2700x1325x2000
355	280	2700x1325x2000
400	315	2700x1325x2000
450	355	2700x1325x2000
500	400	2700x1325x2000
560	450	2700x1325x2000
630	500	2700x1325x2000
710	560	2700x1325x2000
800	630	2700x1325x2000
900	710	2700x1325x2000
1000	800	2700x1325x2000
1120	900	2700x1325x2000
1250	1000	2700x1325x2000
1400	1120	3050x1575x2100
1600	1250	3050x1575x2100
1800	1400	3050x1575x2100
2000	1600	3050x1575x2100
2250	1800	3050x1575x2100
2500	2000	3050x1575x2100
2800	2240	4500x1325x2050
3000	2400	4500x1325x2050
3150	2500	4500x1325x2050
3500	2800	4500x1325x2050
3750	3000	4500x1325x2050
4000	3150	4500x1325x2050
4500	3550	4500x1325x2050

NOTE

- The overall dimensions do not include the height of the cooling fan. The maximum height of the fan is 480 mm for models of 2500 kVA and below (10 kV series), 560 mm for models of 2800 kVA and above (10 kV series), 380 mm for models of 630 kVA and below (6 kV series), 480 mm for models between 710 kVA and 1600 kVA (6 kV series), and 550 mm for models of 1800 kVA and above (6 kV series) .
- The overall dimensions are for reference only. The actual dimensions are determined by your order.

2 Installation and Wiring

Install the MV AC drive in proper position and refer to the foundation diagram that is delivered together with the equipment for workshop arrangement and construction.

2.1 Installation Requirements

2.1.1 Environment Requirements

1 For device application, the requirements listed in the following table must be met.

Table 2-1 Application envrionment requirements

Item	Requirements	
Ambient temperature	-10°C to 40°C Preheated when below 0°C , and de-rated when above 40°C The average temperature for 24 hours must be in the range of 5 to 35°C .	
Relative humidity	Below 50% at 40°C 85% or less at low temperature No condensation due to temperature change	
Altitude	Below 1000 m De-rated when above 1000 m Notify our company in advance if the altitude is above 1000 m.	
Air pressure	860 to 1060 kPa	
Air quality	The dust in the electrical room must be equal to atmospheric dust and cannot contain ferrous power or organic silicon particles.	
Corrosion factors	Corrosive Gases	Concentration
	Hydrogen sulfide (H_2S)	⩽ 0.001 PPM
	Sulfur dioxide (SO_2)	⩽ 0.05 PPM
	Chlorine ($C1_2$)	⩽ 0.1 PPM
	Ammonia (NH_3)	⩽ 0.1 PPM
	Nitrogen oxide (NO_x)	⩽ 0.02 PPM
	Ozone (O_3)	⩽ 0.002 PPM
	Hydrogen chloride (HCl)	⩽ 0.1 mg/m^3

NOTE

The preceding table gives the standard specifications. For details, see the Technical Protocol.

DANGER

- Never use silicon series paraffin for the electrical room floor. Failure to comply will have bad impact on electrical contacts.
- After connecting external cables (ground cables, main circuit cables and control cables) into the cabinet, seal the cable entry hole with the putty. Otherwise, small animals such as rats may gain access to the cabinets and this may cause serious damage to the equipment

2 For device storage, the requirements listed in the following table must be met.

Table 2-2 Storage envrionment requirements

<table>
<tr><th>Item</th><th colspan="2">Specification</th></tr>
<tr><td>Storage temperature</td><td>-20°Cto 50°C
Temperature change less than 1°C/min</td><td rowspan="2">No freezing or condensation due to sharp change in temperature</td></tr>
<tr><td>Relative humidity</td><td>5% to 95%</td></tr>
<tr><td>Storage environment</td><td colspan="2">Free from direct sunlight, dust, corrosive gases, inflammable gases, oil mist, vapor and water drop</td></tr>
</table>

NOTE

- ◆ Improper storage will influence the serving life of the AC drive and may even cause the AC drive not to be used normally.
- ◆ For the reference of storage environment, refer to the standards IEC61800-4(GB12668.4-2006), UDC 621.3:658.78 and GB4798.1-88.

General requirements:

1) Never directly place the AC drive on the floor but place it on a pallet.
2) Add an appropriate amount of desiccant if it is moist.
3) Use polyethylene sheet or aluminum foil as protective packing to avoid water seepage.
4) Periodical Inspections: Check the conditions of storage and packing of the AC drive every month during the whole storage period. Pay special attention to the damage caused by mechanical forces, humidity, temperature or fire. If the packing is damaged or you find any damage on the AC drive, check the damage immediately. After the damaged AC drive is repaired, store it as described above.

Storage of spare parts:

Pay attention to the following requirements to protect the spare parts from being damaged:

CAUTION	
	◆ The spare parts must be stored in the position free from vibration and shock and be protected against moisture, frost, temperature change, dust and gravel. ◆ The spare parts must be stored in their original packing in a dry and insect-proof room. The storage place must be free of corrosive gases. ◆ Relative humidity: 5% to 95%. If you find the maximum allowed humidity is allowed, protect the spare parts by taking proper measures such as reducing temperature, heating and dehumidifying. ◆ The spare parts must be stored at the temperature of -20°C to 50°C . ◆ The electronic boards must be stored in the antistatic bag that prevents desiccant leakage and free from corrosive gases or gases containing salt, soda or other impurities. No water condensation is allowed. ◆ Power cells have built-in electrolytic capacitors. Long-term storage will degrade the electrolytic capacitor. Thus, the power cells must be energized once every six months.

2.1.2 Installation Clearance Requirements

For the cabinet size and installation of the MV AC drive, refer to the related drawings of the delivered technical materials. Install all cabinets according to the drawings.

- Maintain sufficient clearances around the MV AC drive for proper ventilation, maximum door swing and maintenance.
- Provide a passage for access to the installation foundation and ensure sufficient space of the auxiliary equipment that is used to transport the AC drive.

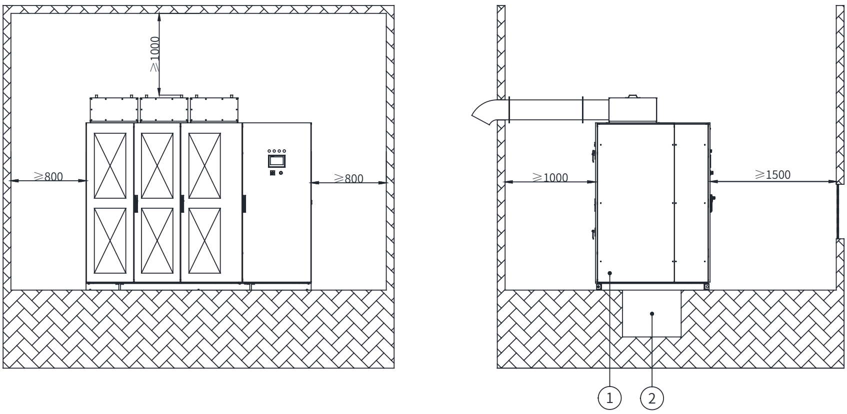


Figure 2-1 Clearance requirements (unit: mm)

No.	Component Name
①	MV AC drive
②	Cable trench

NOTE

- Install all cabinets on the U-steel base solidly and tie them to the workshop ground reliably.
- The armor of MV inlet and outlet cables must be grounded reliably and fixed to the cabinets, The connection must have sufficient mechanical strength, and keep proper grounding insulation distance as stipulated in all MV technical specifications.

2.1.3 Heat Dissipation

The MV AC drive is large-sized electrical equipment and has very strict requirements on the environment. According to statistics on multiple equipment on site, the equipment is easy to get faulty because of too high ambient temperature. Thus, our company provides the following three heat dissipation solutions:

- Add an air conditioner.
- Add air duct.
- Use the air-water cooling system.

The three solutions are applicable to different situations. Select a proper solution according to the on-site environment.

1 Add an air conditioner.

- Refrigerating capacity of the air conditioner

Place an MV AC drive in an enclosed room and install an air conditioner in the room. The air conditioner dissipates the heat produced by the MV AC drive outside.

The total air conditioner capacity shall be MV AC drive heat output plus space refrigerating capacity required for the room.

$$Q_{\text{Air conditioner capacity}} = \{Q_{\text{AC drive heat output}}\} + \{Q_{\text{Space refrigerating capacity(ignored if below 40°C)}}\}$$
$$= (W_{\text{AC drive output power x3.5\%}}) + (S_{\text{Room area x 0.15}})$$

The heat produced by the MV AC drive must be estimated based on the actual operating condition. Considering certain margin, the maximum heat output is 4% of the rated power of MV AC drive.

Thus, the heat output of the MV AC drive is 3.5% of the actual output power on average. If the MV AC drive runs at below 40 Hz for a long time, the heat output can be considered as 2% of the rated power.

The space refrigerating capacity is calculated based on the actual room area. Normally, 0.15 kW is required per square meter. Ignore this if the ambient temperature is below 40°C .

■ Selection of air conditioner

1) Selection based on HP

$$X_{\text{Air conditioner HP}} = Q_{\text{Air conditioner capacity}} \div 2.5$$

2) Selection based on the model

Normally, 1 HP is equal to 2500 W refrigerating capacity (model 25), and 1.5 HP is equal to 3500 W refrigerating capacity (model 35). You can estimate the horsepower according to refrigerating capacity. For example, model 50 corresponds to 2 HP.

$$\nabla_{\text{Model}} = Q_{\text{Air conditioner capacity}} \div 100$$

3) Selection based on air conditioner power

$$W_{\text{Power}} = Q_{\text{Air conditioner capacity}} \div \eta_{\text{Energy efficiency ratio}}$$
$$\approx X_{\text{Air conditioner horse power}} \times 735 \text{ (unit: watt)}$$

■ Advantage of adding an air conditioner

Adding an air conditioner can keep the indoor environment clean, prolong the serving life of the MV AC drive and reduce the maintenance rate.

2 Add an Air Duct

■ Design of air duct

Generally, the air duct is designed above the cabinet, which directly dissipates heat produced by the MV AC drive. Cold air is continuously supplied from the air inlet to cool the system. The following two methods of installing the air duct are provided.

1) Connect the air duct to the fan cover.

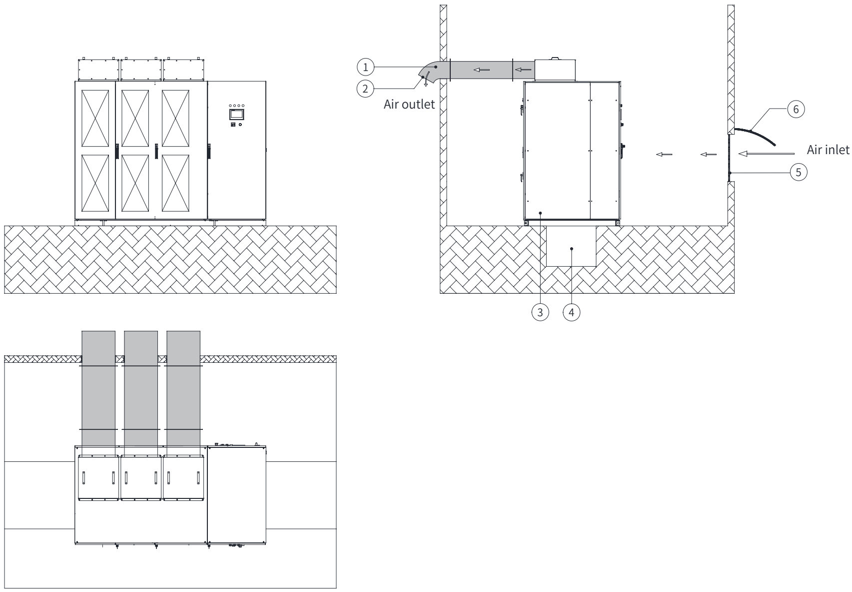


Figure 2-2 Connecting the air duct to the fan cover (10 kV series - models of 2500 kVA and below)

No.	Component Name
①	Air outlet
②	Steel filter
③	MV AC drive
④	Cable trench
⑤	Filter
⑥	Awning

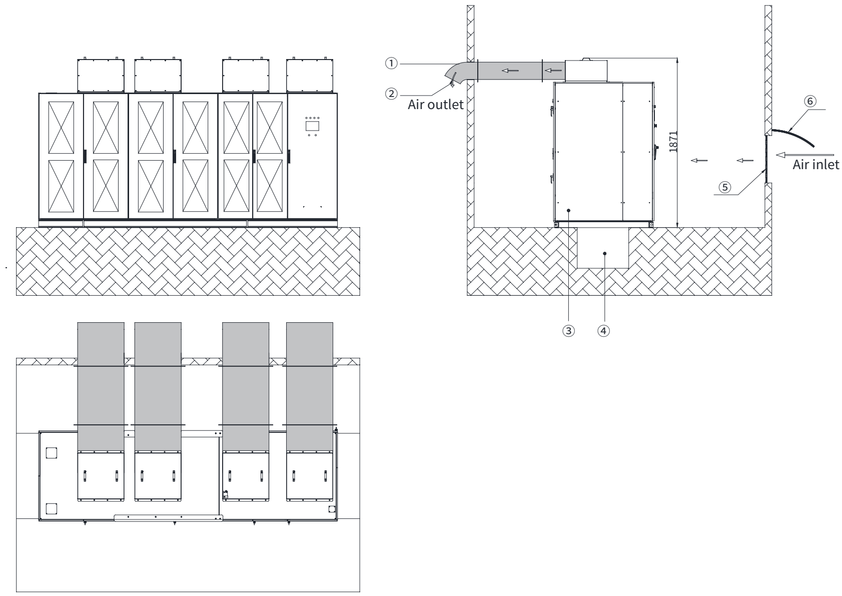


Figure 2-3 Connecting the air duct to the fan cover (10 kV series - models of 2800 kVA and above)

No.	Component Name
①	Air outlet
②	Steel filter
③	MV AC drive
④	Cable trench
⑤	Filter
⑥	Awning

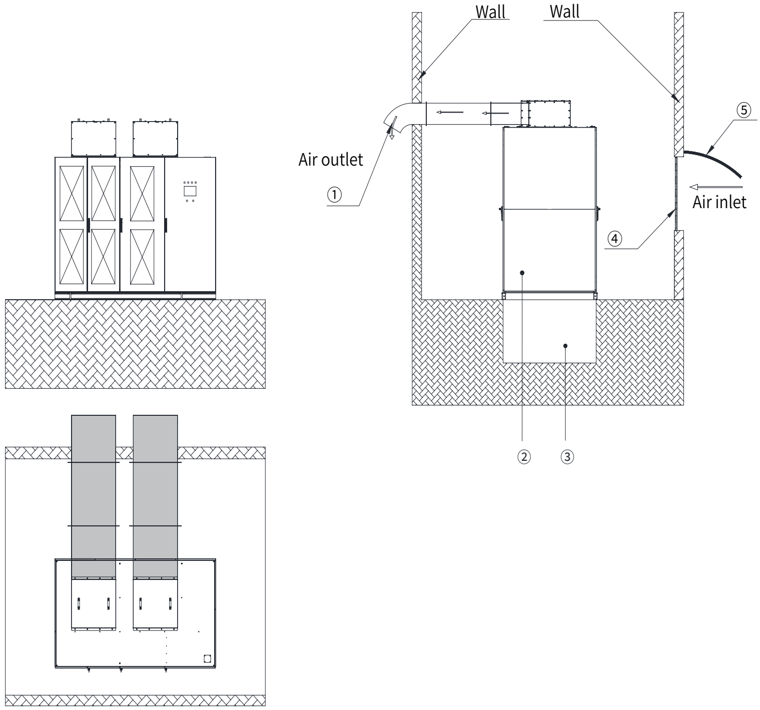


Figure 2-4 Connecting the air duct to the fan cover (6 kV series - models of 2800 kVA and below)

No.	Component Name
①	Steel filter
②	MV AC drive
③	Cable trench
④	Filter
⑤	Awning

2) Add an air duct to the power cell cabinet and transformer cabinet separately.

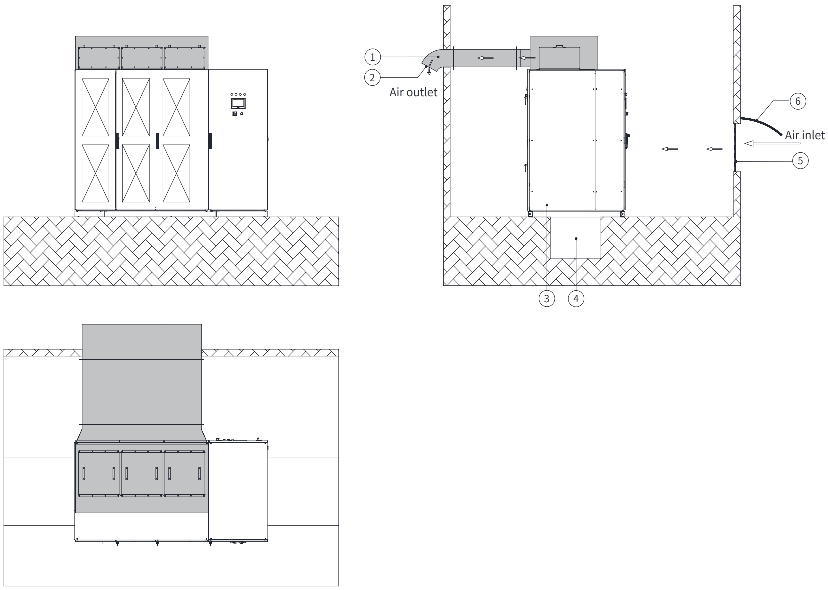


Figure 2-5 Adding air duct to the power cell cabinet and transformer cabinet (10 kV- models of 2500 kVA and below)

No.	Component Name
①	Air outlet
②	Steel filter
③	MV AC drive
④	Cable trench
⑤	Filter
⑥	Awning

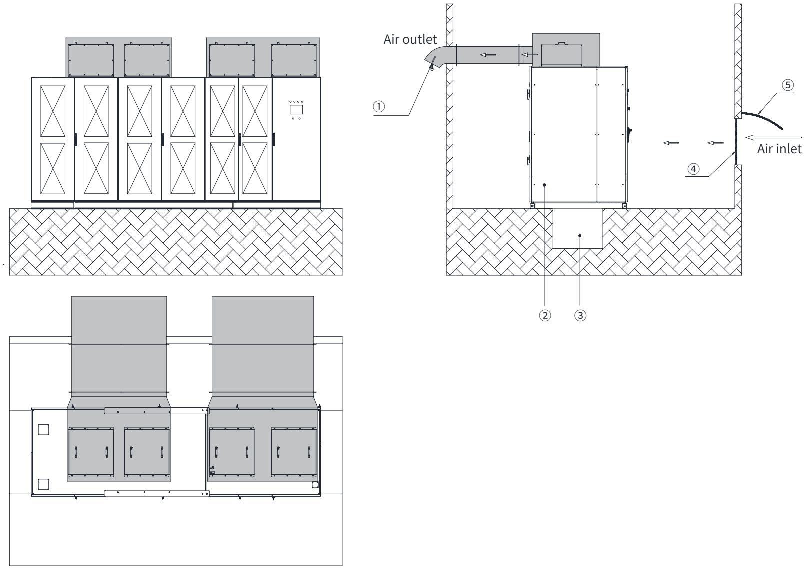


Figure 2-6 Adding air duct to the power cell cabinet and transformer cabinet (10 kV series - models of 2800 kVA and above)

No.	Component Name
①	Steel filter
②	MV AC drive
③	Cable trench
④	Filter
⑤	Awning

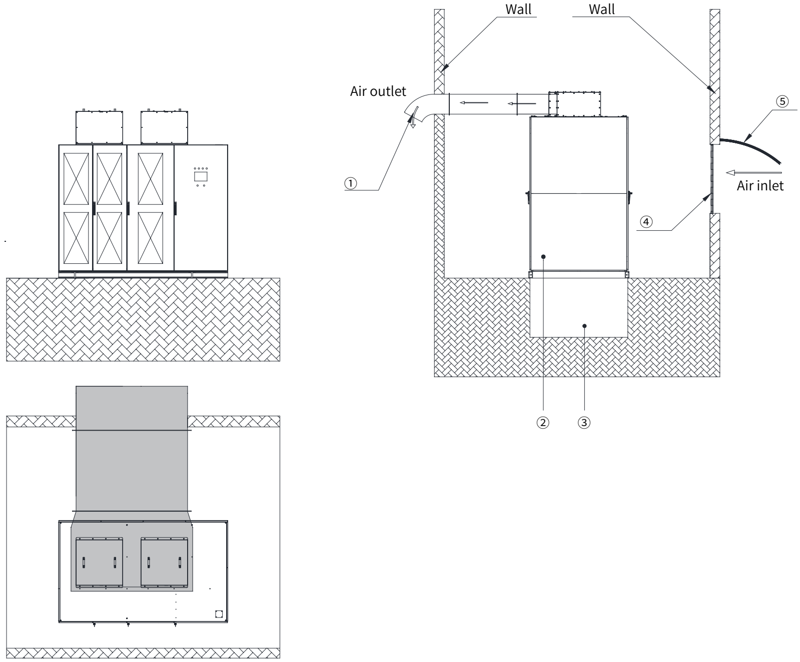


Figure 2-7 Adding air duct to the power cell cabinet and transformer cabinet (6 kV series - models of 2800 kVA and below)

No.	Component Name
①	Steel filter
②	MV AC drive
③	Cable trench
④	Filter
⑤	Awning

3) Advantage of adding an air duct

The air duct is cost-effective, highly reliable and well ventilated. It is applied to clean environment.

NOTE

- If the cooling fan on the top of the cabinet is near the air outlet (less than 10 m, no turning in air duct), it is unnecessary to install an auxiliary exhaust fan at the air outlet. Otherwise, install an auxiliary exhaust fan there. If on-site construction is inconvenient at the air inlet and the air duct requires turning, install a fan to force air inlet.
- If the air duct is designed improperly, rainwater may flow backward on rainy days, which results in short-circuit to the MV AC drive. The whole ventilation pipe must have a certain inclination angle. Cut a hole at the downside of the pipe for ventilation to avoid rainwater flowing backward, add an air filter to the hole to prevent access of small animals.
- Make the air duct according to related air duct design drawing delivered together with the equipment.

3 Use the Air-Water Cooling System

■ Air-Water Cooling Principle

The warm air produced by the AC drive runs through the air duct and enters the air-water cooling device, which then performs heat transfer and takes away the heat by the cooling water. Finally, the cooled air is directly fed indoors.

The temperature of the cooling water must be below 33°C , which ensures that the indoors ambient temperature of the AC drive is below 40°C when the warm air passes through the heatsink.

The cooling water is completely separated from the re-circulating air. The water pipeline is outside the AC drive room, protecting the AC drive from security threat and accident such as waterproof damage or insulation damage. This cooling method has the advantages of low degree of dust and less maintenance work and reduces the negative effect of stability of power cell cabinet and control cabinet.

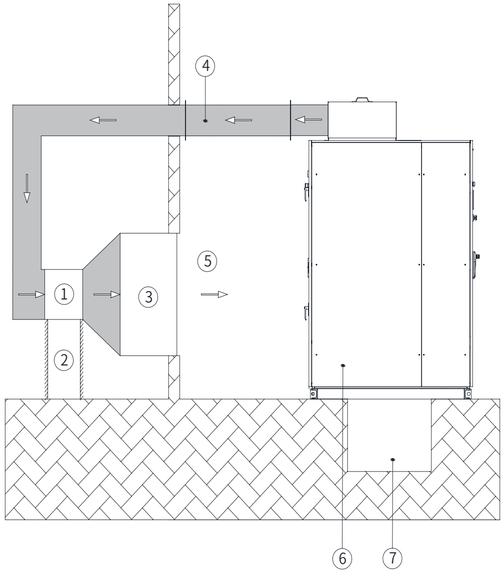


Figure 2-8 Air-water cooling system structure

No.	Component Name
①	Boost fan
②	Support
③	Water cooler
④	Hot air
⑤	Cool air
⑥	MV AC drive
⑦	Cable trench

■ Air-water cooling conditions

1) The on-site provided industrial cooling water temperature must be equal to or below 33°C . The air injection pressure must be between 0.25 MPa and 0.55 MPa. The water backflow pressure drop must be equal to or below 0.1 MPa.

2) The necessary amount of cooling water can be provided on site. You can obtain the necessary amount of cooling water from the formula: Heating power (kW): Cooling water flow (m3/h) = 4 : 1 (single air-water cooling system).

3) Prepare an enclosed room with 10 cm above an insulating layer or thermal insulation measure for the AC drive.

4) The net height of the enclosed room must be equal to or greater than 3.5 m. The length of the construction site must be two times the room length in the room length direction and its width must be 2.0 m at least.

5) Two-circuit 380 VAC/3 PH power supplies must be provided on site. The AC drive room requires the power capacity of 6 kW.

6) The cooling water must have no deposition accumulations and the PH value must be equal to or greater than 7.2.

■ Selection Principle

Take the 800 kW load as an example:

If the rated power is 800 kW and the running efficiency is 96%, the maximum heating power of the AC drive is 800 x 4% = 32 kW.

The system implements heat transfer of the warm air exhausted by the AC drive through the air-water cooling device and then feeds the cooled air back to the room. This reaches the air cycle efficiency of close to 99%.

Considering the heat dissipation of ultimate running, higher water temperature and heat transfer efficiency, generally select a 1.15 to 1.2 times margin for the air-water cooling device. That is, the heat transfer power of single air-water cooling device must be equal to or greater than 37 kW. Then select the air-water cooling device with cooling power of 40 kW.

The total cooled air volume of the AC drive is obtained from: Air volume of single fan x Number of fans. The fans on the AC drive cabinet top and the fan of the air-water cooling device are in the hot standby structure.

The system adopts indoors enclosed circulating cooling method to keep the ambient temperature below 40°C . When the air-water cooling device is faulty or the outdoor temperature is low, separate the air exhaust outlet of the AC drive from the air inlet of the air-water cooling device. The warm air produced by the AC drive is directly exhausted outside. This can reduce the AC drive running costs.

The on-site cooled water flow can be estimated according to 3 to 4 m3/h required every 10 kW cooling power.

2.1.4 Foundation Design

The MV AC drive must be installed on the concrete non-flammable floor. Ensure that the floor is level with surface irregularity of less than 5 mm, moisture-proof, smooth with no wear, and able to bear the weight of the MV AC drive.

The cable ducts must use non-flammable materials and has no wear on the surface. Moisture-proof, dustproof and rat-proof measures are required.

The foundation construction must be done according to the related foundation diagram.

In the design of the foundation, take the following items into consideration:

■ Adequate space for inspection and maintenance in the front and back of the MV AC drive

- Position of the air duct
- Cabling of power cables, MV motor cable, and system control cables
- Design the cable trench or cable channel below the MV AC drive. The MV cables, power cables and signal cables must be separated.

The cable arrangement is shown in the following figure. For detailed dimensions, see the product brochure delivered together with the equipment.

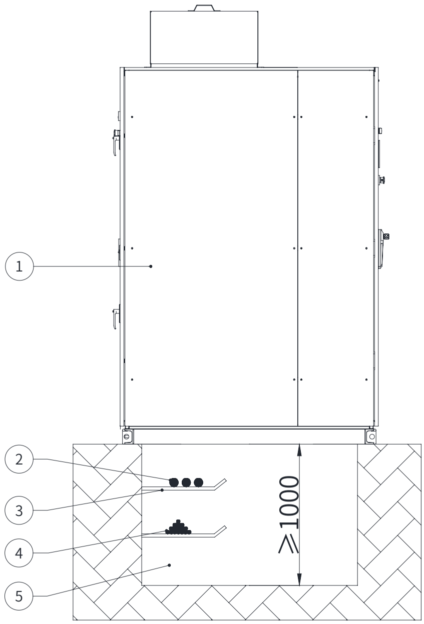


Figure 2-9 Cable arrangement

No.	Component Name
①	MV AC drive
②	Power cable
③	Cable rack
④	Signal cable
⑤	Cable trench

CAUTION	
	◆ Strictly separate MV cables and low-voltage cables. ◆ The cable trench must use non-flammable materials and be smooth. Moisture-proof, dust-proof and rat-proof measures are required.

Cable requirements:

1) Power cables

■ Arrangement of main power cables and motor cables must comply with local codes and refer to descriptions of cable manufacturers.

■ To ensure compliance with the EMC requirements, it is recommended that a steel armored three-phase cable with each phase individually shielded be used. If single-phase cables are used, the cables of three different phases must be grouped together.

■ If the cross-sectional area of the cable shield is smaller than 50% of the sectional area of one phase, lay an additional grounding cable along the power cable to avoid overtemperature of the cable shield. For details, query local codes.

■ Reserve adequate distance between cable racks, ladders or trays inside the cable trench for laying cables and connect connectors conveniently. This also simplifies replacing or adding a cable and its connector when multiple cables are laid on the same rack, ladder or tray.

■ The distance between cable racks, ladders or trays must be greater than 300 mm; the minimum clear distance from the bottom rack to the trench bottom must be greater than 100 mm.

■ The cables are fixed with cable racks. For horizontal cabling, if the outside diameter of power cables and control cables is 50 mm or smaller, set a rack every 0.6 m. If the outside diameter of power cables is larger than 50 mm, set a rack every 1.0 m. The single-phase cables that form a regular triangle must be tied up with a strap every 1.0 m. For vertical cabling, set a rack every 1.0 to 1.5 m.

■ Lay power cables and control cables separately on racks on different sides of the trench with a vertical distance of larger than 300 mm. If the requirement is not satisfied, set power cables on the rack above control cables.

2) Ground cables

■ Laying of ground cables must comply with local codes.

3) Control cables

■ Do not lay control cables in parallel to power cables. If parallel cabling cannot be avoided, a minimum vertical distance of 300 mm (12 inches) must be maintained between control cables and power cables. In addition, control cables and power cables must be crossed at an angle of 90° .

NOTE

The power cables must be terminated with connectors according to the cable manufacturer's requirements. Power connectors must be made by authorized personnel.

2.2 Mechanical Installation

2.2.1 Packing

Whether to use crate packing or simple packing is determined according to logistics difficulty and client agreement. No matter which packing method is selected, the equipment security during transportation can be ensured. If you have special packing requirement, negotiate with the company before placing an order.

- Crate packing: The whole product is packed in the crate.
- Simple packing: The product has the pallet at the bottom and takes simple waterproof and dustproof measures such as plastic film on the other parts.

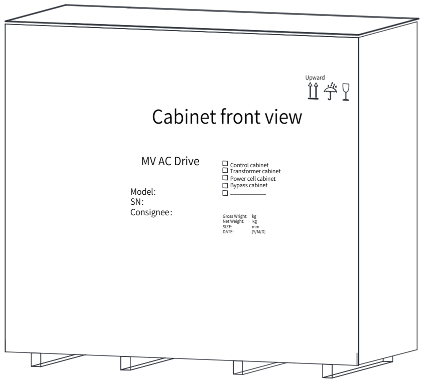


Figure 2-10 Crate packing

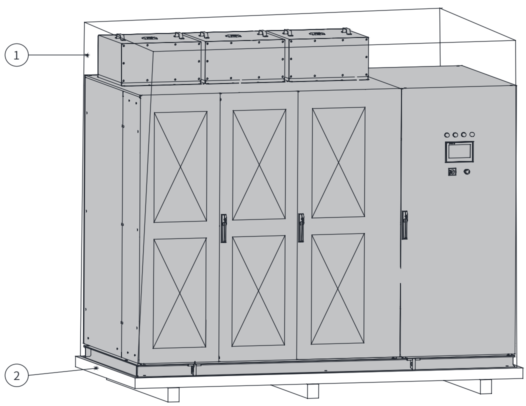


Figure 2-11 Simple packing

No.	Component Name
①	Plastic film (or waster/dust-resistant method)
②	Pallet

2.2.2 Long-distance Transportation

The MV AC drive can be transported by road, rail and ship. Observe the following precautions during transportation:

- Hand it with care to prevent damage.
- Never expose it to sunlight and rain.
- Never shake or strike the AC drive, or transport it with upside down.
- Keep the temperature within the range of -40°C to 70°C .
- The maximum height of the AC drives (10 kV series) of 1250 kVA and below is 2485 mm (fan included). The maximum height of the AC drives (10 kV series) between 1400 kVA and 2500 kVA is 2585 mm (fan included). The maximum height of the AC drives (10 kV series) of 2800 kVA and above is 2600 mm (fan included).
- The maximum height of the AC drives (6 kV series) of 710 kVA and below is 2385 mm (fan included). The maximum height of the AC drives (6 kV series) between 800 kVA and 1600 kVA is 2480 mm (fan included). The maximum height of the AC drives (6 kV series) of 2800 kVA and above is 2600 mm (fan included).
- Total height after packaging cannot exceed 2800 mm. Take the height limit into consideration when selecting the transportation vehicle.

2.2.3 Onsite Moving

The MV AC drive can be moved by: hoist, roll pallet truck, or rollers.

1) Transporting the MV AC drive by a hoist

The cabinet body of the MV AC drive has a design of openings on the base for the hoist apparatus.

Install the four hoist rings respectively across the four openings on the base, then run the hanging belt (never use steel rope) through the hoist rings, and lift the AC drive by the hoist. After the hoisting is complete, remove the hoist rings.

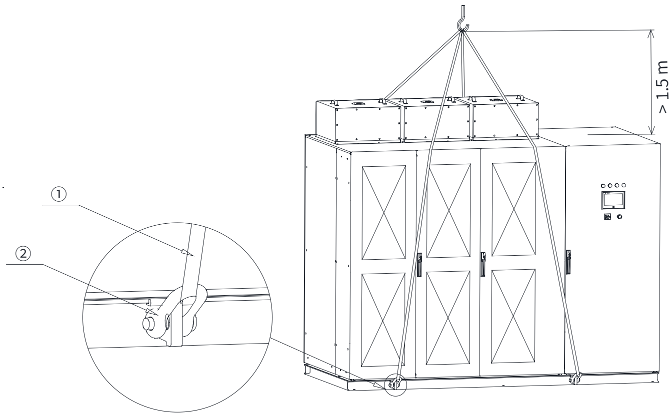


Figure 2-12 Transporting the MV AC drive by a hoist

No.	Component Name
①	Hanging belt
②	Shackle

2) Transporting the MV AC drive by a roll pallet truck

When the MV AC drive is transported by a roll pallet truck, the roll pallet truck must be placed under the four corners of the cabinet base, as shown in the following figure.

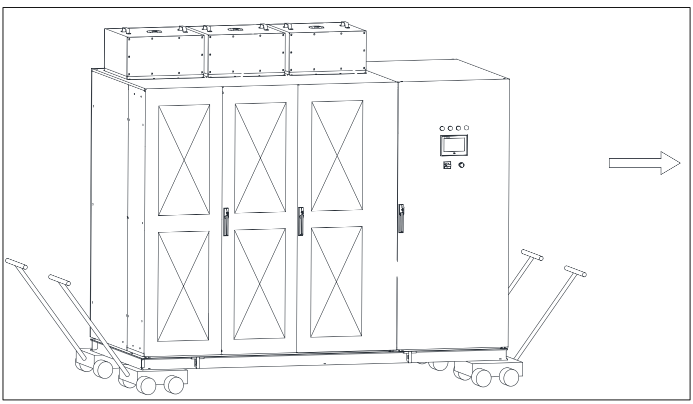


Figure 2-13 Transporting the MV AC drive by a roll pallet truck

3) Transporting the MV AC drive by rollers (recommended)

When using rollers to transport the AC drive, put multiple rollers side by side on floor and move the cabinet on the rollers. Then run the rollers circularly to transport the AC drive, as shown in the following figure.

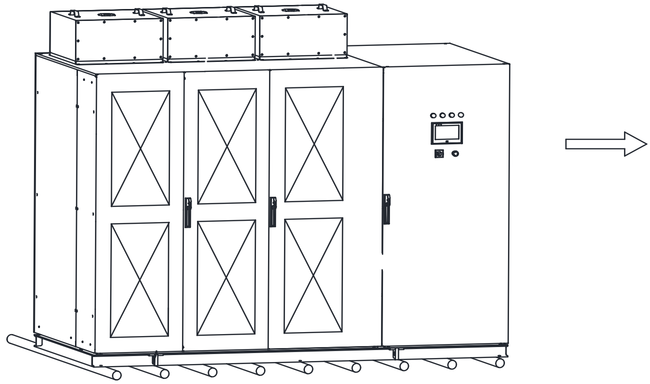


Figure 2-14 Transporting the MV AC drive by rollers

2.2.4 Unpacking

After receiving the MV AC drive, check whether any spare part is damaged. If yes, contact the company immediately. Our company will assume no responsibility for any damage caused by external forces or external environment in the warranty period.

1) Before unpacking

Checking Items	OK
Check whether the packing is intact and whether there is severe mechanical damage, collision, dust, water stain, mould, deformation and corrosion.	
Check whether the product SN is consistent with your order.	
Check whether the number of packing materials is consistent with the packing list.	

NOTE

If the equipment is damaged during transportation, take photos of the damaged part and fill in the transportation damage report. Then mail the report together with the photos to the company or the transportation company.

2) Unpacking the crate

Steps	Operations
1	Place the crate in the workshop that is empty and flat, and prepare the tools such as the crowbar and iron rod.
2	Use the crowbar to pry off the crate along the gap from the board edge. Then remove the roof board, sideboards, ends boards and pallet. In the process, put the crowbar into the crate as short as possible so as to prevent damaging the equipment. Pry off the crate with care and protect you from being injured by nails.
3	Remove the inner packing materials such as plastic film. (Do not use a sharp tool to avoid scratching the equipment.)

Steps	Operations
4	Remove the screws that connect the equipment and the pallet.

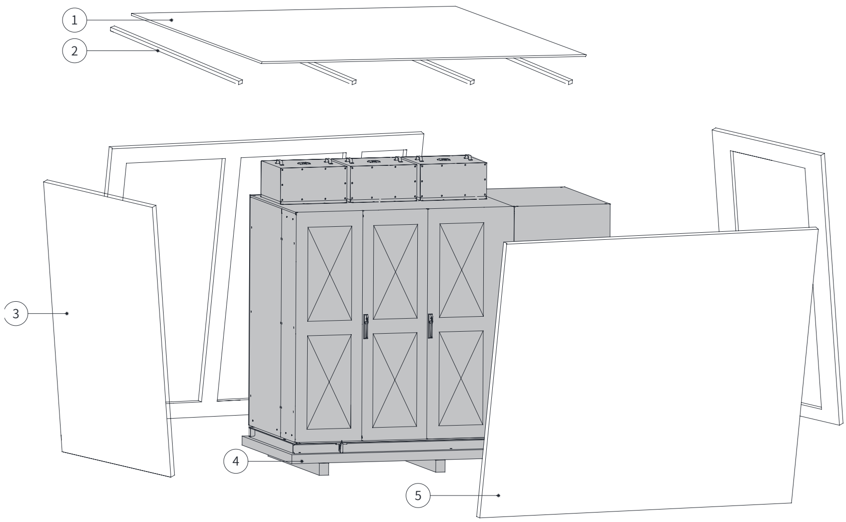


Figure 2-15 Unpacking the crate

No.	Component Name
①	Roof board
②	Support beam
③	End board
④	Pallet
⑤	Sideboard

NOTE

- ◆ When unpacking the crate, remove the roof board, support beams, sideboards, end boards and the pallet in turn.
- ◆ Keep a minimum clearance of 20 mm between the equipment and the crate.

3) Unpacking the simply packed equipment

Steps	Operations
1	Place the equipment in the workshop that is empty and flat, and remove the plastic film. (Do not use a sharp tool to avoid scratching the equipment.)
2	Remove the screws that connect the equipment and the pallet.

4) Checking after Unpacking

Checking Items	OK
Open the back panel of the inverter part and check the internal condition.	
Check the equipment related conditions (for example, transformer) according to the related user guide.	
Compare the equipment with your order to avoid missing any spare part. If any part is missed, immediately contact the company or the transportation company.	

Precautions
◆ Check whether painting off and deformation occurs on the door and side panels. ◆ Check whether the control cables become loose. ◆ Check whether the spare parts that have not been assembled are intact. ◆ Check whether the screws are tightened tightly. ◆ Check whether any spare part is damaged. ◆ Check the dust-proof layer. ◆ Check whether any water stain exists. ◆ Check whether any damage caused by worm and ants exists.

2.2.5 Moving the MV AC drive to Mounting Site and Fastening

The mounting instructions in this section apply to normal mounting conditions in the industrial environment. To mount the AC drive in special scenarios, contact the company in advance for detailed installation procedure.

1) Before performing mechanical installation, make sure that all preceding environment requirements described are satisfied.

2) Check the floor with a spirit level. The maximum allowable overall unevenness is less than 5 mm. If the floor is uneven, make it leveled.

3) Open all cabinet doors and check whether the AC drive and attached components are damaged during transportation. If you find any defective or missing component, contact our company and the transportation company.

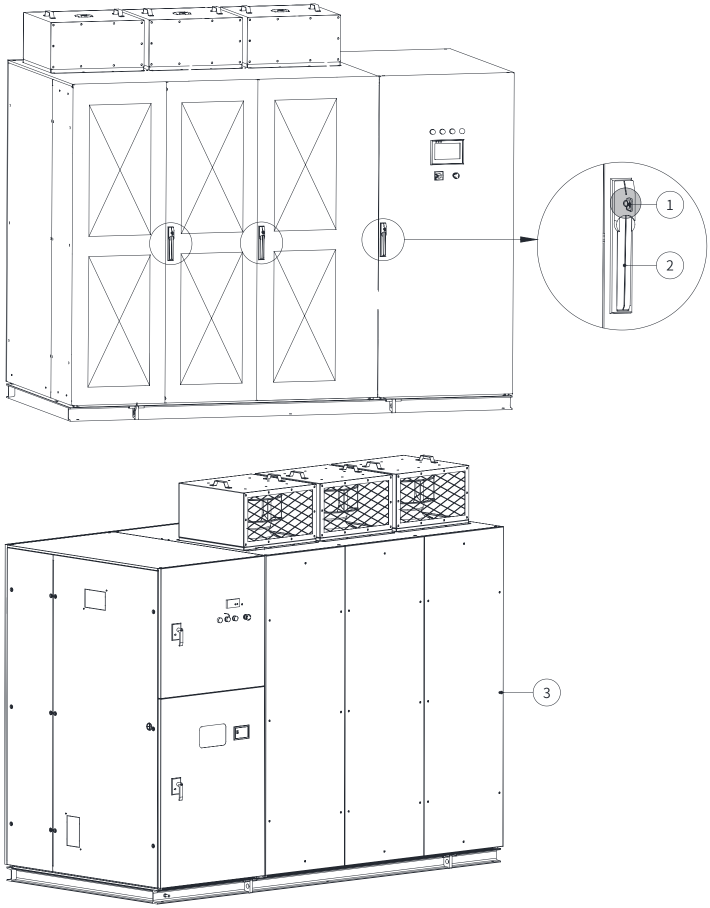


Figure 2-16 Opening the front/back cabinet doors (10 kV series - models of 2500 kVA and below)

To open the front door of the cabinet, insert the key that is delivered together with the AC drive and turn it clockwise. To open the back door of the cabinet, remove all the M6x18 combination screws (with big washers) on the back.

No.	Component Name
①	Keyhole
②	Lock
③	M6 cross recessed hexagon screw

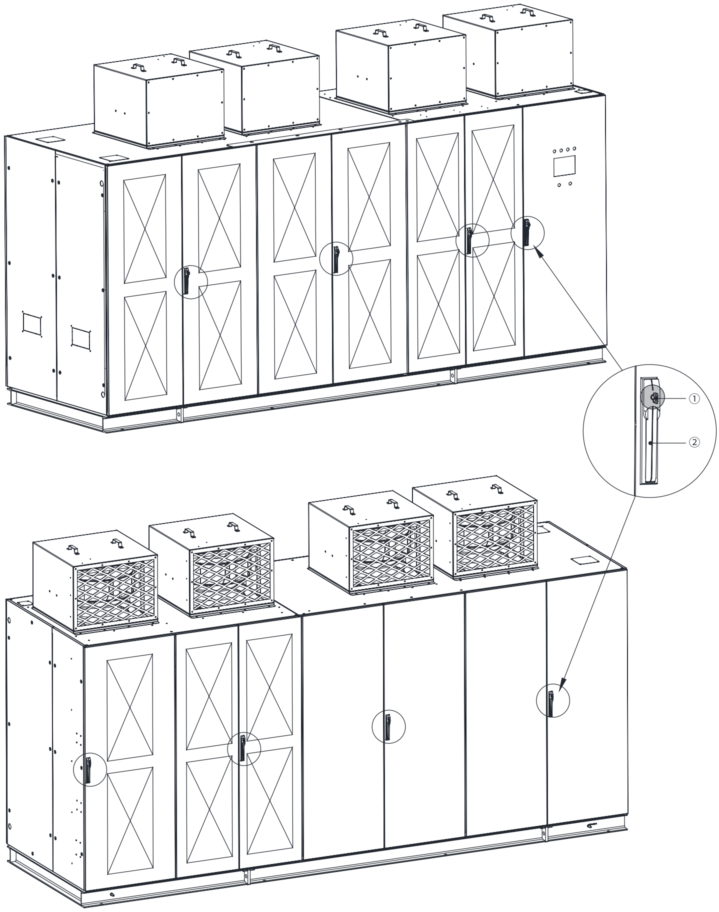


Figure 2-17 Opening the front/back cabinet doors (10 kV series - models of 2800 kVA and above)

To open the front and back doors of the cabinet, insert the key that is delivered together with the AC drive and turn it clockwise.

No.	Component Name
①	Keyhole
②	Lock

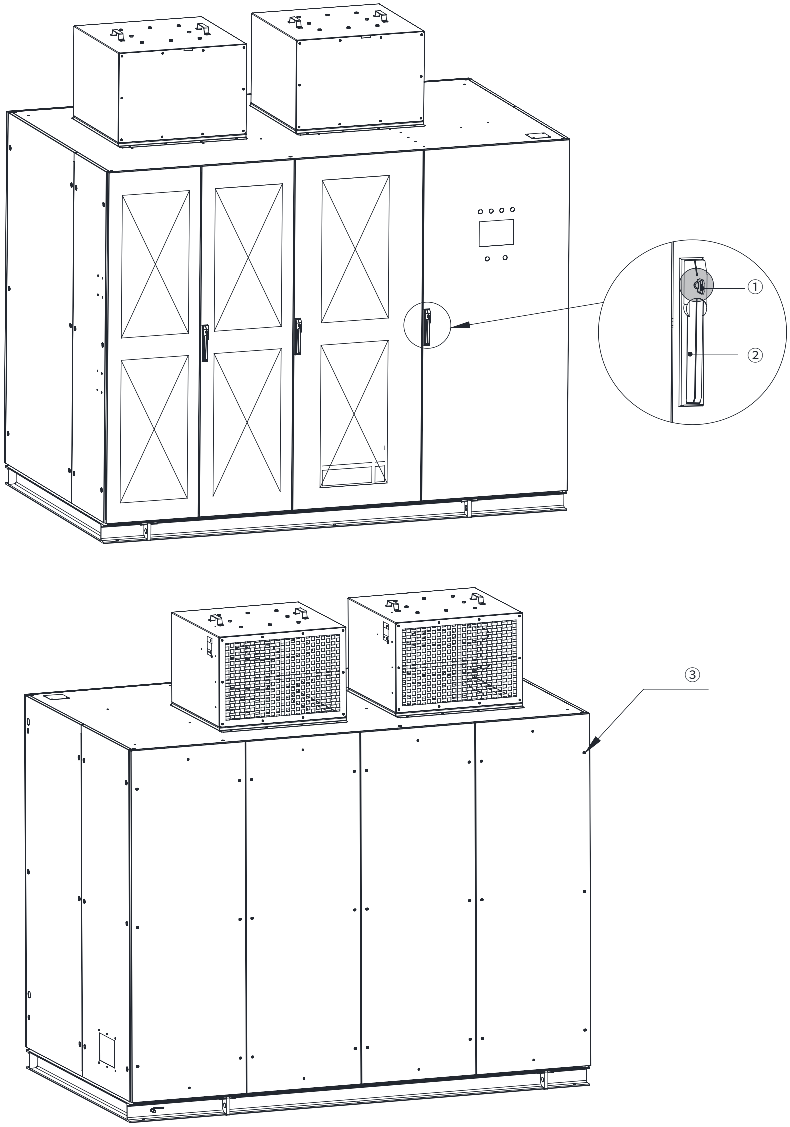


Figure 2-18 Opening the front/back cabinet doors (6 kV series - models of 2800 kVA and below)

To open the front door of the cabinet, insert the key that is delivered together with the AC drive and turn it clockwise. To open the back door of the cabinet, remove all the M6x18 combination screws (with big washers) on the back.

No.	Component Name
①	Keyhole
②	Lock
③	M6 cross recessed hexagon screw

4) Check whether cabinet doors can be opened and closed completely. If not, adjust the cabinet body. Check the door limit lock. After power-on, all front and back doors, except the doors of the main control cabinet, cannot be opened. If the cabinet doors are opened without permission, the system will report a fault and enable the input MV breaker.

5) Adjust slightly the cabinets and solder cabinet base on the channel steel directly （for details, see the engineering drawing delivered with the equipment） , as shown in the following figure.

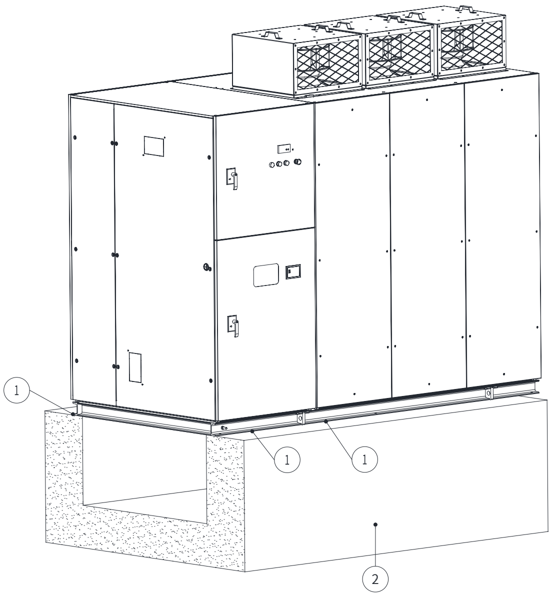


Figure 2-19 Soldering points

No.	Component Name
①	Soldering point
②	Foundation

CAUTION	
	◆ Open the cabinet doors as described in this user manual. Otherwise, the equipment will be damaged.

2.3 Electrical Installation

2.3.1 Precautions on Electrical Installation

CAUTION

- Ensure that the diameter and withstand voltage of the MV inlet cables and control power cables meet the requirements. The input and output MV cables must pass the withstand voltage test.
- Ensure that the effective lightning-proof measure has been taken on the MV switch on the input side.
- The armor of MV inlet cables and motor cables must be grounded reliably, be fixed into cabinets reliably, have sufficient mechanical strength, and keep proper insulation distance as stipulated in all MV technical specifications.
- Wire the input and output cables separately to avoid cable mixing and danger caused by insulation damage.
- Separate signal cables from power cables. Use shielded twisted-pair (STP) cables as analog signal cables and ensure that the shield is reliably grounded at one end.
- Always keep the AC drive cabinet be grounded to workshop reliably to ensure personal safety.
- Set a special grounding rod in the control cabinet before electrical installation and ensure its ground resistance is 2 Ω or less.
- Before measuring the insulation resistance of the transformer or performing the withstand voltage test, short all terminals on the secondary side of the transformer. Otherwise, power cells will be damaged. The test on the transformer must be agreed and supported by the manufacturer.

2.3.2 Cable Inlet/Outlet Holes

Precautions on cable inlet/outlet are as follows:

CAUTION

- Confirm the inlet/outlet holes of all cables.
- Make sure to strictly separate power cables from control cables.

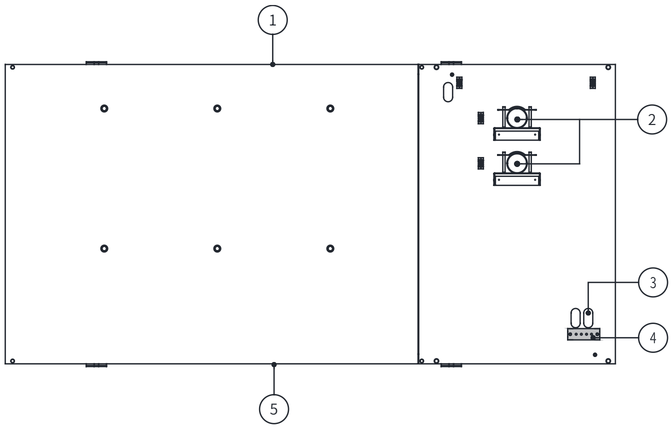


Figure 2-20 Positions of cable inlet/outlet holes (10 kV series - models of 2500 kVA and below)

No.	Component Name
①	Back of the cabinet
②	MV cable inlet/outlet holes
③	Control cable inlet/outlet holes
④	Main busbar
⑤	Front of the cabinet

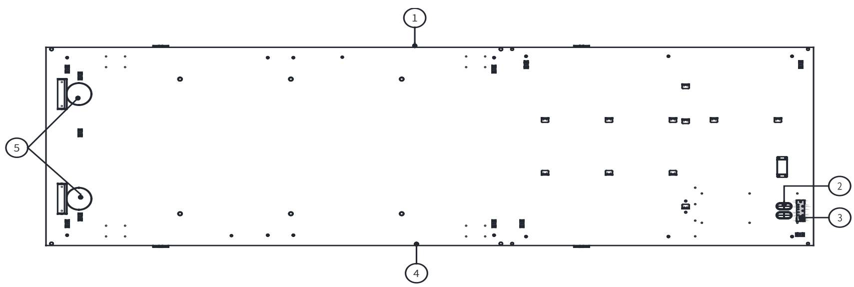


Figure 2-21 Positions of cable inlet/outlet holes (10 kV series - models of 2800 kVA and above)

No.	Component Name
①	Back of the cabinet
②	Control cable inlet/outlet holes
③	Main busbar
④	Front of the cabinet
⑤	MV cable inlet/outlet holes

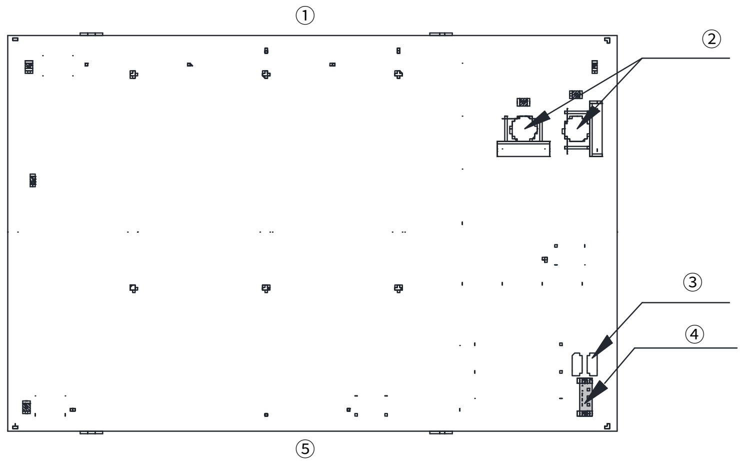


Figure 2-22 Positions of cable inlet/outlet holes (6 kV series - models of 2800 kVA and below)

No.	Component Name
①	Back of the cabinet
②	MV cable inlet/outlet holes
③	Control cable inlet/outlet holes
④	Main busbar
⑤	Front of the cabinet

2.3.3 Grounding the MV AC drive

Ensure that the ground resistance is smaller than 4 Ω and use a busbar of 25 x 4 mm for grounding.

Install the busbar in the cable trench under the foundation U-steel frame. Directly connect the main ground point of the MV system to the busbar tightly and then connect the busbar to the base of all cabinets. Combine all signal cables into one ground point and connect the point to the busbar, as shown in the following figure.

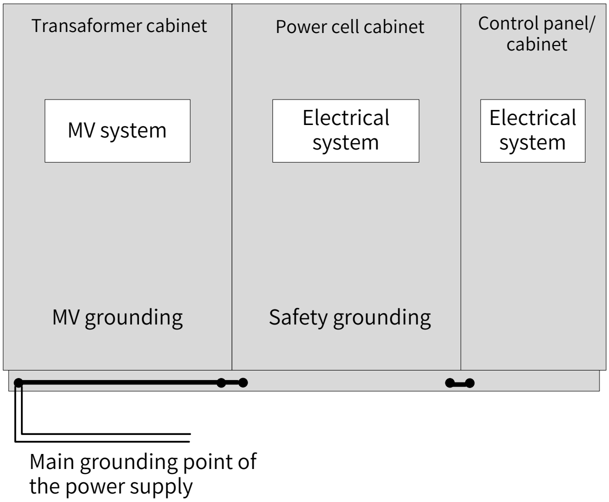


Figure 2-23 Grounding the MV AC drive

2.3.4 Connecting the Main Grounding Screw

The precautions on connecting the main grounding screw are as follows:

CAUTION	
	◆ Measure the resistance of the ground cable and the resistance must be smaller than 4 Ω. ◆ Mark the ground cable clearly. ◆ Ensure that the MV AC drive is in the de-energized state.

As shown in the following figure, connect the user main grounding cable or busbar to the main grounding screw of the AC drive. Then tighten the screw with a torque of 45 N·m.

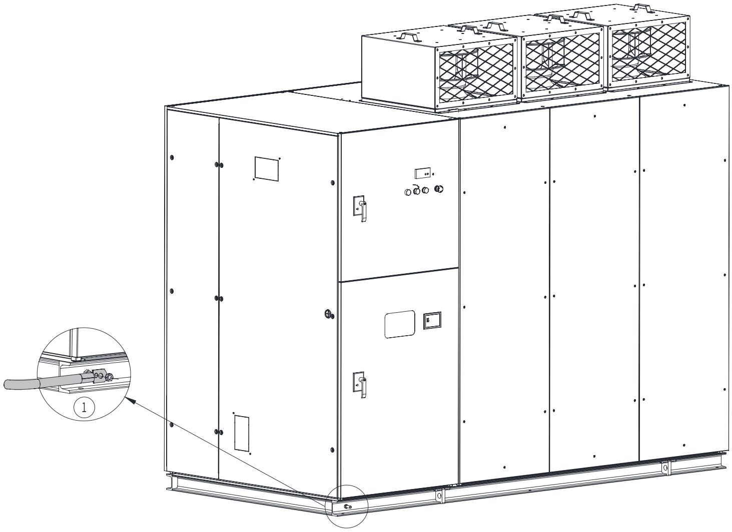


Figure 2-24 Wiring the main grounding screw

No.	Component Name
①	Position of the main grounding screw: inside the U-Steel frame in the base on the back side of the control cabinet and the transformer cabinet

2.3.5 Wiring Main Circuits

DANGER	
	◆ Never wrongly connect the input and output terminals. Failure to comply will result in severe damage to the MV AC drive. ◆ Ensure that the power supply has been cut off before wiring. Failure to comply will result in electric shock or a fire. ◆ Only allow authorized electrical engineers to perform wiring. Failure to comply may result in electric shock or a fire. ◆ Ensure reliable grounding of cabinets. Failure to comply may result in electric shock or a fire. ◆ Check that the emergency stop button is normal before power-on. ◆ Never touch output terminals directly, connect output terminals to the housing of the AC drive, or short output terminals. Failure to comply may result in electric shock or short circuit.

Connect the inlet MV power cables to the input terminals, and motor cables to the output terminals of the AC drive. The MV power supply runs through the main circuit breaker and then to the MV AC drive. Only after receiving the MV switch-on allowed signal from the MV AC drive, the main circuit breaker can be closed. The output terminals of the AC drive is connected to the motor directly (or through the bypass cabinet).

1) If a bypass cabinet (automatic bypass cabinet used as an example) is used, the main circuits are wired according to the following figure.

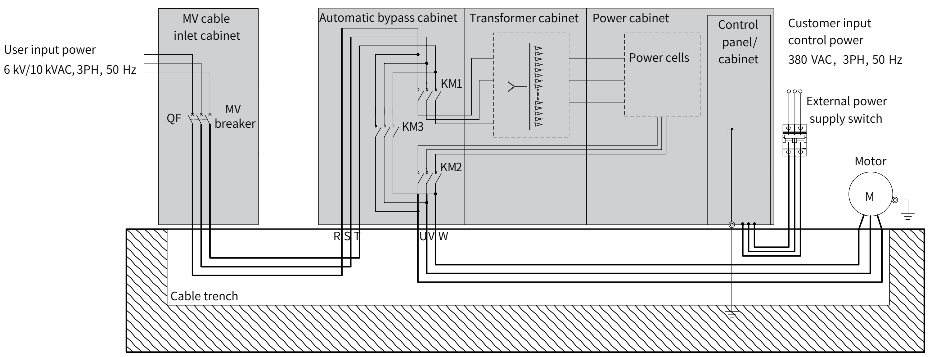


Figure 2-25 Wiring main circuits with an automatic bypass cabinet

NOTE

- If a manual bypass cabinet is selected, only replace contactors KM1, KM2 and KM3 in the preceding figure with isolation switches QS1, QS2 -a and QS2-b, and the rest wiring is the same.
- Prepare cables for connection in the preceding figure by yourself. For selection and making of these cables, refer to the engineering drawing that is delivered together with the AC drive.

2) If the bypass cabinet is not used, the main circuits are as wired in the following figure.

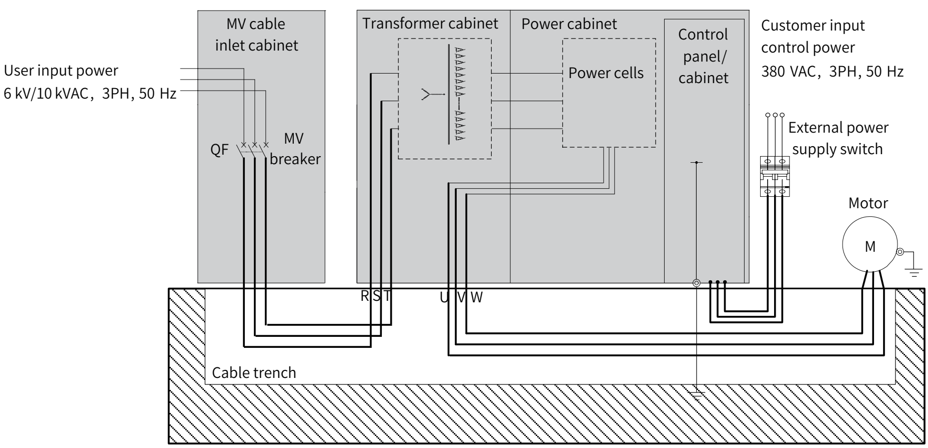


Figure 2-26 Wiring main circuits without a bypass cabinet

NOTE

- Prepare cables for connection in the preceding figure by yourself. For selection and making of these cables, refer to the engineering drawing that is delivered together with the AC drive.

2.3.6 Connecting MV Inlet and Outlet Terminals

The precautions on connecting the MV inlet and outlet terminals are as follows:

CAUTION	
	◆ Check phases U, V, W and mark them clearly. ◆ Ensure that the MV AC drive is in the de-energized state.

As shown in the following figure, run the three-phase (U, V, W) cable into the corresponding cable holes and connect it to the corresponding three-phase busbar. Then tighten the M10 screw with a torque of 45 N·m.

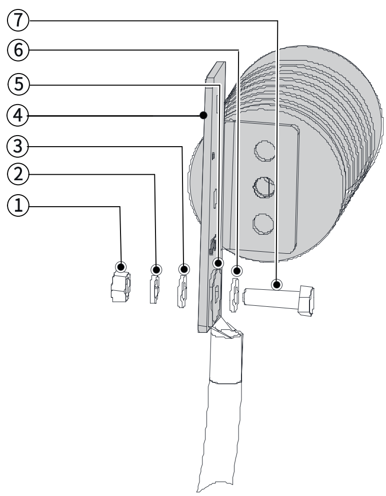


Figure 2-27 Connecting the MV inlet and output terminals

No.	Component Name
①	M10 nut
②	Spring washer
③	Flat washer
④	Copper busbar
⑤	Copper pipe terminal
⑥	Flat washer
⑦	M10 hexagon bolt

2.3.7 Connecting Control Cables

1) Layout of the control circuit components

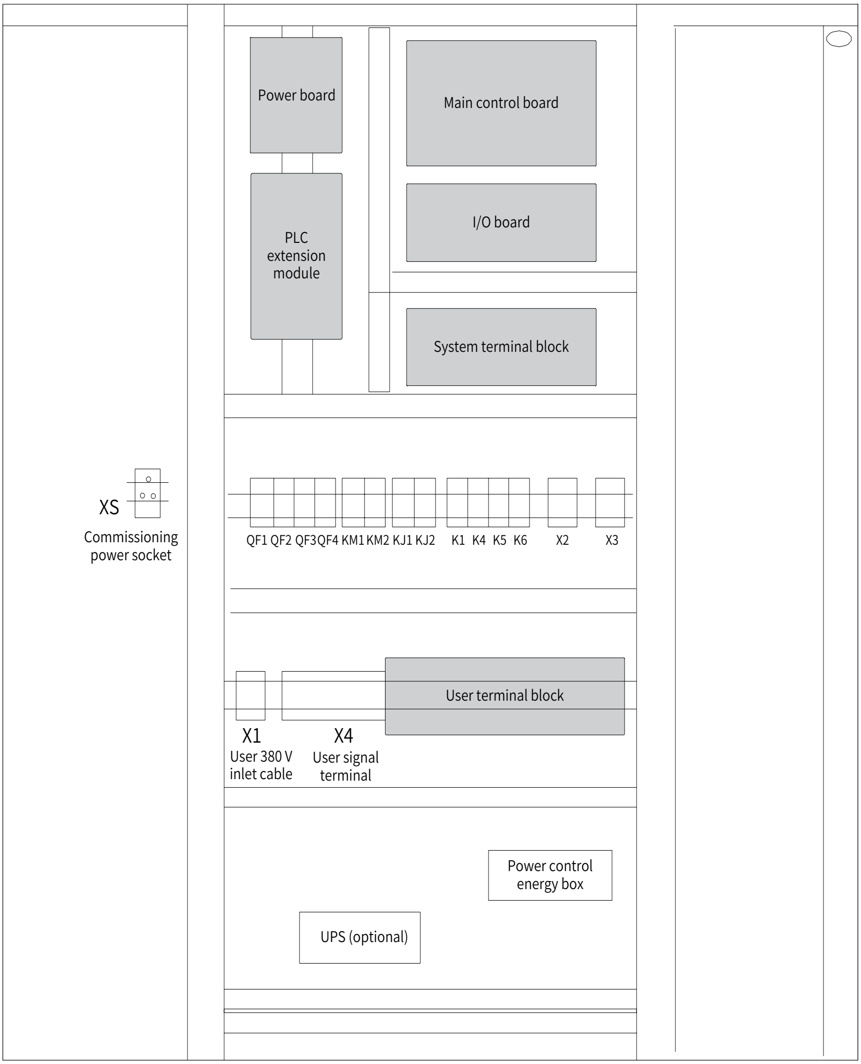


Figure 2-28 Layout of the control circuit components (10 kV series - models of 2500 kVA and below)

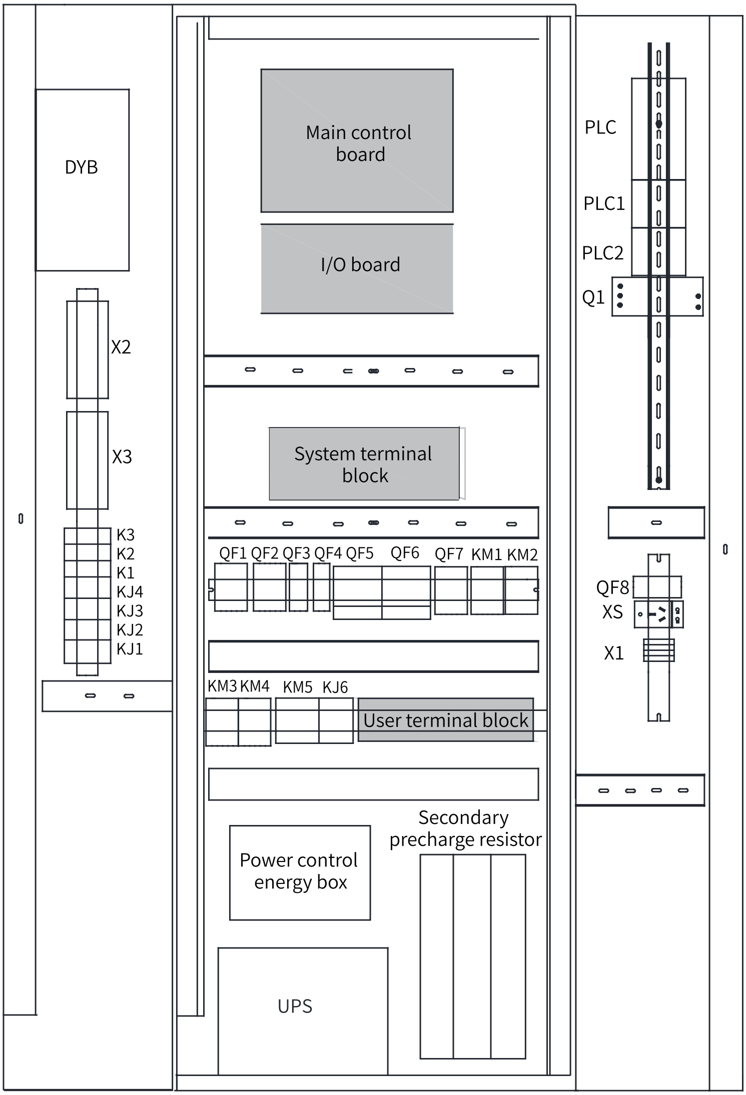


Figure 2-29 Layout of the control circuit components (10 kV – models of 2800 kVA and above)

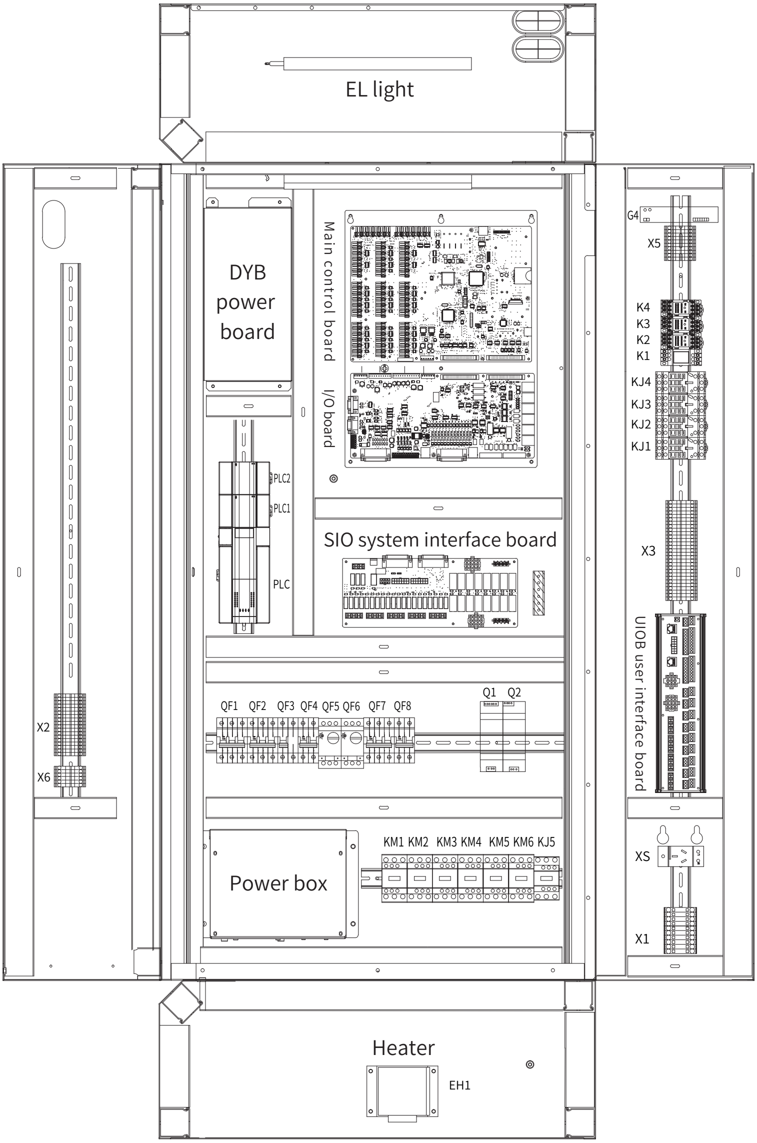


Figure 2-30 Layout of the control circuit components (6 kV series - models of 2800 kVA and below)

NOTE

- The preceding figure takes the control panel as an example. The component layout in the control cabinet is similar to the layout of the control panel.
- The internal wiring is complete before delivery. You only need to perform wiring on the user terminal block and user interface board. For details, refer to the description of the user terminal block and user interface board at the end of this section.
- The control circuit is composed of the main control unit, power board, air switch.

Table 2-3 Composition of the control panel

Name	Function
Main control board	◆ Implement the system logic function, human-machine interaction and communication with the bus. ◆ Implement motor control algorithm, real-time protection and cell diagnostics. ◆ Implement phase-shifting PWM output, communication with cells, real-time data exchange with DSP/ARM, and system clock.
I/O interface board	◆ Provide power supply to the whole hardware system, including the main control board and fiber-optic board ◆ Complete conditioning of input and output current/voltage signals ◆ Provide interfaces to other boards, extended cards, HMI, DI/DO and AI/AO, and implementing functions of human-machine interaction, communication and I/O extension
System terminal block	◆ Connected with I/O board ◆ The fiber-optic board is the bridge between the system logic function and main control system. ◆ Integrated relay module, DI/D0 interface, HMI power.

2) Description of the MV AC Drive Control Circuit

Table 2-4 DO function table of system interface board

Port	Function
DO1	MV switch-off
DO2	MV switch-on allow
DO3	Main power indicator
DO4	Ready
DO5	AC drive in operation
DO6	AC drive stop
DO7	Fault
DO8	Alarm
DO24	Cabinet top fan control
DO25	Heater control
DO26	Backup DO for transformer cabinet
DO27	Mains frequency indication
DO28	Frequency variation indication

NOTE

- ◆ If the AC drive is not configured with a bypass cabinet (standard configuration), DO10 to DO17and DO18 to DO23 cannot be used in other occasions, because the system interface panel is not configured with the relay. DO29 to DO34 on the I/O panel are standby DO that can be used as an external relay for expansion.
- ◆ If the AC drive is configured with the manual or automatic bypass cabinet, DO18 to DO23 cannot be used in other occasions, because the system interface panel is not configured with the relay. DO29 to DO34 on I/O panel are standby DO that can be used as an external relay for expansion.

Table 2-5 Functions of the air switch

Name (Electrical Symbol)	Function
QF1	User cable inlet switch
QF2	Transformer auxiliary winding switch
QF3	Switch of lighting and 220 V power socket in the control cabinet
QF4	Control power switch
QF5	Fan power switch 1
QF6	Fan power switch 2

3) Wiring of the I/O board

The I/O interface board provides the MV AC drive with 18-channel digital inputs, 16-channel digital outputs, 4-channel analog inputs and 5-channel analog outputs. The DI, DO, AI and AO terminals can be extended according to user requirements.

■ DI

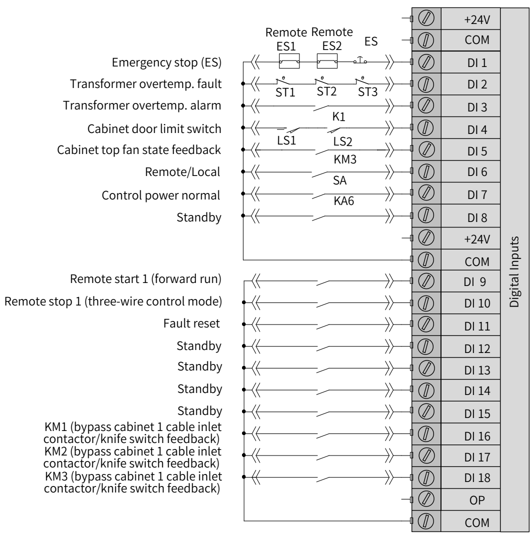


Figure 2-31 Connecting DI terminals

NOTE

◆ DI19 to DI26 are standby DI terminals.

■ DO

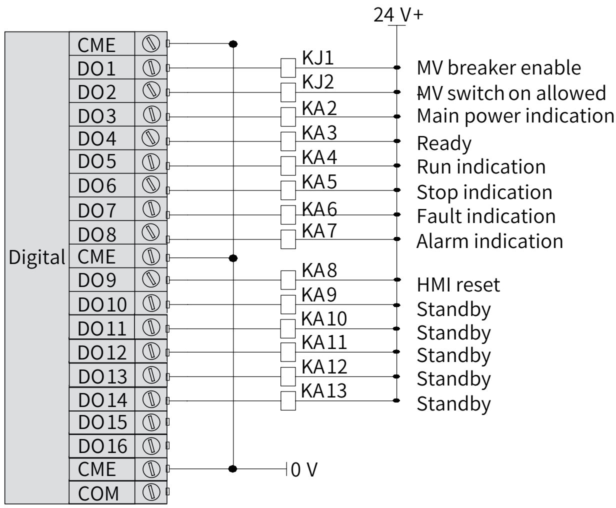


Figure 2-32 Connecting DO terminals

■ Communication interfaces

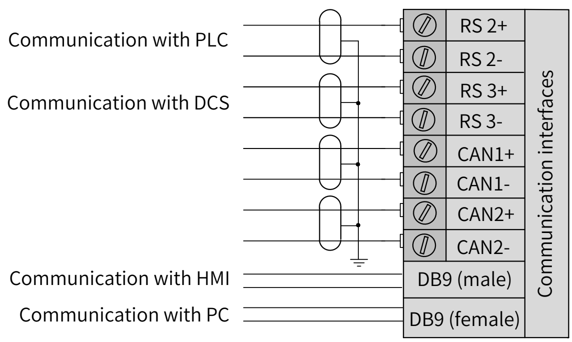


Figure 2-33 Connecting communication terminals

NOTE

If the PROFIBUS-DP communication card is selected, see *"Appendix C PROFIBUS-DP Extension Card"* for the related description.

- AI/AO

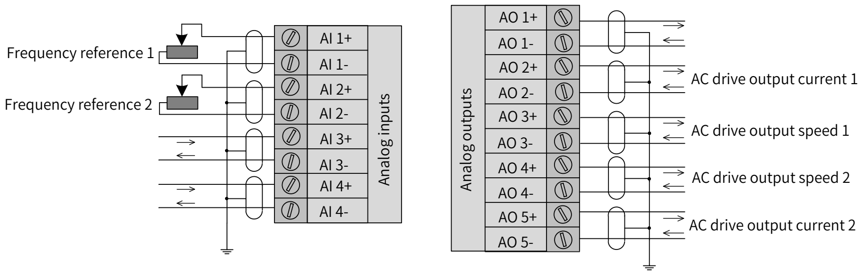


Figure 2-34 Connecting AI and AO terminals

- Encoder terminals

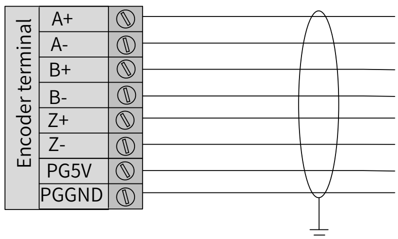


Figure 2-35 Connecting encoder terminals

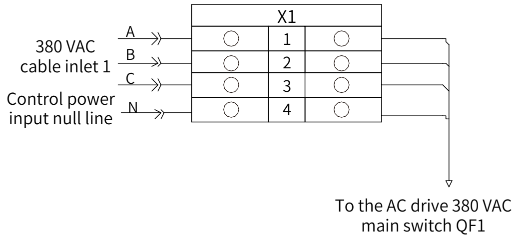
NOTE

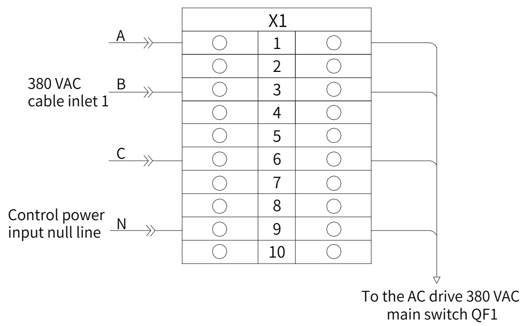
For detailed description on the encoder, see *"Appendix D Common Encoder Extension Cards".*

4) User terminal block

The MV AC drive has combined the terminals that the user need to use to the terminal blocks X1. Follow the following diagrams to wire the terminals.

Table 2-6 User terminal block description

<table>
<tr><th>Type</th><th>Signal Name</th><th>User Wiring</th><th>User Power Cable Inlet Block</th><th>Internal Wiring</th></tr>
<tr><td>User power terminal</td><td colspan="4">Models of 4500 kVA and below in 10 kV series


Models of 2800 kVA and below in 6 kV series

</td></tr>
</table>

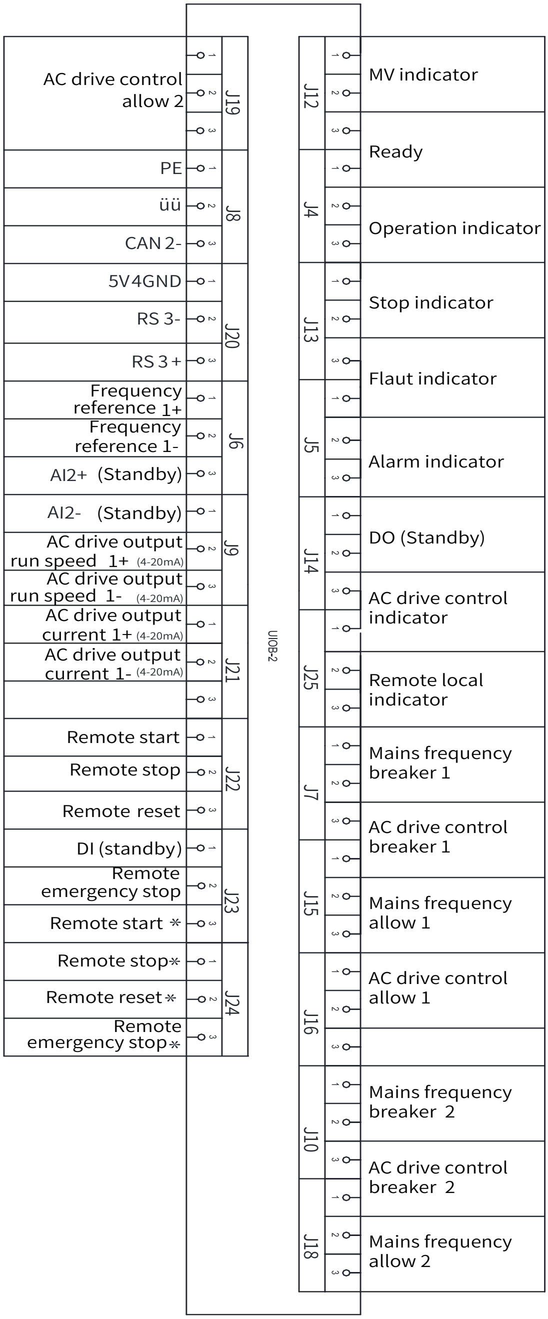


Figure 2-36 User terminal block (10 kV series - models of 2500 kVA and below)

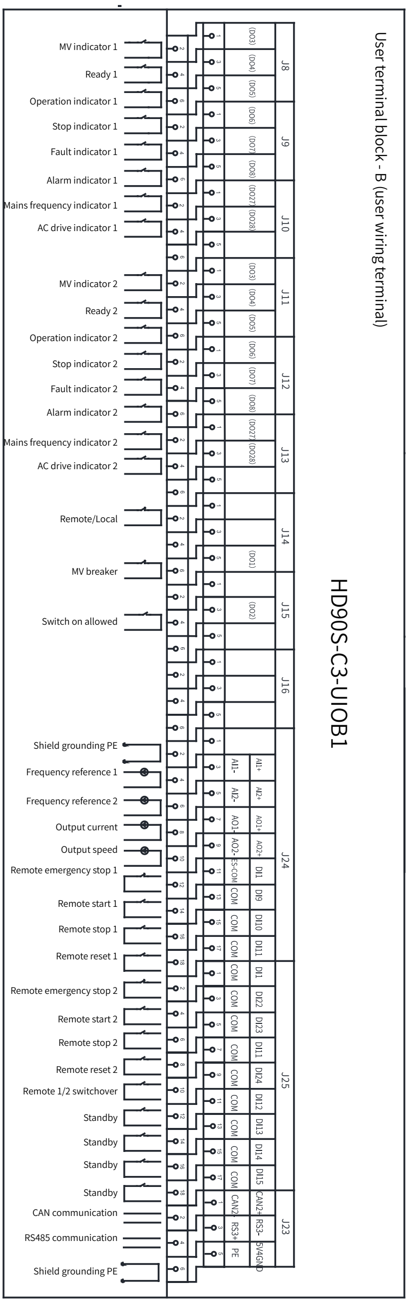


Figure 2-37 User terminal block (10 kV series - models of 2800 kVA to 4500 kVA, 6 kV series – models of 2800 kVA and below)

2.3.8 Peripheral Wiring

The peripheral wiring takes the MV AC drive with capacity of 1000kVA as an example and is shown in Figure 2-33 at the end of this chapter. For the wiring of the equipment you received, refer to the drawing that is delivered together with the equipment.

2.3.9 Typical Application Wiring

As shown in the following figures, all signals are connected to corresponding terminals. Select the signals for connection according to the actual application.

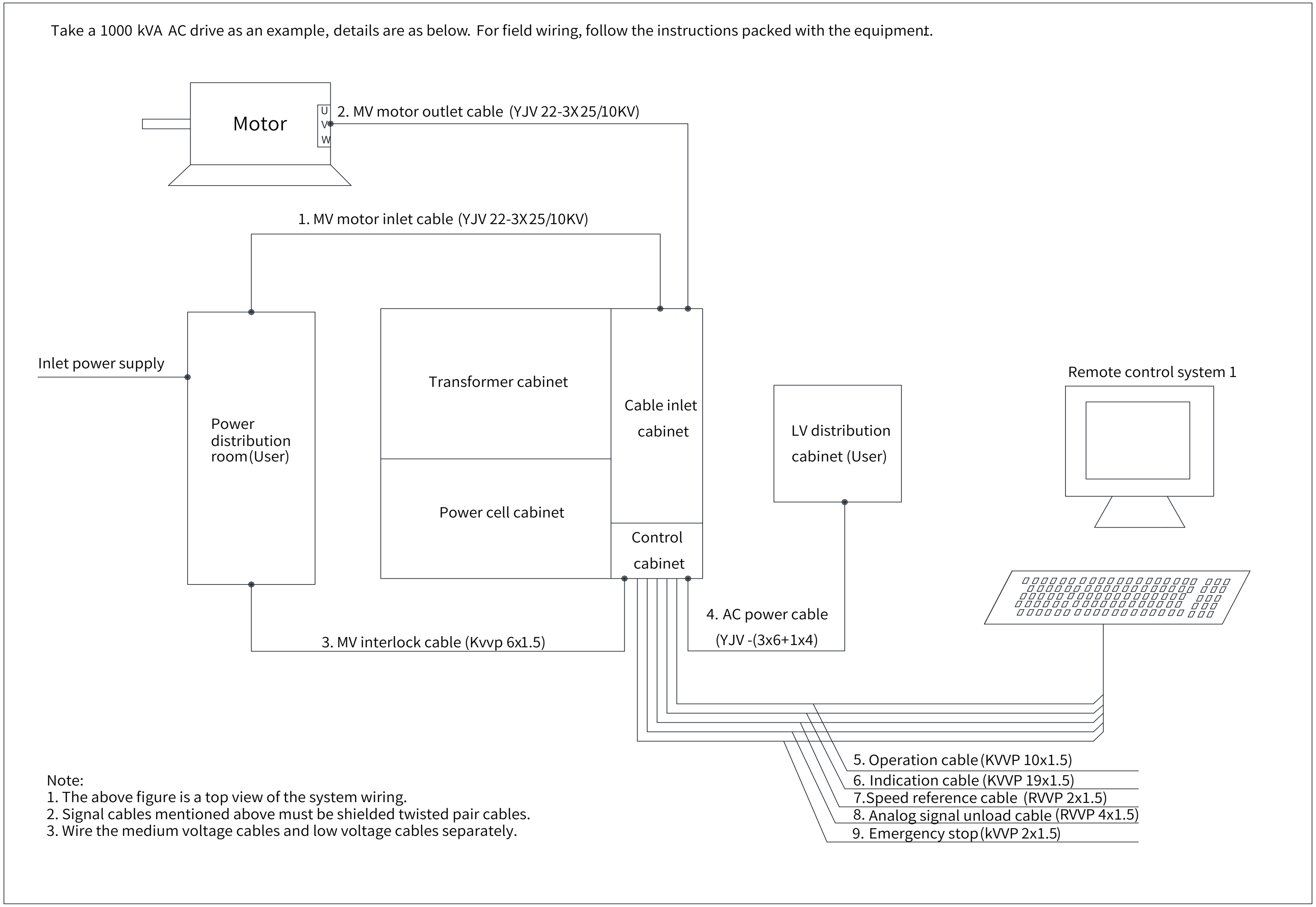
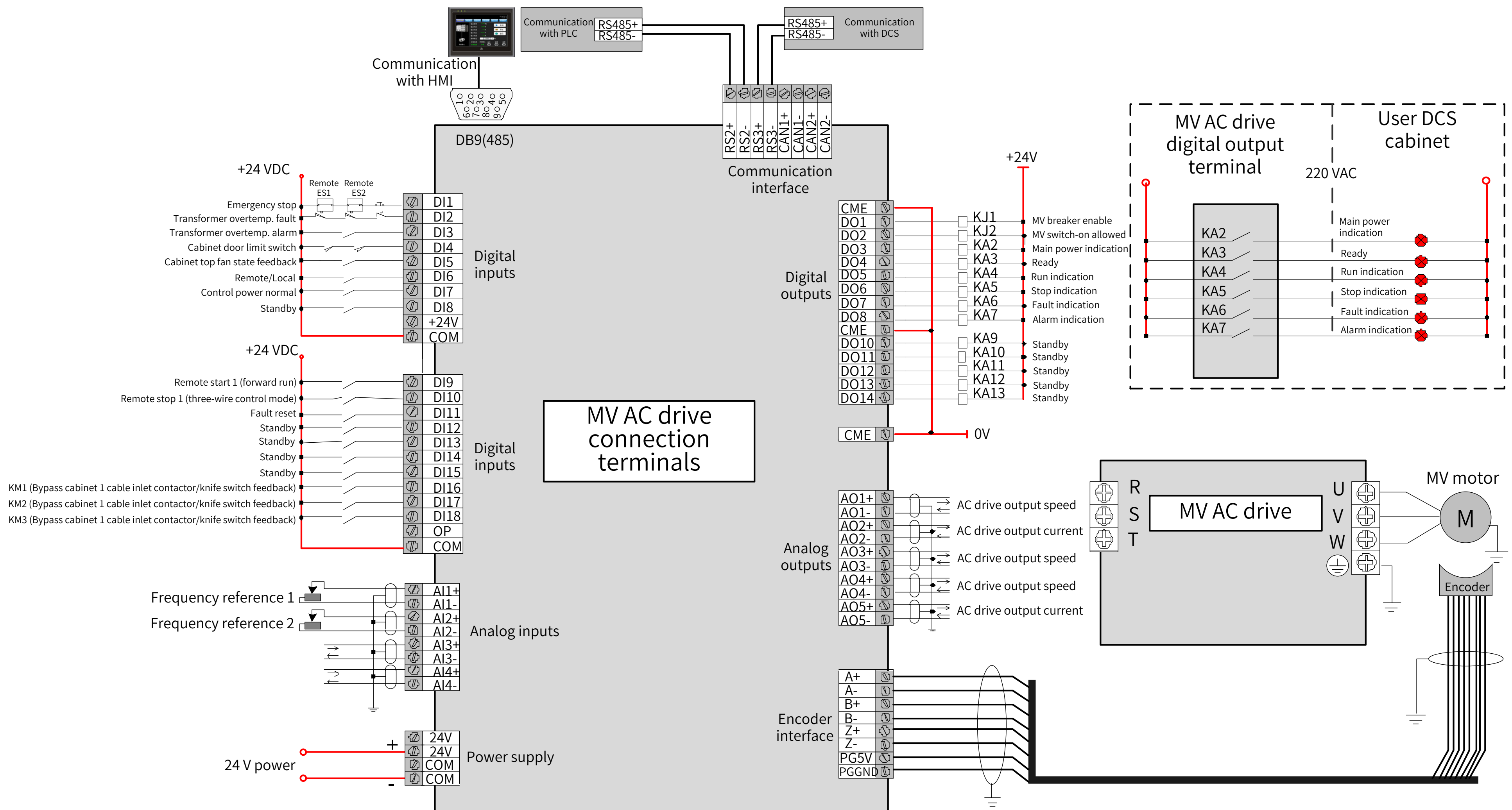


Figure 2-38 Peripheral wiring



◆ Note: Prepare cables for connection in the figure by yourself. For selection and making of these cables, refer to the engineering drawing that is delivered together with the AC drive.

Figure 2-39 Typical application wiring

3 Commissioning

3.1 Commissioning Procedure

All steps for starting the MV AC drive from checking before power-on to MV motor test must be performed under guidance of our company engineers or only by users who have been trained. The function test, commissioning, and parameter setting must be performed according to related regulations and the instructions in the guide.

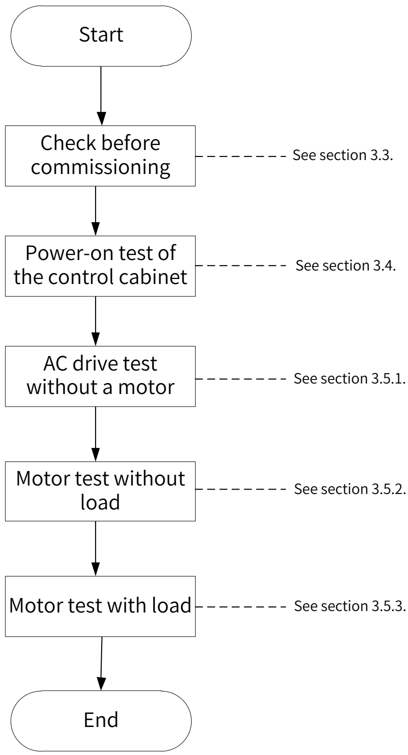


Figure 3-1 System commissioning flowchart

3.2 Commissioning Precautions

During commissioning, at least two electric technicians from customers must be available for commissioning, who must:

1) Be familiar with the MV electric equipment and related safety specifications.

2) Be familiar with the load transmission process.

3) Be authorized to operate the MV equipment (such as power circuit breaker and other MV transmission switches).

4) Be authorized to operate the transmission equipment.

CAUTION	
	◆ Never cut off the control power after the MV power is applied. Otherwise, the cooling, monitoring, and control systems will stop working, which may cause serious faults or damage to the systems.

DANGER	
	◆ If the AC drive is not installed or checked properly, the test operations will probably cause severe personal injury or even death. ◆ Before performing test operations, be sure to cut off the power supply of the AC drive and obey the operation regulations such as using the correct interlock and warning signs. ◆ Even if the MV circuit breaker and control power switch are turned off, hazardous voltage may still exist in the AC drive cabinet (because of stored energy in the cell).

3.3 Check Before Commissioning

Checking Items	OK
No foreign matter exists inside the cabinet.	
All electric connections are fastened. The cabinet is intact without damage or serious painting off. If there is damage, check whether the components, cables or other matters surrounding the damaged part are intact.	
The conductors of cables at the joints and gaps are not exposed due to friction or improper transportation.	
The AC drive cabinet is reliably tied to the workshop ground.	
The cables of the AC drive connected to the ground cable of the ground bar are intact and connected securely.	
The cabinets that are separated during transportation must be connected again with a grounding cable.	
The fans on the top of the cabinet are mounted solidly and can rotate freely without any abnormal friction noise.	
The power cables of the fans on the top of the cabinet are connected securely.	
The wiring between the phase-shifting transformer and the power cells is correct and secure.	
The optical fibers between the optical fiber board in the main control cabinet and all power cells are connected correctly and securely.	
All strips of the I/O board are connected correctly and securely. The communication cable between the main control board and the optical fiber board is connected correctly.	

Checking Items	OK
It is recommended that the analog signal cable provided by the user be shielded cable to guarantee electromagnetic compatibility and be separated from power cables.	
All user wiring is correct and secure.	
The control power and main power are connected reliably according to related electrical codes.	
Apply the power only after ensuring that wiring of the AC drive is correct and all cabinet doors are locked. Never open the cabinet doors after the power is applied.	

CAUTION

- Be sure that all cabinets are grounded reliably and power cables and power cell cables are connected correctly. Otherwise, personal injury or equipment damage may occur.

3.4 Power-on Test of the Control Cabinet

Step	Commissioning
1	Check whether wiring of the control power is correct and whether the voltage is within the specification.
2	Check whether the indicator of the surge protection device is ON, and turn on the power switch (QF1) of the control cabinet.
3	Turn on the light power switch (QF3), and check whether the light is on.
4	Turn on the control power switch (QF4), and check whether the power supply is normal.
5	Turn on the fan power switches (QF5 and QF6) and enable the "Fan auto run" function to turn on the cabinet top fans. Check whether the fans rotate smoothly in the required direction.
6	Observe whether the touch screen (HMI) displays normally.
7	After confirming that the display of the HMI is normal, enter the "Sys. Property" interface. In the pop-up login dialog box, enter the password.
8	After the login is successful, switch to the "Pr. setting" interface. Input correct motor parameters and related control parameters.
9	Verify whether the logic of the MV cabinet interlock, emergency stop button, remote/local switch are correct, effective, and reliable.
10	Go on with the MV power-on test.

3.5 Power-on Test of the MV AC Drive

CAUTION

- Before applying MV power, be sure to test whether the input MV breaker can be enabled and disabled properly at interlock with the AC drive.

3.5.1 Test Procedure Without a Motor

CAUTION	
	◆ The input terminals R, S, T and output terminals U, V, W of the AC drive must be connected to the yellow, green, and red cables on-site, respectively. The phase sequence must be consistent.

Step	Commissioning
1	Ensure that the system is in power-off state, and connect the input terminals R, S, T of the AC drive to the MV cabinet. Ensure that the output terminals U, V, W of the AC drive are disconnected from the motor and all cabinet doors are closed.
2	Apply the AC control power (for the operation, see section *"3.4 Power-on Test of the Control Cabinet"*). After the AC drive outputs the MV switch-on allowed signal, notify the operator that the MV power will be applied.
3	Apply the MV power according to the operation regulations (for the first-time operation, all personnel must be 3 m away from the cabinet). In case of any abnormality, press the emergency stop button and notify the operator to switch off the MV power immediately.
4	Verify again that the MV breaker can be enabled reliably at emergency stop.
5	Observe whether the input voltage is normal after the MV power is applied.
6	Observe whether the power cells and system alarm or report any fault and whether the display of various states is normal.
7	Verify basic functions such as start, stop, acceleration, and deceleration.
8	Verify whether certain alarms and faults can be reported timely and the AC drive can perform related actions correctly.
9	After ensuring that each power cell is normal, verify the dual power switchover function.
10	After ensuring that all are normal, stop the AC drive and switch off the MV power.
11	Go on with the no-load motor test.

CAUTION	
	◆ Never start or stop the MV AC drive by directly connecting or disconnecting the MV power.

3.5.2 Motor With No Load Test Procedure

Step	Commissioning
1	Ensure that the motor is disconnected from the load.
2	After the control power and MV power are switched off, connect the motor cables to the output terminals U, V, W of the AC drive securely.
3	Apply the MV power and ensure that the AC drive self-checking is normal.

Step	Commissioning
4	Ensure that all parameter settings are correct and perform motor auto-tuning. After the motor auto-tuning is complete, set the frequency reference (5 to 10 Hz for the first time).
5	Start the AC drive, and check whether the motor rotates in the correct direction (if the mains frequency bypass cabinet is provided on site, test the forward and reverse of the motor at mains frequency) and whether the motor running is normal.
6	Increase the frequency reference to 50 Hz gradually and then decrease it to 5 Hz several times and observe whether the motor running is abnormal during acceleration and deceleration.
7	After ensuring that all are normal, stop the AC drive, switch off the MV power, and go on with the with-load motor test.

3.5.3 Motor With Load Test Procedure

Step	Commissioning
1	Connect the load to the motor. After all checking is complete, apply the control power and MV power.
2	After the AC drive is ready, start it on the condition that the load is light. Start the AC drive, and observe the AC drive voltage and current rise as the frequency reference increases. Then, increase the load until the production process requirement is met.
3	If an alarm occurs or a fault is reported during start or running, stop the AC drive immediately and perform troubleshooting according to the troubleshooting instructions.
4	During the trial running, monitor the running on-site for 24 hours. Record the equipment running frequency, transformer temperature, input and output voltage, input and output current and other data.
5	After 24-hour trial running is complete, the operators will be trained and the duty is transferred.

NOTE

If the AC drive is not started normally, wait until the motor enters the stop state or wait at least 10 minutes and then start the drive for the second time.

4 Operations

This chapter describes the operation procedure after the AC drive is installed and commissioned successfully. You are required to follow the operation procedure strictly.

DANGER	
	◆ Only operators that have been trained and are authorized can operate the AC drive. All operations must be performed according to "Safety Instructions". ◆ The AC drive is medium-voltage equipment and may endanger the operators. The operators must be familiar with the following precautions before any operation. Otherwise, personal injury and equipment damage will occur.

4.1 Precautions Before Operation

CAUTION

- Ensure that the input voltage is within the rated range.
- When starting a spinning motor, please set and enable the catching a spinning motor function.
- The power-on and power-off sequence must be: When starting the system, apply the control power and then the MV power. When stopping the system, after the motor stops completely, switch off the MV power and then the control power.
- Operators must monitor the load running all the time, stops the system immediately if any abnormality occurs, and press the emergency stop button if necessary.
- There is no abnormal electromagnetic interference around the AC drive installation location.
- Operators must have been trained, be familiar with the AC drive structure, and know the operation procedure, safety information and precautions.
- Follow the MV operation regulations during maintenance, such as wearing insulation gloves, insulation shoes, and safety glasses.
- Always work with another person present.
- Install a security fence (marked with MV danger), and never move it away during operation and maintenance.
- Never put combustible materials (including the equipment drawings and user guide) near the AC drive.
- When processing or measuring AC drive components, prevent signal cables and control cables from shorting together or touching other terminals.
- Never run the AC drive with cabinet doors open, or never open any cabinet door during AC drive running because this will cause human injury.
- Remove or repair the cooling fan only after the MV power is switched off.
- When transporting the AC drive, lay it well in the transporting vehicle and ensure that the ground where the AC is unloaded to is flat.
- When maintaining or replacing the power cell, wait for at least 10 minutes after the MV power is switched off and then open the cabinet door. (For the specific waiting time, refer to the label on the AC drive cabinet door.) Ensure that the power indicator of power cells are in the off state before operation, because hazardous MV may still exist inside the AC drive in a short time after switch-off of the MV power.
- After installation and commissioning of the AC drive are complete, the running parameters must not be modified by non-professional personnel. Otherwise, abnormal stop or equipment fault may be caused.

4.2 Components on Cabinet Door

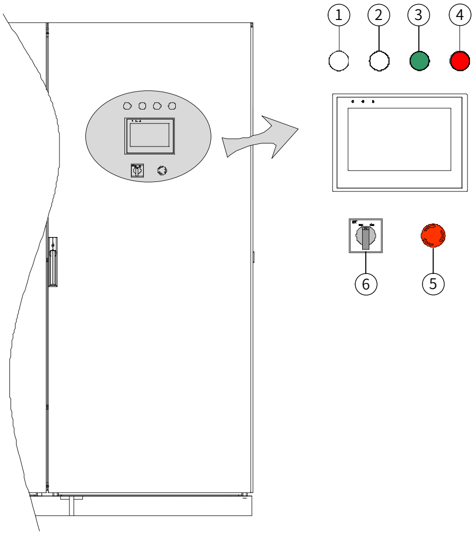


Figure 4-1 Control cabinet panel

No.	Component Name	Function
①	Main power indicator	This indicator indicates whether the MV input is normal. If normal, this indicator is ON.
②	Control power indicator	This indicator indicates whether the 220 VAC control power is normal. If it is normal, this indicator is ON.
③	RUN indicator	This indicator indicates whether the AC drive is in running state. If yes, this indicator is ON.
④	Fault indicator	This indicator indicates whether the AC drive is in faulty state. If a fault occurs, this indicator becomes ON.
⑤	Emergency stop button	When an emergency fault occurs on the system, press this button to shut off all IGBTs. Then, the AC drive stops output and enables the input MV breaker, reducing the loss to the minimum.
⑥	Local/Remote switch	This switch is used for switchover between local control and remote control.

CAUTION

- After pressing the emergency stop button, reset the button by turning it clockwise and then apply the MV power.
- The emergency stop button is invalid when the bypass cabinet is connected to the mains frequency. In this case, press the emergency stop button on the bypass cabinet to cut off the MV power.

4.3 Local/Remote Switchover

4.3.1 Local Control

When you turn the Local/Remote switch to "Local", you can directly start and stop the AC drive on the HMI. The target frequency is set using "Frequency reference" on the HMI touchscreen.

4.3.2 Remote Control

When you turn the Local/Remote switch to "Remote", the frequency reference and command source can be set using function parameters. Generally, select the DI terminal as the command source and select the AI terminal as the frequency reference setting channel.

NOTE

The AC drive supports Local/Remote switchover during running and will not stop, but the target frequency may change.

4.4 AC Drive Running Mode

The MV AC drive supports multiple running modes such as open-loop running, closed-loop running, decelerating to stop, and coasting to stop.

4.4.1 Open-Loop Running

In standby state, when the "Local/Remote" switch is turned to "Remote", if there is a remote start command, the AC drive starts based on the acceleration time of the system, and then runs at the frequency reference set by the user.

In standby state, when the "Local/Remote" switch is turned to "Local", the remote startup command is invalid, and you can touch "Start" on the HMI to start the AC drive.

4.4.2 Closed-Loop Running

If PID is selected as the frequency reference setting channel, the AC drive runs in closed-loop mode after start. In the closed-loop mode, you can set the desired value of the controlled variables (such as pressure, temperature, converted to 4 to 20 mA analog). Based on the actual values of the controlled variables and PID parameter setting, the AC drive automatically adjusts the motor speed so that the actual values can follow the desired value.

4.4.3 Normal Stop

When the "Local/Remote" switch is turned to "Remote", the AC drive stops according to the set stop mode once receiving a remote stop command.

When the "Local/Remote" switch is turned to "Local", the remote startup command is invalid. You can touch "Stop" on the HMI to stop the AC drive.

4.4.4 Emergency Stop

In any condition, the emergency stop button on the panel is valid. After receiving the emergency stop command, the system immediately stops output and coasts to stop and meanwhile enables the input MV breaker. The MV switch-on is allowed only after the emergency stop button is reset.

4.5 Alarm/Fault Reset

When an alarm (such as transformer overtemp.) occurs on the system, the alarm is cleared automatically after the system restores to normal. When a fault occurs on the system, you can press "Reset" to reset the fault.

4.6 AC Drive Operation Procedure

The MV AC drive is directly connected to the MV grid. Therefore, follow the precautions below during operations.

- Wear insulated safety shoes before entering the MV system room to perform operations.
- Lay the insulation pad or rubber pad around the equipment.
- Always work with another person present.

DANGER	
	◆ After the MV power is switched off, wait for at least 10 minutes and then open the cabinet doors to start maintenance. Failure to comply will result in electric shock because the DC bus of the power cell is still energized. ◆ The product is only applicable to the power system of the voltage class stated in the technical protocol.

4.6.1 Powering On the AC Drive

- Check before first-time power-on or after maintenance

Checking Items	OK
Check that screws of input and output terminals are tightened securely.	
Check that cables for cabinets that are separately transported are connected properly and securely.	
Check that all control cables and signal cables are connected properly and securely.	
Check that all cabinets that are separately transported are grounded to the workshop reliably.	
Check that cables for connecting power cells in series and neutral point cables are connected properly and securely.	

■ Routine check before power-on

Checking Items	OK
Remove all temporary grounding protection before power-on.	
Check whether the air filter needs to be replaced.	
Check whether the faults of the AC drive have been handled properly.	
Close and lock all cabinet doors.	

1) Power on the control cabinet.
2) Ensure correct setting of the parameters that are related to frequency reference, control mode, and running curve of the AC drive.
3) Close all cabinet doors (the control cabinet door may not be closed).
4) After the MV switch-on allowed signal from the AC drive becomes valid, switch on the pre-charge cabinet.
5) Apply the MV power, and check that the HMI displays "Ready". Then, you can start the AC drive.

CAUTION	
	◆ Remember to confirm the setting of parameters that have special effect on start to ensure equipment safety and normal start. ◆ If a cabinet door is not closed properly, the system will report a fault and does not output the switch-on allowed signal.

4.6.2 Starting the AC Drive

1) Power on the system according to the procedure in "4.6.1 Powering On the AC Drive".
2) Check that the system state displayed on the HMI is "Ready", and that the fault indicator on the control cabinet is OFF. If an alarm or a fault occurs, perform troubleshooting according to the alarm/fault information displayed on the HMI or operation panel and the troubleshooting methods described in "7 Troubleshooting".
3) Set the frequency reference based on the specified frequency reference setting channel.
4) Give the start signal based on the set control mode.

4.6.3 Stopping the AC Drive

Stop the AC drive based on the set stop mode.

NOTE

When "Decelerate to stop" is selected, if you give the start signal again before the output frequency decelerates to the stop frequency, the AC drive accelerates again to the frequency reference.

4.6.4 Coasting to Stop

In this stop mode, the AC drive stops voltage output, and the motor coasts to stop (under the effect of load and friction, the motor decelerates gradually to stop).

CAUTION

- Estimate whether the process allows the motor to coast to stop.
- When the motor coasts to stop, there is still residual voltage on the output cables due to residual magnetism of the motor.

4.6.5 Powering Off the AC Drive

Except that the MV power can be switched off directly in the case of critical faults, switch off the MV power only after the AC drive stops.

Checking Items	OK
Notify all persons involved to prepare for power-off.	
Press the stop button to stop the AC drive.	
Turn off the MV switch.	

DANGER

The DC voltage reduces to the safety value at least 10 minutes after the MV power is switched off. For the specific waiting time, refer to the label on the AC drive cabinet door.

4.6.6 Troubleshooting

1) If the main control system is abnormal, press the emergency stop button on the control cabinet to switch off the MV power immediately.

2) The fault levels are graded into minor (alarm), major, and critical. When an alarm occurs, the AC drive continues to run. When a major fault occurs, the AC drive determines whether to continue to run, decelerate to stop, or stop immediately based on the related setting. When a critical fault occurs, the AC drive immediately coasts to stop and disconnects the MV power input.

3) The AC drive stops.

4) Power off the system.

5) Perform troubleshooting 10 minutes after power-off according to the description in *"7 Troubleshooting"*.

CAUTION

If you pressed the emergency stop button, turn the button clockwise to reset it only after the fault is rectified.

4.6.7 Inspection

DANGER	
	After the MV power is switched off, wait for at least 10 minutes and then open the cabinet doors to start maintenance. Failure to comply will result in electric shock because the DC bus of the power cell is still energized.

1) Power off the AC drive.
2) Press the emergency stop button to ensure that upper-level MV switch cabinet is in the power cut-off state, ground the grounding switch and set up the warning board.
3) Open the transformer cabinet doors, and tie the grounding cable on the input side of the transformer to the ground reliably.
4) Inspect the transformer cabinet and power cell cabinet.
5) After the inspection is complete, remove the grounding cables on input and output sides of the transformer.
6) Reset the emergency stop button.

■ Maintenance and Inspection

Checking Items	OK
Before any maintenance or inspection work, turn off the MV breaker and all isolation switches and meanwhile put a warning board to prevent sudden power-on.	
Ensure that the AC drive is in the stop state and the MV presence indicator is OFF.	
After medium voltage and low voltage are cut off, perform an electrical inspection before any inspection work. For medium voltage inspection, use an electroscope of the corresponding voltage class and wear insulated safety articles.	
After verifying that the AC drive is de-energized, tie the input three phases of the AC drive to ground to ensure your safety.	
All parts of the AC drive which are liable to become energized must be grounded. When inspecting a bus knife switch, an isolation switch or a load switch in the double-circuit system, pull down both bus knife switches and ground the inspected switch at both ends.	
When installing a ground cable, make one end of the cable grounded first, and then attach the cable. When removing a ground cable, do in the reverse sequence. For either installation or removal, wear insulated personal protective equipment (PPE).	
Attach the grounding cable to the place where the cable can be seen all the time and put a "Working" warning board at the grounding cable.	

■ ESD

ESD

The printed circuit boards (PCBs) and power cells contain components that are sensitive to electrostatic discharge (ESD). Remove static electricity first before handling or repairing these components, which must be done by qualified personnel. Failure to comply may cause damage to the components, resulting in equipment faults. For removal of static electricity, obey the following rules:

◆ Wear an anti-static wrist strap.
◆ Transport static sensitive equipment in anti-static bags.
◆ When handling a PCB, hold the board by its edges.
◆ Never slide PCBs across any surface.
◆ When returning any component to our company for repairing, deliver it in anti-static pack.

5 HMI Operation

The MV AC drive is configured with a human-machine interface (HMI). You can set functions and view information about the AC drive by operating the HMI. The following figure shows the functions of the HMI.

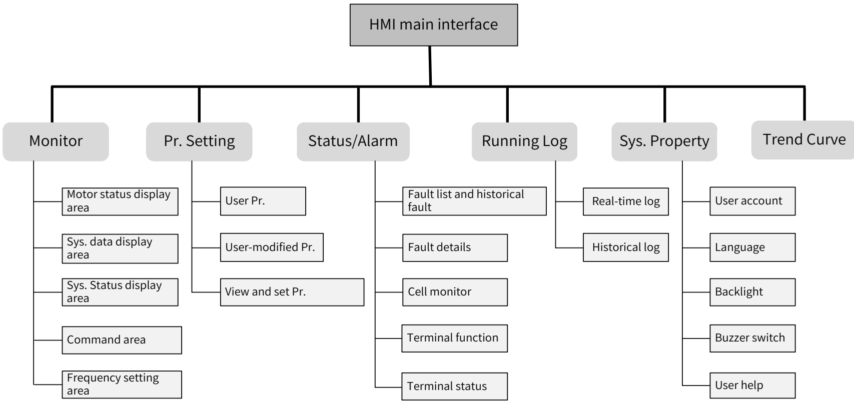


Figure 5-1 Functions of the HMI

The six functions can be switched over by touching the tabs. After selecting a function, the tab becomes highlighted. As shown in the following figure, the "Monitor" interface is displayed after power-on by default.

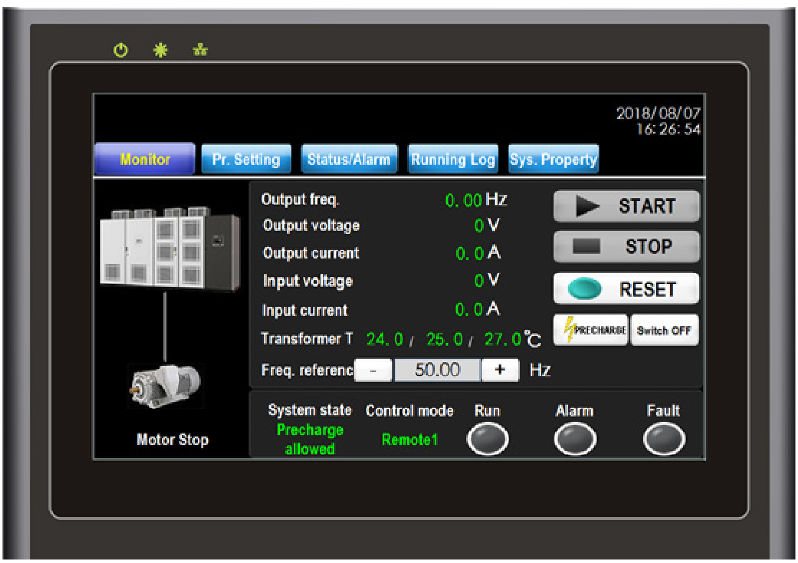


Figure 5-2 System main interface-monitor interface

5.1 Monitor Interface

As shown in Figure 5-3, the monitor interface consists of five areas: the motor status display area, the system data display area, the system state display area, the command area and the frequency setting area.

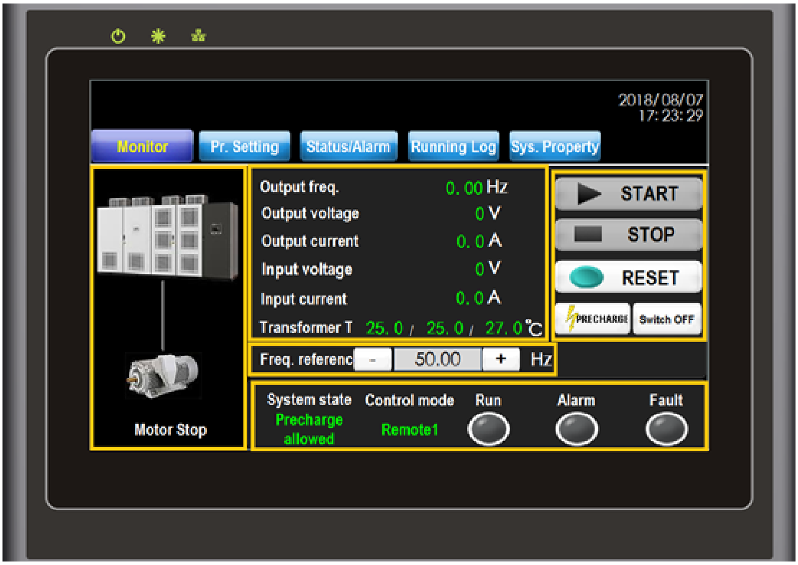


Figure 5-3 Monitor interface

The functions of the five areas are described in the following table.

Table 5-1 Functions of the five areas

No.	Area Name	Function Description
①	Motor status display area	Display the motor running state.
②	Sys. data display area	Display the system commonly used parameters, such as the system output frequency, input and output voltage, and input and output current.
③	Sys. status display area	Display the current system state, including the control mode, running state and fault or alarm state.
④	Command area	Allow you to start or stop the AC drive in the local control mode.
⑤	Frequency setting area	Allow you to set the frequency reference through the increment or decrement function or directly input the frequency reference value in the setting box.

NOTE

- START : When the system is at the "Ready" state and the frequency reference has been set, touch this key and confirm the start operation. The AC drive will run according to the currently set mode. The HMI supports on-line modification of the frequency reference during the drive running. The last frequency reference is considered the target frequency.
- STOP : Touch this key and confirm the operation. The AC drive will stop according to the set stop mode.
- RESET : Touch this key to reset the system fault. It is valid in either local or remote control mode.
- In the remote control mode or in the dehumidification state, START and STOP are disabled and do not respond to your operation.
- Freq. reference: Set the frequency reference here only when the frequency reference setting channel is HMI. It does not take effect if the frequency reference setting channel is not HMI.
- Alarm/Fault indicator: When a fault or alarm occurs on the system, a fault or alarm information dialog box pops up automatically and the backlight becomes on. "System State" on the interface becomes "System Fault" or "System Alarm", and the corresponding status indicator becomes on or blinks.

5.2 Parameter Setting

The MV AC drive has many parameters to satisfy the requirements of different applications. You can view and modify parameters here and this interface contains six sub-functions.

■ User parameter

The initial interface is "User Pr". You can quickly adjust the user-level parameters here.

■ User-modified parameter

It is used to display the parameters that are modified to a non-default value.

■ View and set parameter

You can enter the parameter No. and then view or modify the parameter here using an after-sales account.

■ Parameter setting

You can use an after-sales account to modify the commonly used system parameter.

■ Motor/factory parameter

You can use an after-sales account to check the factory parameters and motor 1 parameters of the AC drive.

■ Testing instruction

You can also use an after-sales account for quick field configuration.

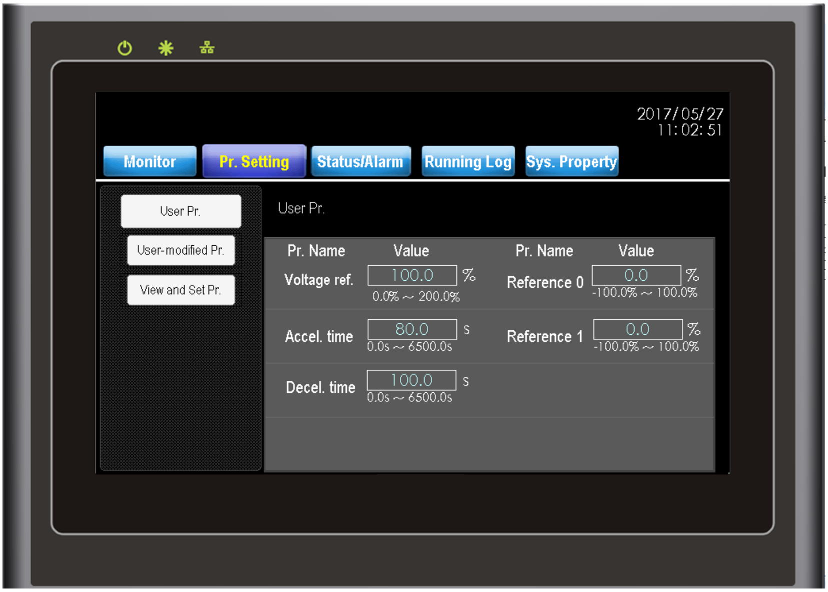


Figure 5-4 Parameter setting interface

5.2.1 User Parameter

It is used to set the commonly used user parameters. Except frequency reference, acceleration time, deceleration time, reference 0 and reference 1 are set in the following parameters respectively.

Parameter Name	Parameter No.	Parameter Name	Parameter No.
Acceleration time	F0-17	Reference 0	FC-00
Deceleration time	F0-18	Reference 1	FC-01

5.2.2 User-modified Parameter

It is used to display the parameters that are modified to a non-default value. Each page displays p to eight parameters.

You can switch over the display of the pages in a loop by touching ⬅ ➡ on the top right corner. As shown in Figure 5-5, F8-53 (Auxiliary function selection) is 0x0001 by default but has been modified to 0x40A1 actually. Thus it is listed into the user-modified parameters.

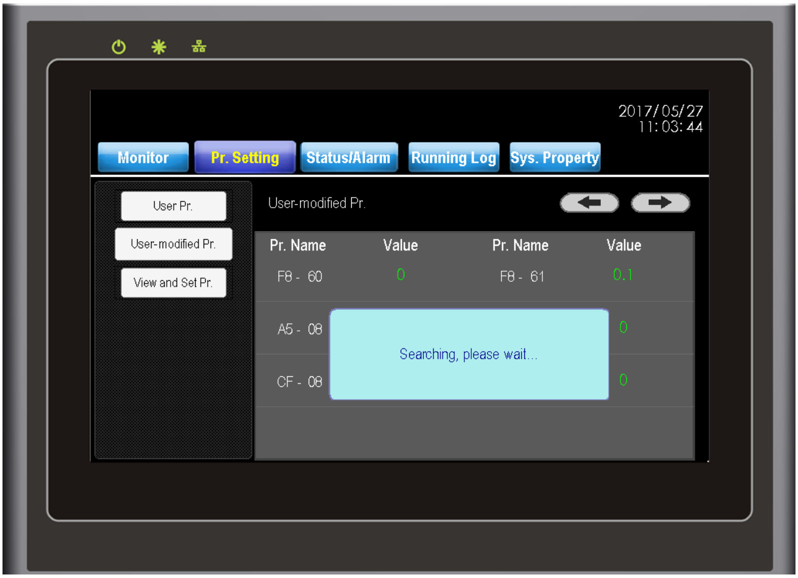


Figure 5-5 User-modified parameter interface

5.2.3 Viewing and Setting Particular Parameters

The function of viewing and setting a particular parameter is enabled after you log in to the after-sales or R&D account. The parameter function supports all parameter setting and check. Steps are as follows:

1) Log in to the aftersales or R&D account.
2) Correctly enter the parameter No. that you need to check or set. If you enter incorrect information, the HMI will give a prompt for incorrect input.
3) You will see the current value of the parameter after you enter a correct parameter No. If the parameter is not a read-only parameter, you can touch the download button to modify the parameter setting after changing the parameter value. The operation is similar to group parameter setting.
4) If parameter download is successful, the HMI will give a prompt "Download succeeds". Touch the dialogue box to close it and proceed with further operations.
5) Touch "Real-time refresh" after entering the correct parameter No. Then the setting value of the parameter on the current interface will be updated automatically.

NOTE

You must log in to an R&D account to check the factory parameters in the FF group.

Figure 5-6 Viewing and setting particular parameters

Figure 5-7 Viewing and setting particular parameters fault notice (Group wrong)

Figure 5-8 Parameter setting success notice

5.2.4 Setting Parameter

Use the parameter setting function to modify common parameters. Steps are as followings:

1) Log in to the after-sales account.

2) Touch the corresponding parameter setting area, enter the parameter value based on the prompted keyboard notice. You can also touch "+" or "-" to set the parameter value.

3) Confirm the modification or touch the download icon.

4) The interface gives a prompt of "Download succeeds", indicating that the procedure ends.

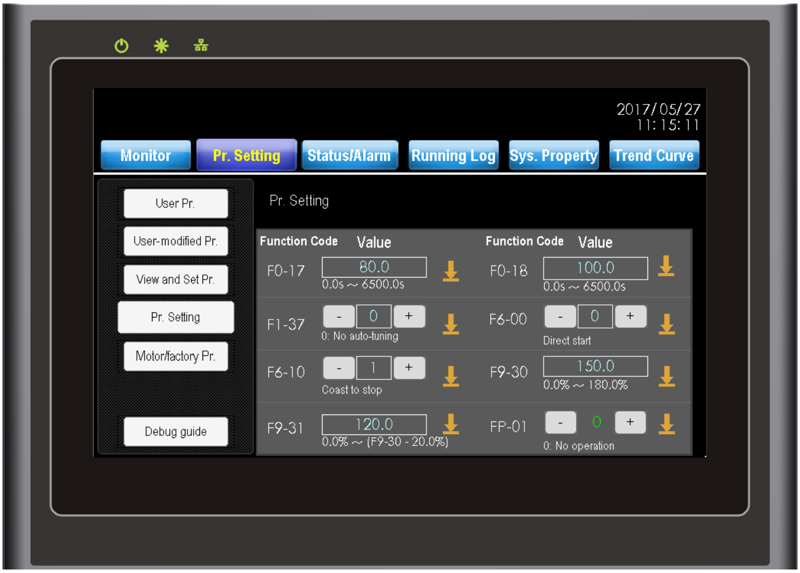


Figure 5-9 Parameter setting interface

5.2.5 Motor/Factory Parameters

You can use an after-sales account to check factory parameters and motor 1 parameters of the AC drive.

5.2.6 Commissioning Guide

Commissioning guide is available only for the after-sales or R&D account. It provides guidance for setting general parameters, motor parameters, optional functions, and model parameters.

■ Setting general parameters

1) To switch between pages, touch   in the upper right corner.

2) Set general parameters. Then, touch "OK" to download the parameters.

3) After the parameters are downloaded, a message indicating successful download is displayed. Touch "OK" to return to the "Debug guide" page.

Figure 5-10 Setting general parameters

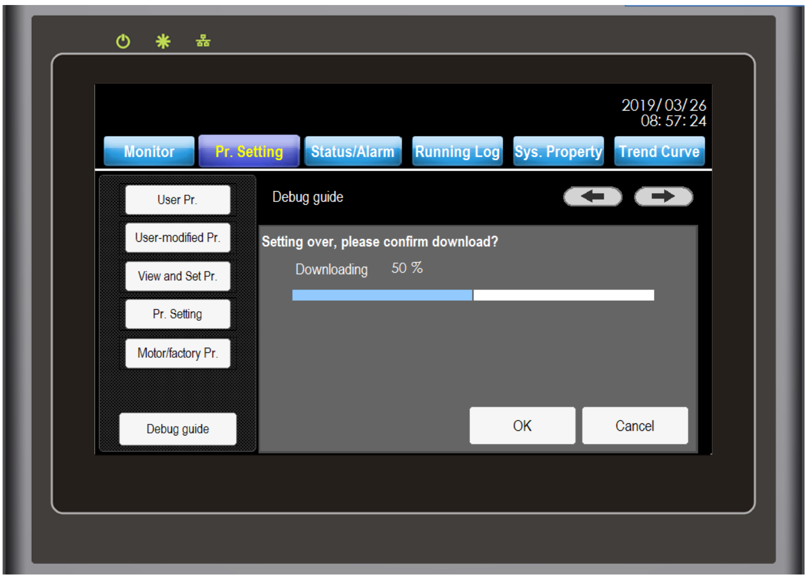


Figure 5-11 Downloading parameters

■ Setting motor parameters

1) To switch between pages, touch in the upper right corner.

2) Set motor parameters. Then, touch "OK" to download the parameters.

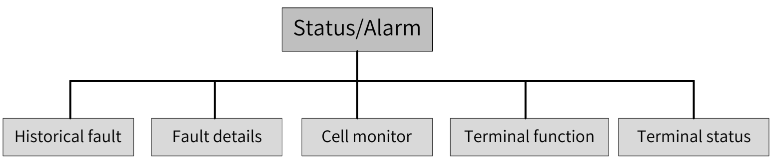
3) After the parameters are downloaded, select a motor auto-tuning mode according to the field conditions.

4) After motor parameters are set, the page indicating successful motor parameter auto-tuning is displayed. Touch "Back" to return to the "Debug guide" page.

Figure 5-12 Setting motor parameters

5.3 Status/Alarm

The status/alarm interface has the following five functions:



These functions help you to locate system fault, monitor power cells and view status of the I/O interfaces.

5.3.1 Fault List and Historical Fault

After you touch "Status/Alarm" on the main menu, the HMI displays the fault list by default. The list displays all faults and fault occurring/resuming time since the recent power-on. It supports the display of recent 100 faults. The fault list will be emptied after you re-power on the control cabinet. But you can view historical fault information by touching "Historical fault".

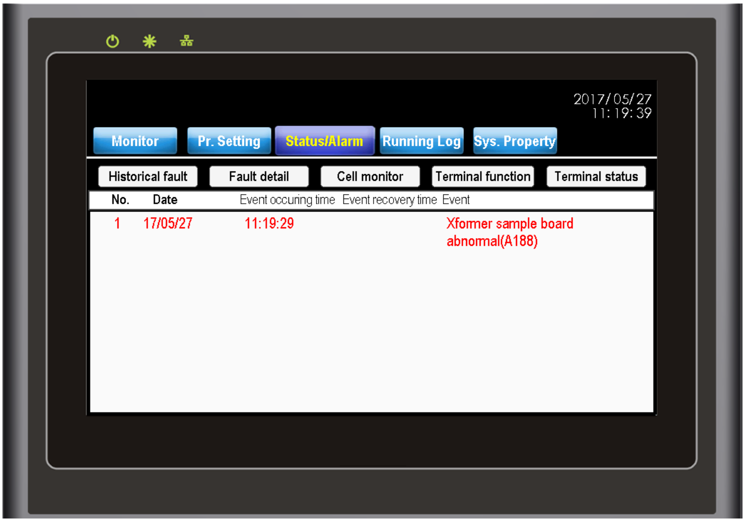


Figure 5-13 List of real-time faults

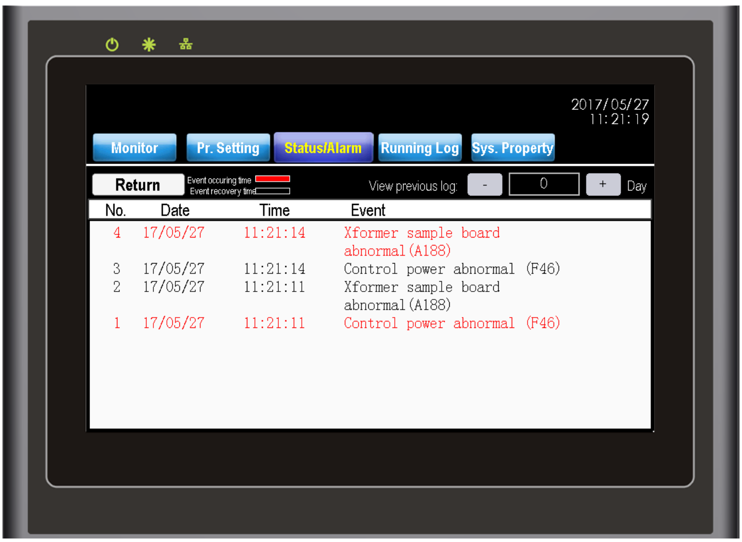


Figure 5-14 List of historical faults

Touch "Historical fault" to view the historical faults in recent consecutive 255 days after delivery. The faults are displayed on a daily basis. Switch over fault records for two adjacent days by touching "+" and "-" on the right of "View previous log". The red line in the list indicates the fault occurring time, and the black line indicates the fault resuming time.

5.3.2 Fault Details

The details of faults occurred in the recent 255 days recorded in the SD card are displayed here, including fault occurring time, fault No. and fault subcode, facilitating the maintenance person to analyze the fault and perform troubleshooting.

Figure 5-15 Fault details

5.3.3 Cell Monitor

It is used to display the system topology and the real-time status of all cells. You can see the status (normal or faulty) of all cells in the system topology. The detailed status information of a cell such as bus voltage, cell temperature and version can be viewed after you touch the cell.

As shown in Figure 5-15, the AC drive is configured with five power cells per phase, and the detailed status of A1 is shown in Figure 5-16.

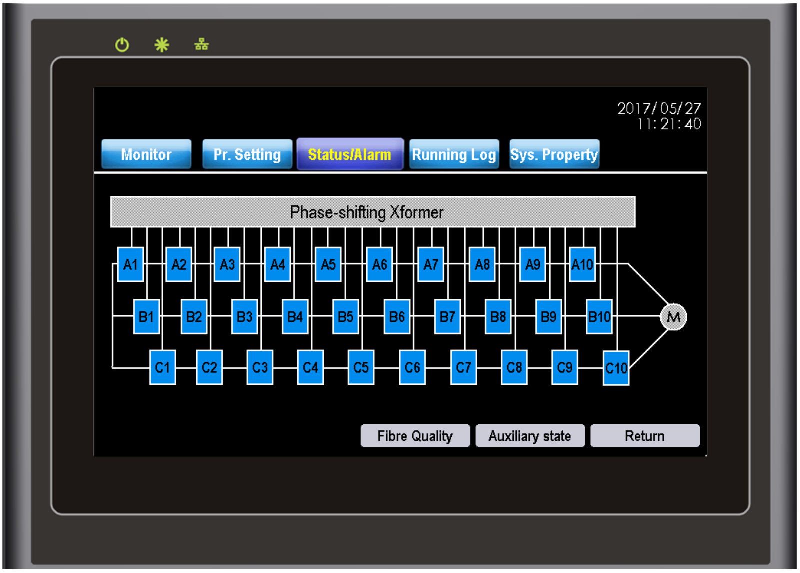


Figure 5-16 System topology

Figure 5-17 Detailed status information of cell A1

Touch "Auxiliary state". You can view the bypass contactor self-check state, temperature and bus voltage value of all power cells.

Figure 5-18 Viewing the auxiliary state of power cells

5.3.4 Terminal Function

The MV AC drive provides the DI/DO terminals with functions. The "Terminal function" is used to display the functions of all DI/DO terminals and whether the current functions are valid.

When the function of a DI/DO terminal is valid, the corresponding function name is green. When it is invalid, the corresponding function name is gray.

If a function is allocated to a DI/DO terminal, the DI/DO terminal is displayed after the function name. If a function is unallocated, no DI/DO terminal is displayed.

As shown in the following figure, DI9 is allocated with "Forward RUN (FWD)" and the function is invalid currently. DI10 is allocated with "Three-wire control mode" and the function is valid currently.

Figure 5-19 State of DI functions

Figure 5-20 State of DO functions

Multiple DO terminals can be set for the same DO function simultaneously. When a DO function is repeatedly allocated, will be displayed ahead of the function No., and the related function parameters will be displayed in scroll.

5.3.5 Terminal Status

The MV AC drive provides a number of DI, DO, AI and AO terminals. The "Terminal status" function is used to refresh terminal status, analog sampling/output, temperature, and communication interface status in real time, facilitating commissioning engineers to monitor the current signal of terminals. A blue indicator indicates that the DI/DO is valid, and a grey indicator indicates that the DO/DI is invalid.

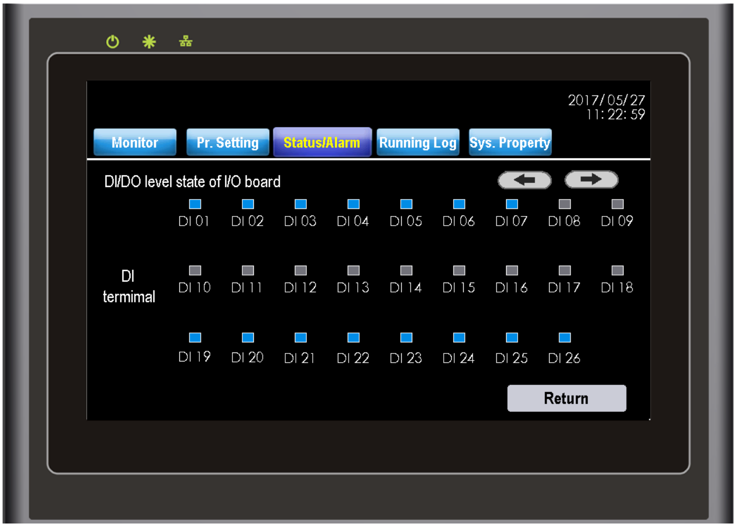


Figure 5-21 Display of DI level state

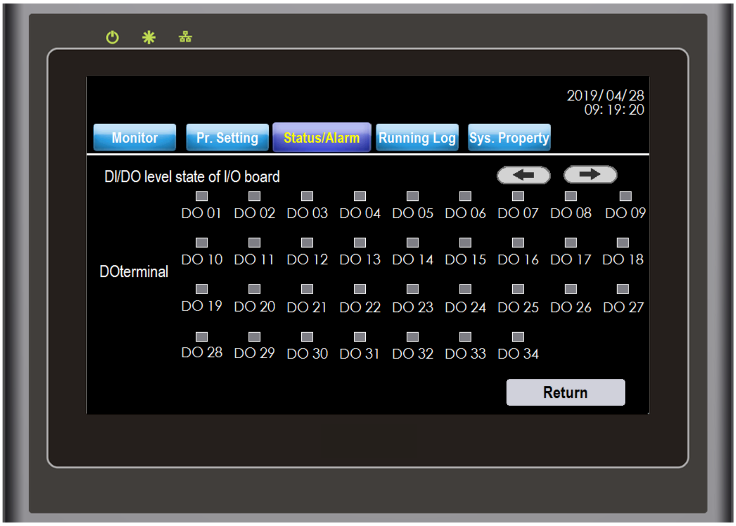


Figure 5-22 Display of DO level state

Figure 5-23 Display of AI/AO, temperature, and communication status

5.4 Running Log

The "Running log" function is used to record the commands, faults/alarms, system status changes and occurring/resuming time of these events in the process of system power-on. Similar to the fault list, "Real-time log" records all running log information from the first time power-on of the control cabinet until now. "Historical log" is used to display the running log information of a day of all historical records. All log information is saved in the SD card in special file format for 255 days. You can export the data from the SD card to the PC after logging in using an after-sales account or an account with a higher level.

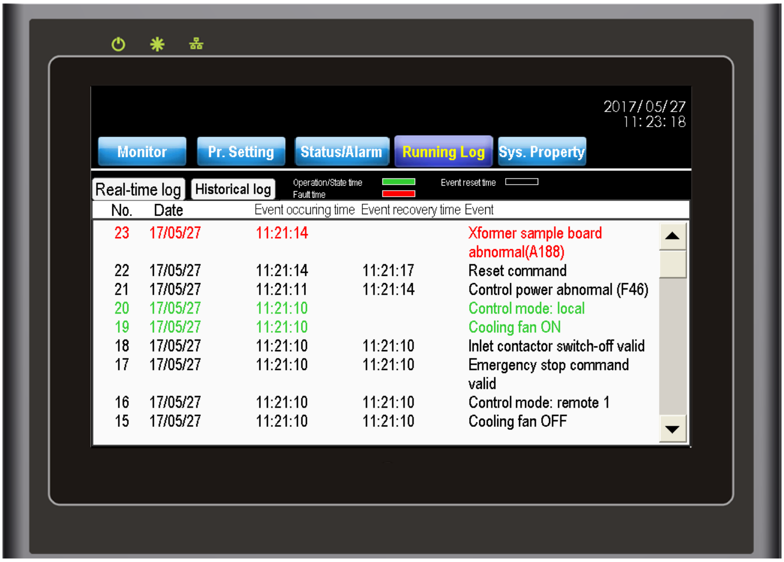


Figure 5-24 Viewing real-time log information

Figure 5-25 Viewing historical log information

Touch "Real-time log" and "Historical log" to switch over the two viewing modes. After you touch "Running log", the HMI displays the real-time log by default. Switch over of records for two adjacent days by touching "+" and "-" on the right of "View previous log". The green line in the list indicates the event occurring time, the black line indicates the event resuming time, and the red line indicates the system fault occurring time.

5.5 Sys. Property

The "Sys. Property" interface is used to set operation authority and comfort and view the operation guidance. It consists of the following six functions:

■ User account

You can log in to and manage accounts of different levels here.

■ Language

It supports simplified Chinese and English。

■ Backlight brightness

You can adjust the backlight of the HMI. There are a total of 15 levels for option.

■ Buzzer switch

It switches on/off the button buzzer.

■ User help

It includes the operation guidance, online troubleshooting of common problems and system version list.

Figure 5-26 System property

Figure 5-27 User help

5.5.1 User Account

The system accounts are categorized into four levels: user, agent, after-sales and R&D. After the control cabinet is powered on, the HMI sets no account level by default. This moment, you are authorized only to view information, start/stop the system and set frequency reference.

You can modify "User Pr." in "Pr. Setting" after login with the user account, modify most parameters after login with the after-sales account, and modify all parameters after login with the R&D account.

Touch "Login" to switch to the account login and management interface. Select the correct account level, input the correct password, and then touch "Login". The system will display a message indicating login success. The following figure shows the login interface.

Figure 5-28 Login with the user account

Touch "Safe Exit" and "ok". The HMI will log out the current account and prompts "Exiting succeeds". The prompt closes automatically 1.5s later.

Figure 5-29 Logout success

NOTE

- The initial password of the user account is 1. The password can be changed by the user.
- If the password of the user account is forgotten, the user needs to be authorized after login with the after-sales account and then reset the password.

5.5.2 Modifying System Time

The HMI displays the system date and time on the top right corner. To modify the system time on the HMI, log in to the system with the account of after-sales or a higher level. Touch the system time area. The system time modification window pops out. Modify the system time and touch "OK", and then the modification becomes effective. If you touch "Cancel", the system time remains unchanged.

Figure 5-30 Modifying system time

5.5.3 System Software Version

In "Sys. Property", you can view information including user help, common problems, and software versions. You can quickly check the main control and cell software versions in "Version."

Figure 5-31 Main control system software versions

5.6 Trend Curve

The "Trend Curve" window facilitates you to keep observing system running parameters visually after login with the after-sales account. It supports the display in the format of either curve or table. The function helps to observe whether the system runs stably.

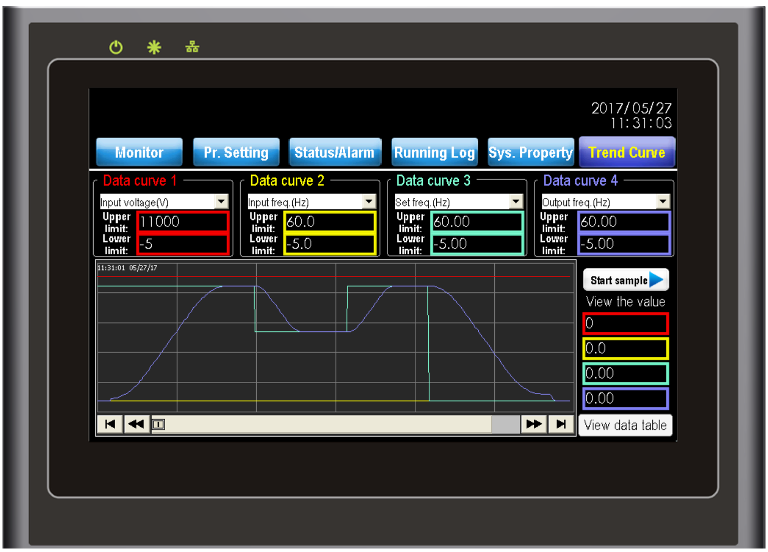


Figure 5-32 Trend Curve window displayed in the curve format

The "Trend Curve" function has a total of four synchronous signal channels and can save the valid sampling records for the recent 90 days. Each channel supports 32 different observation signals. The real-time signal curves are made in different colors. For example, the signal curve of channel 1 is displayed in red and the corresponding "Upper limit", "Lower limit", "View value" and information in the data table are also displayed in red.

The HMI performs sampling once every 200 ms. The four channels have different data precisions. You can select the proper channel according to actual data precision. The time base is 20s/cell in the "Trend Curve" window. A total of 120s signal waveform can be displayed on a screen.

To view the data in the curve format, do as follows:

1) Select at least one valid signal channel and set its upper limit and lower limit.

If there is no valid signal channel or the upper limit and lower limit are set incorrectly, "Sampling start" will not be started.

2) Touch "Sampling start".

The HMI immediately samples the corresponding signals and displays the signals in the curve format. All sampling data will be synchronized to the SD card that is delivered together with the AC drive, facilitating you to view the historical data in the table format.

3) Touch any time point of the trend curve to view the data at that moment under "View the value".

4) Touch "Sampling stop".

The HMI immediately stops sampling signals of all channels.

Figure 5-33 Trend Curve window displayed in the table format

To view the data in the table format, do as follows:

1) Touch "View data table" and "View previous".

■ "0" indicates the recent day. "1" indicates the day before the recent day, and so on.

■ "View previous" in historical fault and "View previous log" in historical log are defined the same.

■ "Days" in the table indicate consecutive N days from the "View previous" day.

2) The table displays the data in time sequence. View all the data by dragging the scrollbar on the right of the table.

NOTE

The trend curve function takes effect only after you select a signal channel and touch "Sampling start". Otherwise, the HMI does not perform sampling.

5.7 HMI Operation Precautions

1) The MV AC drive is a medium voltage device. Any operator must strictly observe the operating instructions.

2) Apply control power first and then apply MV power after MV switch-on is allowed.

3) When using the HMI, touch it slightly with fingers. Never knock it or press it with a hard object.

4) Never allow irrelevant personnel to use the HMI to avoid malfunction.

5) The SD card records important system parameters. Only the user of after-sales or a higher level is allowed to insert and plug the SD card.

6) Never open cabinet doors when the MV AC drive is running. Failure to comply will result in a danger or system stop due to a fault.

5.8 AC Drive Start/Stop

5.8.1 Selecting the Start/Stop Command Source

There are three start/stop command sources, namely, local, remote 1 and remote 2. The command source is selected through the Local/Remote switch on the control cabinet and the user's remote 1/remote 2 switch.

1) Local command source: HMI

The HMI exchanges data with the control system of the AC drive through communication. Turn the Local/Remote switch to "Local". Then you can start/stop the AC drive using the HMI.

2) Remote 1/Remote 2 command source: terminal control

This control mode is applicable to scenarios where the DIP switch or electromagnetic button is used to start or stop the application system or scenarios where the dry contact signal is used to start or stop the AC drive.

The MV AC drive provides multiple terminal control modes. The switch signal mode is set in F4-73. The input terminal of the start/stop signal is set in F4-08 to F4-17. For details, see the description of F4-73 and F4-08 to F4-17.

Example 1:

To use the DIP switch as the start/stop source, and allocate the forward rotation switch signal to DI9 and the reverse rotation switch signal to DI10, perform the setting as shown in the following figure.

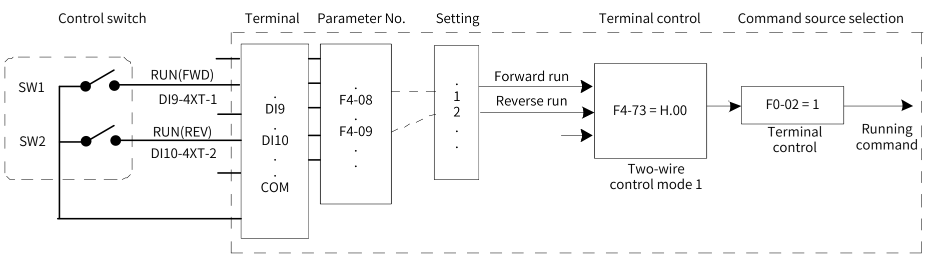


Figure 5-34 Setting of using the DIP switch for start/stop

In Figure 5-33,

- When SW1 is ON, the AC drive instructs a forward run command. When SW1 is OFF, the AC drive stops.
- When SW2 is ON, the AC drive instructs a reverse run command. When SW2 is OFF, the AC drive stops.
- When SW1 and SW2 are ON or OFF simultaneously, the AC drive stops.

NOTE

The system prohibits reverse running by default. If reverse running is required in some applications, set F8-13 to 0.

Example 2:

To use the electromagnetic button as the start/stop source, and allocate the start signal to DI9, the stop signal to DI10 and the reverse direction signal to DI11, perform the following setting.

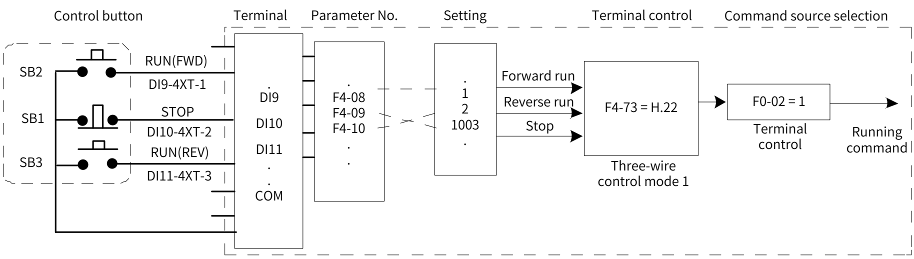


Figure 5-35 Setting of using the electromagnetic button for start/stop

In Figure 5-34,

- Once SB1 becomes OFF during normal running, the AC drive stops immediately.
- When the SB1 is in the OFF state, the signals from SB2 and SB3 become valid once they become ON.

5.8.2 Start Mode

The MV AC drive supports four start modes:

- Direct start
- Catching a spinning motor in forward direction
- Catching a spinning motor in reverse direction
- Catching a spinning motor in both directions

The function is selected in F6-00.

The following figure shows the frequency curve in the direct start mode (F6-00 = 0).

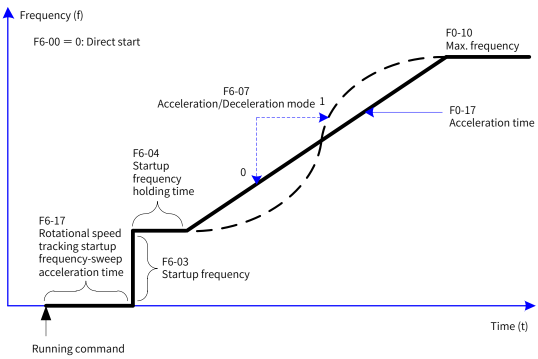


Figure 5-36 Catching a spinning motor startup mode with speedless load

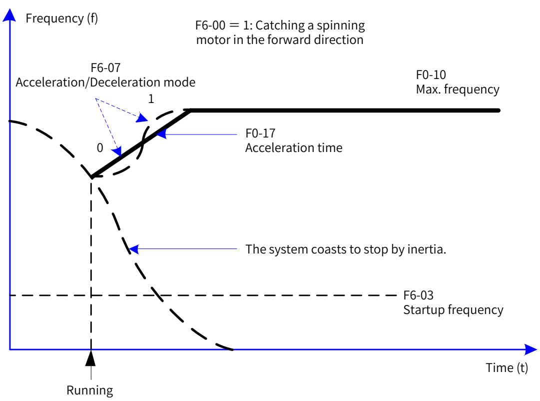


Figure 5-37 Catching a spinning motor startup mode with running load

5.8.3 Stop Mode

The AC drive supports two stop modes, decelerate to stop and coast to stop, set in F6-10.

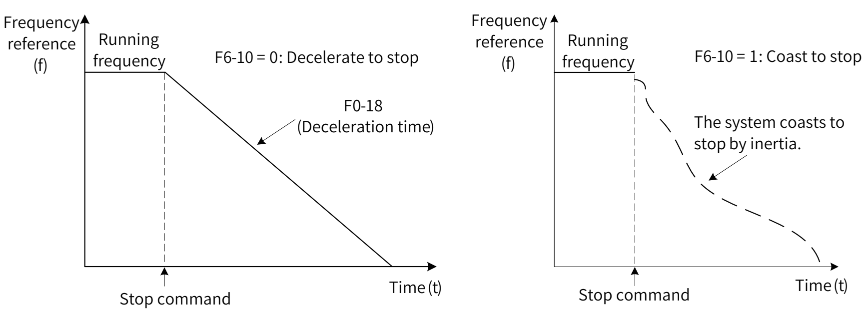


Figure 5-38 Stop modes

5.9 Control of Frequency Reference of the AC Drive

The MV AC drive provides a total of 15 frequency reference setting channels.

5.9.1 Main Frequency Reference Setting Channel

There are a total of 15 setting channels of main frequency reference, digital setting (UP/DOWN modification, non-retentive at power failure), digital setting (UP/DOWN modification, retentive at power failure), AI1, AI2, AI3, AI4, multi-reference, simple PLC, PID setting, PC, Modbus-RTU, PROFIBUS-DP, HMI and CAN . You can select one in F0-03.

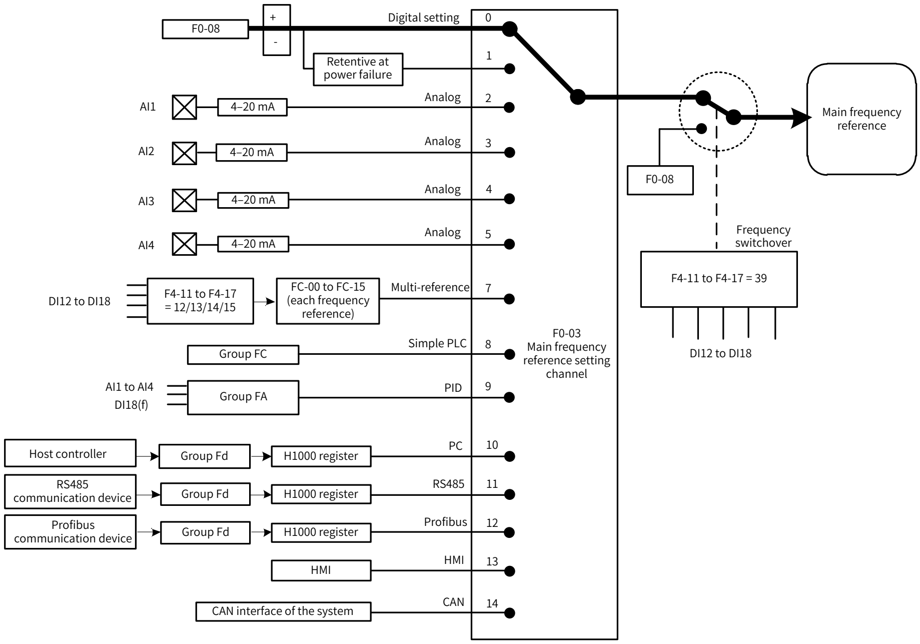


Figure 5-39 Selection of main frequency reference setting channel

According to Figure 5-38, the frequency reference of the AC drive can be set by parameter, manual adjustment, analog input, multi-reference, external feedback signal, PID and several communication codes. For details of the parameters in the figure, see their descriptions in *"Appendix A: Parameter Table"*.

5.9.2 Binding Command Source to Frequency Reference Setting Channel

Command source remote 1 can be bound to its frequency reference setting channel by setting F0-02 and F0-27. For example, if F0-27 is set to H0020 and F0-02 is set to 1, it indicates when the Local/Remote switch is turned to "Remote", the control mode is terminal control 1 and the frequency is determined by AI1. The setting of remote 2 is similar to that of remote 1.

5.9.3 Frequency Reference Controlled by PID

The MV AC drive has a built-in PID regulator. Together with the frequency reference setting channel, the PID regulator can implement automatic adjustment of process control, such as constant temperature, constant pressure, and tension control.

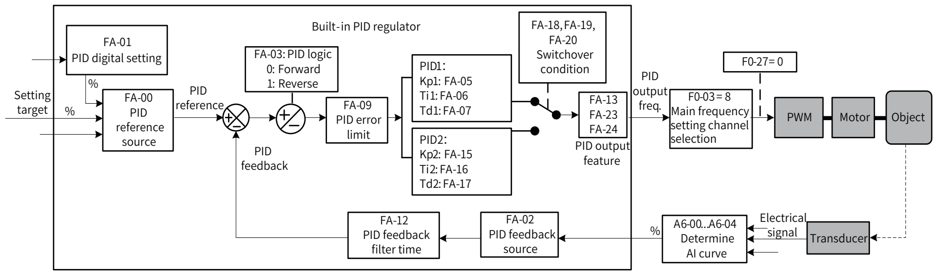
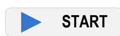


Figure 5-40 Frequency reference controlled by PID

When PID frequency closed-loop control is implemented, F0-03 (Main frequency reference setting channel selection) must be set to 9 (PID). The PID related parameters are set in group FA.

5.9.4 Setting the Motor Rotating Direction

After the AC drive is ready, touch  on the HMI to drive the motor to rotate. In this case, the rotation direction is regarded as the forward direction. If the rotation direction is reverse to the direction required by the equipment, power off the AC drive and exchange any two of the output U, V, W cables (wait for at least 10 minutes until the AC drive discharges completely).

5.10 Use of DI Terminals

The MV AC drive provides a total of 26 DI terminals: DI1 to DI26. Whether it is logic 1 or logic 0 when a DI terminal is active is determined by the setting of the thousand's digit of the parameter. If the thousand's digit of a parameter is set to 1, it is logic 1 when the DI terminal is inactive. If the thousand's digit of a parameter is set to 0, it is logic 0 when the DI terminal is inactive.

For example, the setting 1 of the thousand's digit indicates active when normally-open.

- If the setting value is 1001, the AC drive runs in forward direction when the DI terminal is inactive.
- If the setting value is 1, the AC drive runs in forward direction when the DI terminal is active.

You can set F4-66 (DI filter time) to improve the anti-interference level of the DI signal, but this will reduce the responsiveness of the DI terminal.

The 24 DI terminals can be allocated with functions by setting F4-00 to F4-25. Each DI can be allocated with their respective function according to the electrical diagram. For details, see descriptions of F4-00 to F4-17.

5.11 Use of DO Terminals

The MV AC drive provides a total of 34 DO terminals. DO1 to DO34 are transistor output.

You can define the functions of the DO terminals by setting F5-01 to F5-34. The DO terminals are used to output various working states of the AC drive and related signals of control requirements, implementing specific automatic control.

Terminal	Output Signal Characteristic
DO1 to DO34	Transistor Drive capacity: 24 VDC, 50 mA

5.12 Use of AI Terminals

The AC drive supports a total of four AI terminals. AI1 and AI2 are internally isolated.

Terminal	Output Signal Characteristic
AI1+, AI1-	Receiving the current signal of 4 to 20 mA
AI2+, AI2-	Receiving the current signal of 4 to 20 mA
AI3+, AI3-	Receiving the current signal of 4 to 20 mA
AI4+, AI4-	Receiving the current signal of 4 to 20 mA

As an external voltage/current signal, AI is used for input of frequency reference, torque reference, and PID reference or feedback. The sampling value of AI can be read on the HMI. The AI3 terminal supports voltage input.

5.13 Use of AO Terminals

The MV AC drive provides a total of five AO terminals with output impedance of 0 to 300 Ω. AO1, AO2 and AO3 are internally isolated.

Terminal	Output Signal Characteristic
AO1+, AO1-	Outputting the current signal of 4 to 20 mA
AO2+, AO2-	Outputting the current signal of 4 to 20 mA
AO3+, AO3-	Outputting the current signal of 4 to 20 mA
AO4+, AO4-	Outputting the current signal of 4 to 20 mA
AO5+, AO5-	Outputting the current signal of 4 to 20 mA

AO1 to AO5 can be used to indicate the internal running parameters in the analog mode. The property of indicated parameters can be defined by A6-52 to A6-56. The AO4 and AO5 terminals support voltage output.

The designated running parameters can be rectified before output. The rectification feature is Y = kX + b, among which:

- "X" indicates the running parameters to be output.
- "k" and "b" of AO1 can be set by A6-62 and A6-61.

- "k" and "b" of AO2 can be set by A6-64 and A6-63.
- "k" and "b" of AO3 can be set by A6-66 and A6-65.
- "k" and "b" of AO4 can be set by A6-68 and A6-67.
- "k" and "b" of AO5 can be set by A6-70 and A6-69.

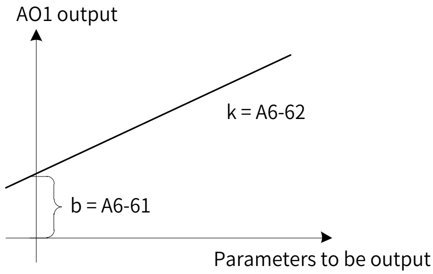


Figure 5-41 Correction feature curve of AO terminal

6 Description of Parameters

Group F0: Standard Parameters

F0-01	Motor 1 control mode		Default	2
	Setting Range	0	Sensorless vector control (SVC1)	
		1	Feedback vector control (FVC)	
		2	Voltage-type sensorless vector control (SVC2)	

■ 0: Sensorless vector control (SVC1)

It indicates the open-loop vector control, and is applicable to high-performance control applications. One AC drive can operate only one motor.

■ 1: Feedback vector control (FVC)

It indicates the closed-loop vector control. The motor must be configured with an encoder and the AC drive provides the PG card matching the encoder type. This control mode is applicable to high-accuracy speed control or torque control applications. One AC drive can operate only one motor.

■ 2: Voltage-type sensorless vector control (SVC2)

It also indicates the open-loop vector control, and is applicable to applications without strict load requirements. Compared with SVC1, this control mode has less control accuracy, and is less dependent on motor parameters. One AC drive can operate multiple motors.

The three control modes supported by the MV AC drive are all vector control, and motor auto-tuning is required for the three control modes. Only accurate motor parameters can achieve good performance of vector control. Better performance can be achieved by adjusting speed regulator parameters in group F2.

F0-02	Remote 1 command source selection		Default	1
	Setting Range	0	Operation panel control	
		1	Terminal control 1	
		2	Modbus	
		3	PROFIBUS-DP	
		5	PC	
		6	CAN	

It selects the input channel of the AC drive remote 1 control command, such as start, stop, forward run, reverse run, and jog.

■ 0: Operation panel control

Commands are given by the RUN and Stop/RES keys on the operation panel.

■ 1: Terminal control 1

Commands are given using multi-functional input terminals with functions such as FWD, REV, FJOG, and RJOG.

■ 2: Modbus

Commands are given by means of the Modbus communication.

■ 3: PROFIBUS-DP

Commands are given by means of the PROFIBUS-DP communication. When this command source is used, use the communication device that supports the PROFIBUS-DP communication card. For details, see *"Appendix B Modbus Communication Protocol"*.

■ 5: PC

Commands are given by clicking the start and stop icons of the PC background software.

■ 6: CAN

Commands are given by means of the CAN communication. For details on the communication parameters, see the description of *"Group Fd: Communication"*.

F0-03	Main frequency setting channel selection		Default	0
	Setting Range	0	Digital setting (initial value F0-08 can be modified by keypad or terminal UP/DOWN, non-retentive at power failure)	
		1	Digital setting (initial value F0-08 can be modified by keypad or terminal UP/DOWN, retentive at power failure)	
		2	AI1	
		3	AI2	
		4	AI3	
		5	AI4	
		7	Multi-reference	
		8	Simple PLC	
		9	PID	
		10	PC	
		11	Modbus	
		12	PROFIBUS-DP	
		13	HMI	
		14	CAN	

This parameter selects the channel to set the main frequency reference. There are a total of 15 channels to set the main frequency reference.

■ 0: Digital setting (non-retentive at power down)

The initial value of the frequency reference is F0-08 (Preset frequency). You can change the frequency reference by pressing ▲ and ▼ on the operation panel (or using the UP/DOWN function of the input terminals).

When the MV AC drive is powered on again after power down, the frequency reference continues from the value of F0-08 (Preset frequency).

■ 1: Digital setting (retentive at power down)

The initial value of the frequency reference is F0-08 (Preset frequency). You can change the frequency reference by pressing ▲ and ▼ on the operation panel (or using the UP/DOWN function of the input terminals).

When the MV AC drive is powered on again after power down, the frequency reference continues from where it last reached.

NOTE

F0-23 (Retentive of digital setting frequency upon stop) decides whether the frequency modification is retained at stop rather than at power down.

■ 2: AI1

■ 3: AI2

■ 4: AI3

■ 5: AI4

The frequency reference is set by an AI terminal that is 4 to 20 mA current input. AI1 and AI2 are internally isolated.

The MV AC drive provides five curves indicating the mapping relationship between the input current of AI1, AI2, AI3 and AI4 and the frequency reference. You can set the curves in group A6.

■ 7: Multi-reference

In multi-reference mode, combinations of different DI terminal states correspond to different frequency references. The MV AC drive supports a maximum of 16 references implemented by 16 state combinations of four DI terminals in Group FC. The multiple references indicate percentages of the value of F0-10 (Max. frequency).

If a DI terminal is used for the multi-reference function, you need to set related parameters in group F4. For details, refer to the descriptions of parameters in *"Group F4: Input Terminals"*.

■ 8: Simple PLC

When using the simple PLC mode as the frequency reference setting channel, the AC drive running frequency can be switched over among the 16 frequency references. You can set the holding time and acceleration/deceleration time of the 16 frequency references. For details, refer to the descriptions of Group FC.

■ 9: PID

PID control is generally used in on-site process closed-loop control, such as constant pressure closed-loop control and constant tension closed-loop control.

When applying PID as the frequency reference setting channel, you need to set parameters of PID function in group FA.

■ 10: PC

The frequency reference is set by means of communication in the background software of the host computer.

■ 11: Modbus

The frequency reference is set by means of the Modbus-RTU communication.

■ 12: PROFIBUS-DP

The frequency reference is set by means of the PROFIBUS-DP communication.

■ 13: HMI

The frequency reference is set on the HMI.

■ 14: CAN

The frequency reference is set by means of the CAN communication.

F0-08	Preset frequency	Default	50.00 Hz
	Setting Range	0.00 to F0-10 (Max. frequency)	

This parameter is the initial value of frequency reference if the frequency reference setting channel is digital setting.

F0-09	Running direction		Default	0
	Setting Range	0	Run in the same direction	
		1	Run in the reverse direction	

By changing this parameter, you can change the motor rotation direction without changing motor wiring. Its function is equivalent to adjusting any two wires of the motor (U, V, W) to switch the motor rotation direction.

NOTE

◆ The running direction of the motor will return to its original state after the parameter is initialized. Therefore, use it with caution for applications where changing the motor rotation direction is strictly prohibited after the system is commissioned.

◆ For scenarios where synchronous switchover is required, do not change the motor rotation direction by modifying F0-09.

F0-10	Max. frequency	Default	50.00 Hz
	Setting Range	50.00 to 600.00 Hz	

100% of the analog input and multi-reference corresponds to F0-10 when they are used as the frequency reference setting channel.

F0-11	Setting channel of frequency reference upper limit		Default	0
	Setting Range	0	Set by F0-12 (Frequency upper limit)	
		1	AI1	
		2	AI2	
		3	AI3	
		5	Communication setting	
		6	AI4	

This parameter defines the source of the frequency upper limit. The frequency upper limit can be set by F0-12 (Frequency upper limit), analog input or communication setting.

When analog (AI1, AI2, AI3, AI4) setting or communication setting is used, the setting is similar to F0-03 (Main frequency setting channel selection). For details, refer to instructions in F0-03.

For example, when the torque control mode is used in the winding control field, to avoid the runaway fault due to broken materials, you can use set the frequency upper limit using analog input. When running up to the frequency upper limit, the AC drive keeps running under this condition.

F0-12	Frequency upper limit	Default	50.00 Hz
	Setting Range	F0-14 (Frequency lower limit) to F0-10 (Max. frequency)	

This parameter sets the frequency upper limit in the range of F0-14 (Frequency lower limit) to F0-10 (Max. frequency).

F0-13	Frequency reference upper limit offset	Default	0.00 Hz
	Setting Range	0.00 Hz to F0-10 (Max. frequency)	

When the source of the frequency upper limit is analog input, the final frequency upper limit is obtained by adding the offset in F0-13 to the frequency upper limit set in F0-11 (Setting channel of frequency reference upper limit).

F0-14	Frequency lower limit	Default	3.00 Hz
	Setting Range	0.00 Hz to F0-12 (Frequency upper limit)	

When the frequency reference is lower than the value of this parameter, the AC drive runs at the frequency lower limit by default.

F0-17	Acceleration time 1	Default	80.0s
	Setting Range	0.0s to 6500.0s	
F0-18	Deceleration time 1	Default	100.0s
	Setting Range	0.0s to 6500.0s	

Acceleration time refers to the time required for the AC drive accelerating from zero to the maximum frequency (set by F0-10). See t1 in Figure 6-1.

Deceleration time refers to the time required for the AC drive decelerating from the maximum frequency (set by F0-10) to zero. See t2 in Figure 6-1.

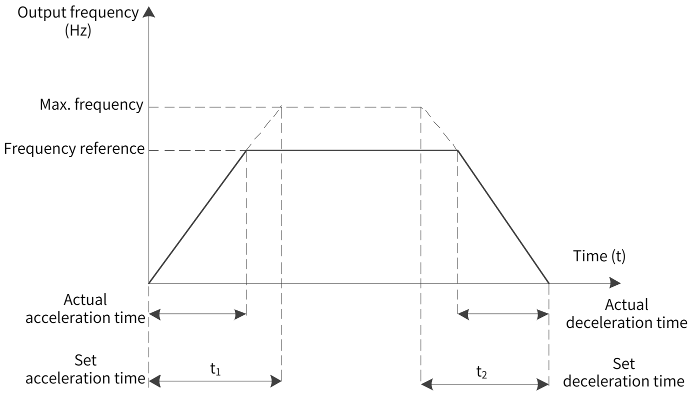


Figure 6-1 Acceleration and deceleration time

F0-21	Frequency offset of auxiliary frequency setting channel for main and auxiliary calculation	Default	0.00 Hz
	Setting Range	0.00 Hz to F0-10 (Max. frequency)	

This parameter is valid only when main and auxiliary calculation is selected for the frequency source.

When the main and auxiliary calculation is selected for the frequency source, the final frequency set value is obtained by adding the offset in F0-21 to the main and auxiliary calculation result, thereby providing more flexible frequency setting.

F0-22	Frequency reference resolution		Default	2
	Setting Range	2	0.01 Hz	

This parameter defines the resolutions of all frequency-specific parameters.

F0-23	Retentive of digital setting frequency upon stop		Default	0
	Setting Range	0	Disabled	
		1	Enabled	

This parameter is valid only when the digital setting is selected for the frequency source.

If it is set to 0, after the AC drive is shut down, the digital setting frequency value is restored to the value set by F0-08 (Preset frequency) and frequency corrections completed by using key ▲ / ▼ on the keypad or terminal UP/DOWN are reset.

If it is set to 1, after the AC drive is shut down, the digital setting frequency value is retained as the frequency set at the moment of the last shutdown and frequency corrections completed by using key ▲ / ▼ on the keypad or terminal UP/DOWN are kept effective.

F0-24	Motor selection		Default	0
	Setting Range	0	Motor 1	
		1	Motor 2	
		2	Motor 3	
		3	Motor 4	

HD90S can drive 4 motors at different time. These 4 motors can be configured with different nameplate parameters, independent parameter tuning, different control modes, and independent performance-specific parameters.

The motor parameter groups and function parameter groups have the following correspondences: 1 to F1 and F2, 2 to A2, 3 to A3, and 4 to A4.

A user can use F0-24 to select the current motor parameter group, or use the digital input terminal (DI) to switch motor parameters. When selection by a parameter is conflicted with that by a terminal, the selection by the terminal prevails.

F0-25	Acceleration/Deceleration time base frequency		Default	0
	Setting Range	0	F0-10 (Max. frequency)	
		1	Frequency reference	
		2	100 Hz	

Acceleration/deceleration time refers to the acceleration/deceleration time from zero frequency to the frequency set by F0-25, as shown in Figure 6-1.

When 1 is selected for F0-25, the acceleration/deceleration time is related to the set frequency. If the set frequency changes frequently, use it with caution that the acceleration of the motor is changing.

F0-26	Base frequency for UP/DOWN modification during running		Default	0
	Setting Range	0	Running frequency	
		1	Frequency reference	

This parameter is valid only when the digital setting is selected for the frequency source.

It is used to determine which method will be used to correct the set frequency, i.e. increasing and decreasing the target frequency based on the running frequency or the set frequency, when key ▲ / ▼ on the keypad or terminal UP/DOWN is used.

The difference between these two setting methods is significant when the AC drive is accelerating or decelerating if the running frequency of the AC drive is different from the set frequency.

F0-27	Binding remote 1 command source to frequency reference setting channel		Default	H.0020
	Setting Range	Ones	Binding PC control to the frequency reference setting channel	
		0	No binding	
		1	Digital setting frequency reference	
		2	AI1	
		3	AI2	
		4	AI3	
		5	AI4	
		6	Pulse reference (DI18)	
		8	Simple PLC	
		9	PID	
		A	PC	
		b	Modbus	
		C	PROFIBUS-DP	
		d	HMI	
		E	CAN	
		Tens	Binding terminal control to frequency reference setting channel (0 to E, same as the ones position)	
		Hundreds	Binding Modbus control to frequency reference setting channel (0 to E, same as the ones position)	
		Thousands	Binding PROFIBUS-DP control to frequency reference setting channel (0 to E, same as the ones position)	

This parameter binds the four command sources with the 14 frequency reference setting channels, facilitating to implement synchronous switchover.

For details on the frequency sources, see the description of F0-03 (Main frequency reference setting channel selection).

Different running command sources can be bound to the same frequency reference setting channels. If a command source has a bound frequency reference setting channel, only the corresponding bound frequency reference setting channel takes effect when the command source is effective.

F0-29	Remote 2 command source selection		Default	1
	Setting Range	1	Terminal control 2	
		0, 2 to 6	same as F0-02 (Remote 1 command source selection)	

This parameter selects the input channel of the AC drive remote 2 control commands. For details, see the description of F0-02 (Remote 1 command source selection). You can select one communication protocol each time.

If remote 2 command source is selected, you must set this parameter properly.

F0-30	Binding remote 2 command source to frequency reference setting channel		Default	H.0030
	Setting Range	0 to H.EEEE		

This parameter is set in the same way as F0-27 (Binding remote 1 command source to frequency reference setting channel).

Group F1: Motor 1 Parameters

F1-00	Motor type selection	Default	0
	Setting Range	0	General asynchronous motor
		1	Variable frequency asynchronous motor
		2	Electrically excited synchronous motor
F1-01	Rated motor power	Default	Model dependent
	Setting Range	1 to 65535 kW	
F1-02	Rated motor voltage	Default	Model dependent
	Setting Range	1 to 65535 V	
F1-03	Rated motor current	Default	Model dependent
	Setting Range	0.1 to 6553.5 A	
F1-04	Rated motor frequency	Default	Model dependent
	Setting Range	0.01 Hz to maximum frequency	
F1-05	Rated motor speed	Default	Model dependent
	Setting Range	1 to 65535 rpm	

Set these parameters according to the motor nameplate no matter whether open-loop or closed-loop vector control is used.

To achieve better open-loop or closed-loop vector control performance, you need to perform motor auto-tuning. The motor auto-tuning accuracy depends on the correct setting of motor nameplate parameters.

F1-06	Asynchronous motor stator resistance	Default	Auto-tuning parameter
	Setting Range	0.01% to 30.00%	
F1-08	Asynchronous motor leakage inductive reactance	Default	Auto-tuning parameter
	Setting Range	0.01% to 50.00%	
F1-10	Asynchronous motor no-load current	Default	Auto-tuning parameter
	Setting Range	0.01% to 100.00%	

These parameters are obtained through motor auto-tuning. Only F1-06 to F1-08 can be obtained through static motor auto-tuning. Through complete motor auto-tuning, F1-10, the encoder phase sequence and current loop PI parameters can be obtained besides F1-06 to F1-08.

If motor auto-tuning cannot be performed on site, manually input the values of these parameters according to data provided by the motor manufacturer. It is recommended that static motor auto-tuning is performed.

F1-27	Encoder pulses per revolution	Default	1024
	Setting Range	1 to 65535	

This parameter is used to set the pulses per revolution (PPR) of the ABZ or UVW incremental encoder. In FVC mode, the motor cannot run properly if this parameter is set incorrectly.

F1-30	A/B phase sequence of ABZ incremental encoder		Default	0
	Setting Range	0	Forward	
		1	Reverse	

This parameter is valid only for the ABZ incremental encoder and is used to set the A/B phase sequence of the ABZ incremental encoder.

It is valid for both the asynchronous motor and synchronous motor. The A/B phase sequence can be obtained through complete auto-tuning.

F1-36	Detection threshold of encoder signal loss	Default	5.0%
	Setting Range	0.0%: No detection 0.0% to 70.0%	

It is used to set the threshold of detecting the encoder signal lost fault. When it is set to 0.0%, the AC drive does not detect the encoder signal lost fault.

When the deviation between the encoder feedback speed and the internal evaluation speed is larger than the value of this parameter, the AC drive reports fault F20.

F1-37	Auto-tuning selection		Default	0
	Setting Range	0	No auto-tuning	
		1	Static auto-tuning	
		2	Complete auto-tuning	

■ 0: No auto-tuning

Auto-tuning is prohibited.

■ 1: Asynchronous motor static auto-tuning

It is applicable to scenarios where complete auto-tuning cannot be performed because the asynchronous motor cannot be disconnected from the load.

Before performing static auto-tuning, properly set the motor nameplate parameters F1-01 (Rated motor power) to F1-05 (Rated motor speed) first. If the AC drive is in the FVC mode, you also need to set the encoder PPR in F1-27 (Encoder pulses per revolution).

Set this parameter to 1, and touch "Start". Then, the AC drive starts static auto-tuning. During static motor auto-tuning, there is current in the motor, but the motor will not rotate or only rotate slightly.

■ 2: Asynchronous motor complete auto-tuning

You must select the complete auto-turning to ensure the dynamic control performance of the AC drive. In this case, disconnect the load from the motor.

During the process of complete auto-tuning, the AC drive performs static auto-tuning first and then accelerates to 30% of the rated motor frequency within the acceleration time set in F0-17 (Acceleration time 1). The AC drive keeps running for a certain period and then decelerates to stop within the deceleration time set in F0-18 (Deceleration time 1).

Before performing complete auto-tuning, properly set the motor nameplate parameters of F1-00 (Motor type selection) to F1-05 (Rated motor speed), the encoder type and the encoder PPR in F1-27 (Encoder pulses per revolution) and F1-28.

By complete auto-tuning, the AC drive will obtain motor parameters of F1-06 (Asynchronous motor stator resistance), F1-08 (Asynchronous motor leakage inductive reactance), and F1-10 (Asynchronous motor no-load current), encoder AB phase sequence in F1-30 (A/B phase sequence of ABZ incremental encoder), vector control current loop PI parameters of F2-13 (Current loop proportional gain) to F2-16.

Set this parameter to 2, and touch "Start". Then, the AC drive starts complete auto-tuning.

To perform auto-tuning on the HMI, perform the following steps:

1) Set local control and log in to the HMI with the after-sales password.

2) Switch to the parameter setting interface and touch "Debug guide" and "Motor Pr." in sequence.

3) Set motor parameters and download the parameters (skip this step if the motor parameters are correct).

4) After the parameters are downloaded successfully, perform operations by following the guidance of "Motor tune".

5) When the system is ready, you can choose static auto-tuning or complete auto-tuning as needed. In the displayed Start/Stop dialog box, touch "Start" to start motor auto-tuning.

Group F2: Motor 1 Vector Control Parameters

F2-00	Speed loop proportional gain 1	Default	0.025
	Setting Range	0.000 to 1.000	
F2-01	Speed loop integral gain 1	Default	0.050
	Setting Range	0.000 to 65.535	
F2-02	Switch frequency 1	Default	5.00
	Setting Range	0.00 to F2-05 (Switch frequency 2)	
F2-03	Speed loop proportional gain 2	Default	0.015
	Setting Range	0.000 to 1.000	
F2-04	Speed loop integral gain 2	Default	0.025
	Setting Range	0.000 to 65.535	
F2-05	Switch frequency 2	Default	10.00
	Setting Range	F2-02 (Switch frequency 1) to F0-10 (Max. frequency)	
F2-08	Speed loop kf gain	Default	1.00
	Setting Range	0.01 to 1.00	

The speed dynamic response characteristics in the vector control mode can be adjusted by setting the PI function: proportional gain and integral gain.

When the running frequency is less than F2-02 (Switch frequency 1) the speed loop PI is adjusted to F2-00 (Speed loop proportional gain 1) and F2-01 (Speed loop integral gain 1). The running frequency is greater than the switching frequency 2. The speed loop PI is adjusted to F2-03 (Speed loop proportional gain 2) and F3-04. The speed loop PI parameter switches between frequency 1 and frequency 2. The two PI parameter groups switch as shown in the following figure:

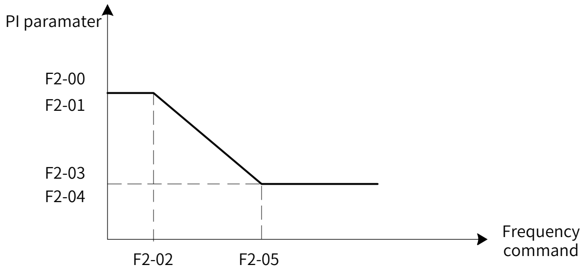


Figure 6-2 PI parameters

To achieve a faster system response, increase the proportional gain and reduce the integral gain. Be aware that this may lead to system oscillation.

The recommended adjustment method is as follows:

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 gain to ensure that the system has quick response and small overshoot.

NOTE

Improper PI parameter setting may cause too large speed overshoot, and overvoltage fault may even occur when the overshoot drops.

F2-09	Drive torque upper limit source in speed control mode	Default	0
	Setting Range	0	F2-10 (Digital setting of drive torque upper limit in speed control mode)
		1	AI1
		2	AI2
		3	AI3
		5	Communication
		6	Minimum (AI1, AI2)
		7	Maximum (AI1, AI2)
		8	AI4
F2-10	Digital setting of drive torque upper limit in speed control mode	Default	120.0%
	Setting Range	0.0% to 300.0%	
F2-12	Digital setting of braking torque upper limit in speed control mode	Default	1.0%
	Setting Range	0.0% to 150.0%	

In the speed control mode, the maximum output torque of the AC drive is restricted by F2-09. F2-09 and F2-10 specify the torque upper limit in the motoring state. F2-12 specify the torque upper limit in the generative state. Too high setting can lead to fault due to overvoltage of the AC drive power unit.

When the torque upper limit source is analog or communication reference, 100% of the setting corresponds to F2-10, and 100% of F2-10 corresponds to the rated motor torque.

F2-13	Current loop proportional gain	Default	0.50
	Setting Range	0.00 to 5.00	
F2-14	Current loop integral gain	Default	25.0
	Setting Range	0.0 to 6000.0	

These parameters are current loop PI tuning parameters for vector control that generally require no editing by default.

Note that the integral regulator of the current loop directly sets an integral gain rather than using an integral time as a dimension.

Too high setting of the current loop PI gain can lead to oscillation of the whole control loop. Therefore, when current oscillation or torque fluctuation is high, you can manually reduce the PI proportional gain or integral gain here.

F2-23	Flux loop proportional gain	Default	1.72
	Setting Range	0.00 to 10.00	
F2-24	Flux loop integral gain	Default	2.0
	Setting Range	0.0 to 1200.0	
F2-25	Flux filter time	Default	0.0300
	Setting Range	0.0000 to 6.5535	
F2-26	Flux set value	Default	1.000
	Setting Range	0.000 to 10.000PU	
F2-27	Flux ramp time	Default	0.5
	Setting Range	0.0 to 5.0s	

These parameters are flux loop PI parameters for vector control that generally require no editing by default.

When the electrically excited synchronous motor runs in vector control mode, in general, if the output current fluctuates largely, F2-24 (Flux loop integral gain) needs to be reduced accordingly.

F2-26 (Flux set value) has the corresponding basic value of rated voltage/rated frequency of the motor. This parameter generally requires no editing. When the motor is required to be subject to flux weakening or flux strengthening, you can adjust this parameter. Note that when this parameter is set higher than 1.000, the motor works in flux strengthening mode. Overexcitation of the motor for a prolonged period of time could lead to damage of the motor due to heated windings.

Group F4: Input Terminals

The MV AC drive provides a total of 24 multi-functional DI terminals. Configure a PLC optional module, if more DI or DO terminals are required.

F4-00	DI1 function selection	Default	1031: Emergency stop
F4-01	DI2 function selection	Default	1025: Transformer overtemp. fault
F4-02	DI3 function selection	Default	1024: Transformer overtemp. alarm
F4-03	DI4 function selection	Default	1026: Cabinet door travel switch
F4-04	DI5 function selection	Default	27: Cabinet top fan state feedback
F4-05	DI6 function selection	Default	1020: Local/Remote
F4-06	DI7 function selection	Default	33: Control power normal
F4-07	DI8 function selection	Default	0
F4-08	DI9 function selection	Default	1: Forward run
F4-09	DI10 function selection	Default	1003: Three-wire control mode
F4-10	DI11 function selection	Default	9: Fault reset
F4-11	DI12 function selection	Default	28: Remote 1/2 switchover
F4-12	DI13 function selection	Default	58: Forward running 2
F4-13	DI14 function selection	Default	1060: Three-wire running control 2
F4-14	DI15 function selection	Default	0
F4-15 to F4-25	DI16function selection to DI26 function selection	Default	0
F4-42 to F4-57	DI43 function selection X00 to DI58 function selection X17	Default	0

These parameters are used to set the functions of the DI terminals, and the values of F4-00 to F4-06 must not be changed.

NOTE

The setting 1 of the thousand's digit indicates active when normally-open.
- ◆ If the setting value is 1001, the AC drive runs in forward direction when the DI terminal is inactive.
- ◆ If the setting value is 1, the AC drive runs in forward direction when the DI terminal is active.

The functions of the digital input terminals are described in the following figure.

Value	Function	Description
0	No function	Set reserved terminals to 0 to avoid malfunction.
1	Forward run (FWD)	External DI terminals set for the two functions control forward and reverse running of the AC drive. It is applicable to remote 1 control.
2	Reverser run (REV)	

Value	Function	Description
3	Three-wire control mode	It is applicable to remote 1 control. The DI terminal set for this function determines three-wire control mode of the AC drive. For details, see the description of F4-73 (Terminal command mode).
4	Forward jog (FJOG)	FJOG indicates forward jog. RJOG indicates reverse jog.
5	Reverse jog (RJOG)	
6	Terminal UP	The terminals set for the two functions are used for increment and decrement when frequency reference is input via external DI terminal, or when the frequency source is digital setting.
7	Terminal DOWN	
8	Coast to stop	When the terminal set for this function becomes on, the AC drive shuts off output and the stop process of the motor is not controlled by the AC drive. It means the same as coast to stop described in F6-10 (Stop mode).
9	Fault reset (RESET)	You can perform fault reset using the DI terminal set for this function. It is the same as the function of the RESET key on the HMI. Remote fault reset is implemented by this function.
10	RUN disabled	When the terminal set for this function becomes on, the AC drive decelerates to stop and retains all running parameters, such as the PLC parameters, wobble and PID parameters. Once the terminal becomes off, the AC drive resumes the running state before stop.
11	External fault NO input	When the terminal set for this function becomes on, the AC drive reports F15.
12	Multi-reference terminal 1	The 16 speeds or 16 other references can be implemented through combinations of 16 states of these four terminals.
13	Multi-reference terminal 2	
14	Multi-reference terminal 3	
15	Multi-reference terminal 4	
16	Terminal 1 for acceleration/ deceleration time selection	Totally four groups of acceleration/deceleration time can be selected through combinations of four states of these two terminals.
17	Terminal 2 for acceleration/ deceleration time selection	
18	Frequency reference setting channel switchover	The terminal set for this function is used to perform switchover between two frequency reference setting channels according to the setting in F0-07.
19	UP and DOWN setting clear (terminal, operation panel)	If the frequency reference setting channel is digital setting, the terminal set for this function is used to clear the modification by using the UP/DOWN function, restoring the frequency reference to the value of F0-08 (Preset frequency).

Value	Function	Description
20	Local/Remote	This terminal is used to perform switchover between local control and remote control (F0-02). When the terminal becomes ON, local control (HMI) is prohibited, and the AC drive is in remote control mode.
21	Acceleration/Deceleration prohibited	This function ensures the AC drive to maintain the current frequency output without being affected by external signals (except the STOP command).
22	PID disabled	This function disables the PID function. The AC drive maintains the current frequency output without supporting the PID function.
23	PLC state reset	When the simple PLC function is enabled again after it was disabled in the execution process, this function restores the original state of simple PLC for the AC drive.
24	Transformer overtemp. alarm	If the terminal set for this function becomes ON, the temperature of phase-shifting transformer of the AC drive reaches the alarm threshold, and the AC drive reports alarm A87.
25	Transformer overtemp. fault	If the terminal set for this function becomes ON, the temperature of the phase-shifting transformer reaches the fault threshold, and the AC drive reports fault F57.
26	Cabinet door travel switch	If the terminal set for this function becomes ON, the cabinet doors are not properly closed or the travel switch is faulty, and the AC drive reports fault F58.
27	Fan state feedback	If the terminal set for this function becomes ON, the fan is not started properly after the MV power is applied, and the AC drive reports fault F59.
28	Remote 1/Remote 2	The terminal set for this function performs switchover between F0-02 (Remote 1 command source selection) and F0-29 (Remote 2 command source selection). When the terminal becomes ON, remote 1 command source is prohibited, and the AC drive is in remote 2 control mode.
29	Torque control prohibited	Torque control is prohibited, and the AC drive enters the speed control mode.
31	Emergency stop	After the "Emergency stop" button is pressed, the system stops and enables the input MV breaker.
33	Control power normal	If this terminal becomes OFF, the AC drive reports fault F46 and stops.
34	Frequency modification enabled	When the terminal set for this function is OFF, the AC drive does not respond to frequency modification until the terminal becomes ON.

Value	Function	Description
35	PID operation direction reverse	When the terminal set for this function becomes ON, the PID operation direction is reversed to the direction set in FA-03 (PID operation direction).
37	Emergency switch-off	When the terminal set for this function becomes ON, the system stops and trips the medium voltage.
38	PID integral disabled	When the terminal set for this function becomes ON, the integral function becomes disabled. However, the proportional and differentiation functions are still enabled.
39	Switchover between main frequency reference and preset frequency	When the terminal set for this function becomes ON, the frequency reference is replaced by the preset frequency set in F0-08 (Preset frequency).
40	Switchover between auxiliary frequency reference and preset frequency	When the terminal set for this function becomes ON, the frequency reference is replaced by the preset frequency set in F0-08 (Preset frequency).
41	Motor selection 1	The AC drive switches over between four groups of motor parameters. If the terminal with this function becomes active first, the AC drive switches over to motor 1 parameters.
42	Motor selection 2	The AC drive switches over between four groups of motor parameters. If the terminal with this function becomes active first, the AC drive switches over to motor 2 parameters.
43	PID parameter switchover	The terminal set for this function performs switchover between groups of PID parameters. The PID parameters are FA-05 (Proportional gain Kp1) to FA-07 (Differential time Td1) when the terminal set for this function becomes OFF.
44	User-defined fault 1	If the terminals set for these two functions become ON, the AC drive reports F27 and F28 respectively.
45	User-defined fault 2	
46	Speed control/Torque control	This function enables the AC drive to switch over between speed control and torque control.
50	Bypass cabinet 1 cable inlet contactor/knife switch feedback	If the terminal set for this function is ON, the upstream vacuum contactor of the AC drive bypass cabinet 1 is closed.
51	Bypass cabinet 1 cable outlet contactor/knife switch feedback	If the terminal set for this function is ON, the downstream vacuum contactor of the AC drive bypass cabinet 1 is closed.
52	Bypass cabinet 1 mains frequency contactor/knife switch feedback	If the terminal set for this function is ON, the mains frequency vacuum contactor of bypass cabinet 1 is closed.
53	AC drive contactor feedback	If the terminal set for this function is ON, the AC drive contactor for motor 1 synchronous transfer is closed.

Value	Function	Description
54	Mains frequency contactor feedback	If the terminal set for this function is ON, the mains frequency contactor for motor 1 synchronous transfer is closed.
56	Excitation cabinet ready	If the terminal set for this function is ON, the excitation cabinet is ready.
57	Excitation cabinet faulty	If the terminal set for this function is ON, the excitation cabinet is faulty and the AC drive reports F54.
58	Forward RUN 2 (FWD 2)	External DI terminals set for the two functions control forward and reverse running of the AC drive. They are applicable to remote 2 control.
59	Reverse RUN 2 (REV 2)	
60	Three-wire control mode 2	It is applicable to remote 2 control. The DI terminal set for this function determines three-wire control mode of the AC drive. For details, see the description of F4-73 (Terminal command mode).
61	Pre-charge command	If the terminal set for this function is ON, the AC drive pre-charge time sequence is executed. This function is applicable to the AC drive requiring pre-charge.
63	Cross-flow fan state feedback	If the terminal set for this function is ON, the cross-flow fan is in the working state. If the terminal is off after the system equipped with the cross-flow fan is started, the system reports A88 (cross-flow fan alarm).
66	Bypass cabinet 2 cable inlet contactor/knife switch feedback	If the terminal set for this function is ON, the upstream vacuum contactor of the AC drive bypass cabinet 2 is closed.
67	Bypass cabinet 2 cable outlet contactor/knife switch feedback	If the terminal set for this function is ON, the downstream vacuum contactor of the AC drive bypass cabinet 2 is closed.
68	Bypass cabinet 2 mains frequency contactor/knife switch feedback	If the terminal set for this function is ON, the mains frequency vacuum contactor of bypass cabinet 2 is closed.
69	Pre-charge contactor feedback	If the terminal set for this function is ON, the pre-charge contactor is closed.
71	Process ready	If this function is selected and the terminal set for this function is OFF, the AC drive cannot be started.
73	Incoming circuit breaker/ contactor feedback	If the terminal set for this function is ON, the incoming circuit breaker/contactor is closed. If the terminal is ON but not input voltage is available for the system, the system reports F160.

Value	Function	Description
75	Synchronous up transfer	When the terminal set for this function becomes ON during the drive running, the AC drive automatically transfers the motor to mains frequency control from the AC drive control. The terminal must be connected to a button.
76	Synchronous down transfer	When the terminal set for this function becomes ON during the motor running, the AC drive automatically transfers the motor to the AC drive control from mains frequency control.
79	Reactor overtemp. fault	If the terminal set for this function is ON, the overtemperature fault occurs on the reactor used for synchronous transfer and the AC reports F161 and stops synchronous transfer.
80	Reactor bypass contactor feedback	It is applicable to the AC drive with the synchronous transfer function and is used to judge whether the reactor bypass contactor is closed.
81	Precharge resister bypass contactor feedback	It is applicable to the AC drive with the pre-charge resistor and is used to judge whether the pre-charge resistor bypass contactor is closed.
82	Excitation cabinet running feedback	The excitation cabinet equipped for electrically excited synchronous motor is controlled by the AC drive. This terminal is used to report the running status of the excitation cabinet. When the excitation cabinet running feedback is different from the AC drive control, the system reports F54.
83	Bypass cabinet up transfer	It is applicable for the automatic bypass cabinet. If the terminal set for this function is ON, the AC drive is in the running state, and the automatic transfer from the AC drive control to mains frequency control is implemented. The terminal must be connected to a button.
85	Bypass cabinet down transfer	It is applicable for the automatic bypass cabinet. If the terminal set for this function is ON, the AC drive automatically transfer from mains frequency to the variable frequency. The terminal must be connected to a button.
86	Fan fault 2	It is applicable for fan troubleshooting. If the terminal set for this function is ON, fan 2 is not properly turned on after AC drive starts.
87	Fan fault 3	It is applicable for fan troubleshooting. If the terminal set for this function is ON, fan 3 is not properly turned on after AC drive starts.
88	Fan fault 4	It is applicable for fan troubleshooting. If the terminal set for this function is ON, fan 4 is not properly turned on after AC drive starts.

Value	Function	Description
89	Fan fault 5	It is applicable for fan troubleshooting, If the terminal set for this function is ON, fan 5 is not properly turned on after AC drive starts.
90	Fan fault 6	It is applicable for fan troubleshooting, If the terminal set for this function is ON, fan 6 is not properly turned on after AC drive starts.
91	Fan fault 7	It is applicable for fan troubleshooting. If the terminal set for this function is ON, fan 7 is not properly turned on after AC drive starts.
92	Pre-charge breaker command	When the terminal set for this function becomes ON, the AC drive switches off all pre-charge contactor, and breaks MV for the whole equipment. It is applicable for AC drive configured with pre-charge function.
93	Motor 3 selection	The total of four groups of motor parameters are switched over by the terminal state priority principle. If the terminal set to function becomes ON first, motor 3 parameters are switched to.
94	Motor 4 selection	The total of four groups of motor parameters are switched over by the terminal state priority principle. If the terminal set to function becomes ON first, motor 4 parameters are switched to.
95	Variable frequency contactor 2 feedback	When the terminal set for this function becomes ON, the variable frequency contactor for motor 2 is closed.
96	Mains frequency contactor 2 feedback	When the terminal set for this function becomes ON, the mains frequency contactor for motor 2 used for synchronous transfer is closed.
97	Variable frequency contactor 3 feedback	When the terminal set for this function becomes ON, the variable frequency contactor for motor 3 is closed.
98	Mains frequency contactor 3 feedback	When the terminal set for this function becomes ON, the mains frequency contactor for motor 3 used for synchronous transfer is closed.
99	Variable frequency contactor 4 feedback	When the terminal set for this function becomes ON, the variable frequency contactor for motor 4 is closed.
100	Mains frequency contactor 4 feedback	When the terminal set for this function becomes ON, the mains frequency contactor for motor 4 used for synchronous transfer is closed.
101	Motor 1 soft start	When the terminal set for this function becomes ON, it indicates that motor 1 is selected and to be started.

Value	Function	Description
102	Motor 2 soft start	When the terminal set for this function becomes ON, it indicates that motor 2 is selected and to be started.
103	Motor 3 soft start	When the terminal set for this function becomes ON, motor 3 is selected and to be started.
104	Motor 4 soft start	When the terminal set for this function becomes ON, motor 4 is selected and to be started.
105	Motor 1 soft start stop	When the terminal set for this function becomes ON, motor 1 stops.
106	Motor 2 soft start stop	When the terminal set for this function becomes ON, motor 2 stops.
107	Motor 3 soft start stop	When the terminal set for this function becomes ON, motor 3 stops.
108	Motor 4 soft start stop	When the terminal set for this function becomes ON, motor 4 stops.
110	Bypass cabinet 1 AC drive branch close	If the system state is switch-on allowed, and the terminal set for this function becomes ON, the inlet and outlet contactor of the automatic bypass cabinet is automatically switched off. The terminal must be connected to a button.
111	Bypass cabinet 2 AC drive branch close	If the system state is switch-on allowed, and the terminal set for this function becomes ON, the inlet contactor 2 and outlet contactor 2 of the automatic bypass cabinet 2 is automatically switched off. The terminal must be connected to a button.
112	Bypass cabinet 2 down transfer command	It is applicable for the automatic bypass cabinet. If the terminal set for this function is ON, motor 2 is automatically transferred from mains frequency control state to the AC drive control state. The terminal must be connected to a button.
113	Grounding knife-switch feedback	When the AC drive is disconnected from MV supply during system maintenance, close the grounding knife-switch to enable the "MV breaker enable" signal and disable the "switch-on allowed" signal to ensure that the system is in the safety state without MV.
114	Heating and dehumidification feedback	The AC drive can be equipped with an optional heater. If the terminal set for this function is ON, the system is in the heating and dehumidification state. The system does not output the "switch-on allowed" signal until the heating and dehumidification are complete.

Value	Function	Description
128	Cooling fan feedback	When the optional control function of the motor cooling fan is used, this terminal is used to report whether the cooling fan is enabled. When the cooling fan control is different from the terminal feedback, the system reports F165.
134	Motor overtemperature feedback	For scenarios where motor overtemperature protection is enabled, if the terminal set for this function is ON, the system will stop or corresponding protection measures will be triggered when the motor overheats. This prevents motor damage caused by overheating.
135	Bypass cabinet power supply feedback	For applications with the optional manual/auto bypass cabinet, this function is used to report whether the bypass cabinet power is normal. When the bypass cabinet contactor/knife switch feedback is abnormal, this function can be used to check whether the contactor/knife switch is disconnected. If the terminal set for this function is ON, the bypass cabinet power is normal.

■ Functional descriptions of multi-reference

The four multi-reference terminals have 16 state combinations, corresponding to 16 reference values. The first eight references are listed in the following table.

K4	K3	K2	K1	Reference Setting	Corresponding Pr.
OFF	OFF	OFF	OFF	Reference 0	FC-00
OFF	OFF	OFF	ON	Reference 1	FC-01
OFF	OFF	ON	OFF	Reference 2	FC-02
OFF	OFF	ON	ON	Reference 3	FC-03
OFF	ON	OFF	OFF	Reference 4	FC-04
OFF	ON	OFF	ON	Reference 5	FC-05
OFF	ON	ON	OFF	Reference 6	FC-06
OFF	ON	ON	ON	Reference 7	FC-07

If the frequency reference setting channel is multi-reference, the value 100% of FC-00 (Reference 0) to FC-15 (Reference 15) corresponds to the value of F0-10 (Max. frequency).

Besides the multi-speed function, the multi-reference can be also used as the PID setting source, satisfying the requirement for switchover of different setting values.

F4-66	DI1 to DI26 filter time	Default	0.030s
	Setting Range	0.000s to 1.000s	

It is used to set the software filter time of a DI terminal. If DI terminals are liable to interference, which may cause malfunction, increase the value of this parameter to enhance the anti-interference capability. However, increase of DI filter time will reduce the response of DI terminals.

F4-67	DI9 delay	Default	0.0s
	Setting Range	0.0–3600.0s	

It is used to set the independent filter time of terminals DI9 to DI12. For example, if F4-67 is set to 1.0s, the AC drive can detect the DI9 input signal only when it lasts for over 1.0s.

F4-71	DI16 replacement selection	Default	0
	Setting Range	0 to 7	
F4-72	DI17 replacement selection	Default	0
	Setting Range	0 to 7	

- When F4-71 is set to 0 or 1, the DI16 replacement function is disabled, and whether DI6 is valid is based on DI16 level and the setting of F4-15 (DI16 function selection).
- When F4-71 is set to a value between 2 and 7, DI16 replaces the corresponding terminal among DI2 to DI7, and whether the function of this corresponding terminal is enabled is determined by DI16 level.

For example, if F4-71 is set to 3, DI16 will replace DI3 and the original DI3 will take no effect. Whether the function of DI3 set in F4-02 (DI3 function selection) is enabled is determined by DI16 level.

F4-72 is set in the same way as F4-71.

F4-73	Terminal command mode		Default	H.22
	Setting Range	Ones	Terminal command channel 1	
		0	Two-wire mode 1	
		1	Two-wire mode 2	
		2	Three-wire mode 1	
		3	Three-wire mode 2	
		Tens	Terminal command channel 2	
		0	Two-wire mode 1	
		1	Two-wire mode 2	
		2	Three-wire mode 1	
		3	Three-wire mode 2	

This parameter defines the four different modes of controlling the AC drive running using external DI terminals.

NOTE

Here takes DI9, DI10 and DI11 as the external DI terminals to control the AC drive running. You can set the function of DI9, DI10 and DI11 by setting F4-08 (DI9 function selection), F4-09 (DI10 function selection) and F4-10 (DI11 function selection), respectively. For details, see the descriptions of F4-08 (DI9 function selection) to F4-17 (DI18 function selection).

0: Two-wire Control Mode 1

It is the most commonly used two-wire control mode. Allocate the DI9 with the forward run function and the DI10 with the reverse run function.

You need to connect the forward run switch to the DI9 terminal and the reverse run switch to the DI10 terminal.

The parameters are set as below:

Parameter No.	Parameter Name	Value	Description
F4-73	Terminal command mode	H.x0	Two-wire control mode 1
F4-08	DI9 function selection	1	Forward RUN (FWD)
F4-09	DI10 function selection	2	Reverse RUN (REV)

K1	K2	Run command
1	0	Forward run
0	1	Reverse run
1	1	Stop
0	0	Stop

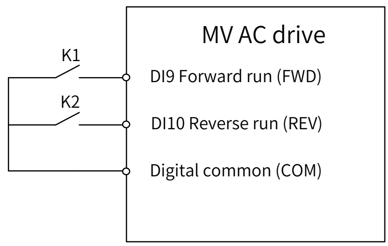


Figure 6-3 Two-wire control mode 1

In this mode,

- When K1 is closed, the motor rotates in the forward direction. When K1 is open, the motor stops.
- When K2 is closed, the motor rotates in the reverse direction. When K2 is open, the motor stops.
- When SW1 and SW2 are both open or closed simultaneously, the motor stops.

1: Two-wire Control Mode 2

In this mode, DI9 is RUN enabled terminal, and DI10 determines the running direction.

The parameters are set as below:

Parameter No.	Parameter Name	Value	Description
F4-73	Terminal command mode	H.x1	Two-wire mode 2
F4-08	DI9 function selection	1	RUN enabled

Parameter No.	Parameter Name	Value	Description
F4-09	DI10 function selection	2	Forward or reverse direction

K1	K2	Run command
1	0	Forward run
1	1	Reverse run
0	0	Stop
0	1	Stop

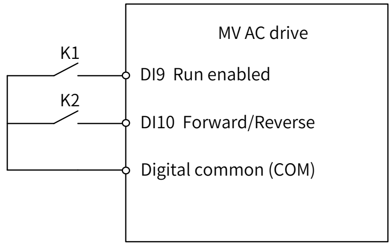


Figure 6-4 Two-wire control mode 2

In this mode,

When K1 is closed, the motor rotates in the forward direction after you keep K2 open.

When K2 is closed, the motor rotates in the reverse direction after you close K2.

When K1 is open, the motor stops no matter whether K2 is open or closed.

2: Three-wire Control Mode 1

In this mode, DI10 is the RUN enabling terminal, and the direction is decided by DI9 and DI11.

The parameters are set as below:

Parameter No.	Parameter Name	Value	Description
F4-73	Terminal command mode	H.x2	Three-wire mode 1
F4-08	DI9 function selection	1	Forward RUN (FWD)
F4-09	DI10 function selection	1003	Three-wire control
F4-10	DI11 function selection	3	Reverse RUN (REV)

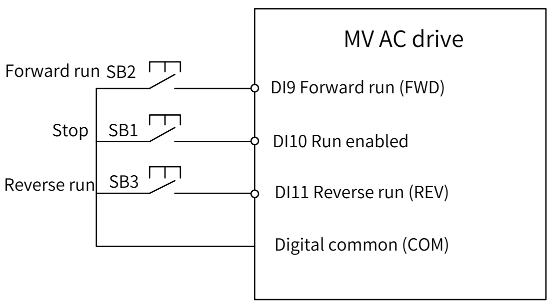


Figure 6-5 Three-wire control mode 1

In this mode:

- SB1 must remain open during the start sequence and during normal run operation.
- The motor stops immediately after SB1 closes.
- Signals from SB2 and SB3 are valid only after SB1 closes.
- On the condition that SB1 is open, after you press down SB2, the motor rotates in the forward direction. After you press down SB3, the motor rotates in the reverse direction.

The running state of the AC drive is determined by the actions of the three buttons.

3: Three-wire Control Mode 2

In this mode, DI10 is the RUN enabling terminal. The RUN command is given by DI9 and the direction is decided by DI11.

The parameters are set as below:

Parameter No.	Parameter Name	Value	Description
F4-73	Terminal command mode	H.22	Three-wire mode 2
F4-08	DI9 function selection	1	RUN command
F4-09	DI10 function selection	1003	Three-wire control
F4-10	DI11 function selection	2	Forward or reverse direction

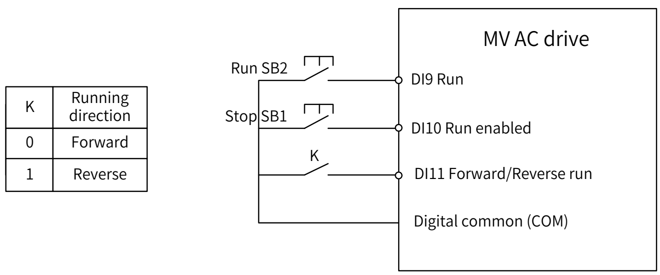


Figure 6-6 Three-wire control mode 2

In this mode,

- SB1 must remain open during the start sequence and during normal run operation.
- The motor stops immediately after SB1 closes.
- Signals from SB2 are valid only at close edge action.
- On the condition that SB1 is open and you press down SB1, the AC drive runs. If you keep K off, the motor rotates in the forward direction. After you turn K on, the motor rotates in the reverse direction.

Group F5: Output Terminals

The MV AC drive provides a total of 34 multi-functional DO terminals. If more DO terminals are required, configure a PLC optional module.

F5-01	DO1 function selection	Default	1041 (MV breaker enable)
F5-02	DO2 function selection	Default	40: MV switch-on allowed
F5-03	DO3 function selection	Default	44: Main power indication
F5-04	DO4 function selection	Default	15: Ready
F5-05	DO5 function selection	Default	1: AC drive running
F5-06	DO6 function selection	Default	1001: AC drive in stop
F5-07	DO7 function selection	Default	2: Stop upon fault
F5-08	DO8 function selection	Default	45: Alarm output
F5-09	DO9 function selection	Default	46: HMI reset
F5-10 to F5-23	DO10 function selection to DO23 function selection	Default	0
F5-24	DO24 function selection	Default	62
F5-25 to F5-32	DO25 function selection to DO32 function selection	Default	0
F5-33	DO33 function selection	Default	1
F5-34	DO34 function selection	Default	2
F5-35 to F5-52	DO35 function selection to DO52 function selection	Default	0
F5-53 to F5-56	Terminal function selection Y14 to terminal function selection Y17	Default	0
F5-57 to F5-64	Terminal function selection Y00 to terminal function selection Y07	Default	0
F5-65 to F5-68	Terminal function selection Y10 to terminal function selection Y13	Default	0

The functions of the digital output terminals are described in the following table.

Value	Function	Description
0	No function	The terminal has no function.
1	AC drive running	When the AC drive is running and has output frequency (can be zero), the terminal set for this function becomes ON.
2	Fault output (stop)	When the AC drive stops due to the occurrence of a fault, the terminal set for this function becomes ON.
5	Zero-speed running	If the AC drive runs with the output frequency of 0, the terminal set for this function becomes ON. If the AC the terminal set for this function becomes OFF.

Value	Function	Description
6	Motor overload pending	The AC drive judges whether the motor load exceeds the overload pending threshold before performing the protection action. If the pending threshold is exceeded, the terminal set for this function becomes ON.
7	AC drive overload pending	This terminal becomes ON 10s before the AC drive performs the overload protection action.
12	Accumulative running time reached	When the accumulative running time of the AC drive reaches the setting threshold, the terminal set for this function becomes ON.
14	Torque limited	In speed control mode, if the output torque reaches the torque limit, the AC drive enters the stall protection state and meanwhile the terminal set for this function becomes ON.
15	Ready for RUN	After the MV power is applied properly, cell self-check is complete and the AC drive does not detect any fault, the AC drive is ready for running and the terminal set for this function becomes ON.
16	AI1 > AI2	When the input of AI1 is larger than the input of AI2, the terminal set for this function becomes ON.
17	Frequency upper limit reached	If the running frequency and the target frequency reach or are above the frequency upper limit, the terminal set for this function becomes ON.
18	Frequency lower limit reached (no output at stop)	If the running frequency and the target frequency reach or are below the lower limit, the terminal set for this function becomes ON. In the stop state, the terminal is OFF.
23	Zero-speed output	If the output frequency of the AC drive is 0, the terminal set for this function becomes ON. In the stop state, the terminal is still ON.
24	Accumulative power-on time reached	When the accumulative power-on time of the AC drive reaches the setting threshold, the terminal set for this function becomes ON.
40	MV switch-on allowed	After the control system is powered on, the terminal set for this function becomes ON when all the following requirements are satisfied: ◆ The emergency stop signal is invalid. ◆ The emergency break input is invalid. ◆ The grounding knife-switch feedback is invalid. ◆ The undervoltage fault F09 does not occur or no fault exists. ◆ The MV switch-off time exceeds the setting of F8-58 (Delay of MV switch-on allowed). ◆ Automatic condensation clearing is complete.

Value	Function	Description
41	MV breaker enable	This terminal becomes ON when any of the following conditions occurs: ◆ The emergency stop signal is valid. ◆ The emergency break input is valid. ◆ The grounding knife-switch feedback is valid. ◆ A major fault happens to the system. Note: When the fault 2) occurs and the bypass cabinet 1 line-voltage contactor opens, the terminal set for this function becomes ON.
44	Main power indication	When the input voltage reaches one-sixteenth of the primary-side rated voltage of the phase-shifting transformer, the terminal set for this function becomes ON.
45	Alarm output	When any alarm occurs, the terminal set for this function becomes ON.
46	HMI reset	When communication interruption between the HMI and the control board lasts 40s, the terminal set for this function becomes ON.
47	Bypass cabinet cable outlet contactor open	For the automatic bypass cabinet, on the condition that the bypass cabinet cable outlet contactor closes, if a fault occurs on the AC drive or the emergency stop signal is active, the terminal set for this function becomes ON.
49	Excitation command output	This function is used to control running of the excitation cabinet.
52	AC drive contactor close	When the down transfer starts, it is used to close the AC drive contactor.
53	AC drive contactor open	When up transfer is complete, it is used to open the AC drive contactor.
54	Line-voltage contactor close	When up transfer is complete, it is used to close the line-voltage contactor.
55	Line-voltage contactor open	When down transfer is complete, it is used to open the line-voltage contactor.
58	Power controller run command	During power controller pre-charge, this function is used to output the run command to the power controller.
59	Power controller contactor control	During power controller pre-charge, this function is used to release or apply the power controller contactor.
60	Pre-charge contactor close	After the system pre-charge is complete, this function is used to close the AC drive upstream vacuum contactor.

Value	Function	Description
61	Motor 1 automatic transfer to mains frequency	For the bypass cabinet 1, when the bypass cabinet 1 cable outlet contactor closes, the MV power is normal and the AC drive is in running state, the bypass cabinet 1 cable outlet contactor opens first when a fault occurs. This moment when the automatic bypass delay is reached, the terminal set for this function becomes ON.
62	Fan automatic running	When the fan automatic running function is enabled or the MV power is applied, the terminal with this function becomes ON to start the fan. If the MV power is switched off, this terminal becomes OFF after F9-71 (Fan off delay time) to stop the fan.
63	Pre-charge contactor open	For the MV AC drive with the optional pre-charge function, when a pre-charge fault occurs, the manual pre-charge contactor open command is valid, or a major fault occurs, the terminal with this function becomes ON to open the pre-charge contactor to disconnect the system from the MV.
64	MV breaker enable of switch cabinet 2	This terminal becomes ON when any of the following conditions occurs: ◆ The emergency stop signal is valid. ◆ The emergency break input is valid. ◆ The grounding knife-switch feedback is valid. ◆ The MV breaker enable function is enabled and the bypass cabinet 2 line-voltage contactor opens.
65	Motor 2 automatic transfer to mains frequency	For the bypass cabinet 2, when the bypass cabinet 2 cable outlet contactor closes, the MV power is normal and the AC drive is in running state, the bypass cabinet 2 cable outlet contactor opens first when a fault occurs. In this case, when the automatic bypass delay is reached, the terminal set for this function becomes ON.
66	Motor 1 in AC drive control indication	When motor 1 is controlled by the AC drive, the terminal set for this function becomes ON.
67	Motor 1 under mains frequency control indication	When motor 1 is controlled by mains frequency, the terminal set for this function becomes ON.
68	Up transfer ready	When the AC drive controls the motor with variable frequency and the input phase sequence of the system is positive, the terminal set for this function becomes ON.

Value	Function	Description
69	Down transfer ready	When the motor is under the control of the mains frequency and the AC drive is in the state of ready to run, the terminal set for this function becomes ON.
70	Synchronous transfer contactor unlock	During the synchronous transfer, this function is used to unlock the interlock control of the line-voltage contactor and the AC drive contactor.
71	Up transfer indication	When the motor is in the up transfer process, the terminal set for this function becomes ON.
72	Down transfer indication	When the motor is in the down transfer process, the terminal set for this function becomes ON.
75	Heater start	For the AC drive equipped with an optional heater, the terminal set for this function becomes ON when the system is in the condensation clearing state and becomes OFF after condensation clearing is complete.
76	Pre-charge resistor bypass contactor open	It is applicable to the AC drive with the pre-charge resistor. The terminal set for this terminal becomes ON when any of the following conditions occurs: ◆ The input of MV breaker enable is active. ◆ The system reports pre-charge fault. ◆ The external device gives the pre-charge open signal. ◆ The medium voltage of the AC drive is switched off.
77	Pre-charge resistor bypass contactor close	It is applicable to the AC drive with the pre-charge resistor. After pre-charging is complete, it is used for the bypass pre-charge resistor.
78	Reactor bypass contactor open	It is applicable to the synchronous transfer. This signal is active when the synchronous transfer command is valid.
79	Reactor bypass contactor close	It is applicable to the synchronous transfer. This signal is active when the synchronous transfer command is invalid.
80	Motor 2 in AC drive control indication	It is applicable to the bypass cabinet in the scenario where one AC drive can drive two motors. When the motor 2 is controlled by the AC drive, the terminal set for this function becomes ON.
81	Motor 2 under mains frequency control indication	It is applicable to the bypass cabinet in the scenario where one AC drive can drive two motors. When the motor 2 is driven by mains frequency, the terminal set for this function becomes ON.
82	Remote 1/Remote 2	It is used to indicate whether the AC drive is controlled by remote 1 or remote 2.

<table>
<tr><th>Value</th><th>Function</th><th>Description</th></tr>
<tr><td>83</td><td>Switchgear 2 MV switch-on allowed</td><td>It is applicable to the scenario where one AC drive is equipped with two bypass cabinets.
<table>
<tr><th rowspan="2">Scenario</th><th colspan="2">Conditions</th><th rowspan="2">Action</th></tr>
<tr><th>Bypass Cabinet 1</th><th>Bypass Cabinet 2</th></tr>
<tr><td rowspan="2">One AC drive with two manual bypass cabinets</td><td>Inlet knife switch closed</td><td>Inlet knife switch open</td><td>The DO with function 40 [1] becomes ON.</td></tr>
<tr><td>Inlet knife switch open</td><td>Inlet knife switch closed</td><td>The DO with function 83 [2] becomes ON.</td></tr>
<tr><td rowspan="2">One AC drive with two automatic bypass cabinets</td><td>N/A</td><td>Inlet knife switch open</td><td>The DO with function 40 [1] becomes ON.</td></tr>
<tr><td>Inlet knife switch open</td><td>N/A</td><td>The DO with function 83 [2] becomes ON.</td></tr>
<tr><td colspan="4">[1] Function 40: Switchgear 1 MV switch-on allowed
[2] Function 83: Switchgear 2 MV switch-on allowed</td></tr>
</table></td></tr>
<tr><td>84</td><td>Designated fault output</td><td>It is used together with F8-65 (Specific fault output No.). If the fault SN of the AC drive is consistent with the setting of F8-65 (Specific fault output No.), this signal is active.</td></tr>
<tr><td>87</td><td>Bypass cabinet 1 outlet cable contactor</td><td>It is applicable for automatic bypass cabinet control. The terminal set for this function becomes ON when a switch-on command is given to the AC drive subcircuit of bypass cabinet 1 or down transfer is performed for bypass cabinet 1. The terminal must be connected to a button.</td></tr>
<tr><td>88</td><td>Bypass cabinet inlet cable contactor open</td><td>It is applicable for automatic bypass cabinet control. If the AC drive stops due to a system fault when controlling a motor with variable frequency, the terminal set for this function becomes ON.</td></tr>
<tr><td>89</td><td>Bypass cabinet 1 mains frequency contactor open</td><td>It is applicable for automatic bypass cabinet control. The terminal set for this function becomes ON when motor 1 is driven with mains frequency and a down transfer command is given to bypass cabinet 1. The terminal must be connected to a button.</td></tr>
<tr><td>90</td><td>Bypass cabinet 2 mains frequency contactor close</td><td>It is applicable for automatic bypass cabinet control. The terminal set for this function becomes ON when a switch-on command is given to the AC drive subcircuit of bypass cabinet 2 or down transfer is performed for bypass cabinet 2. The terminal must be connected to a button.</td></tr>
</table>

Value	Function	Description
91	Bypass cabinet 2 mains frequency contactor open	It is applicable for automatic bypass cabinet control. The terminal set for this function becomes ON when motor 2 is driven with mains frequency and a down transfer command is given to bypass cabinet 2. The terminal must be connected to a button.
92	AC drive contactor 2 close	It is applicable for the switchable bypass cabinet. When motor 2 is in the AC drive control mode or in the synchronous down transfer process, the terminal set for this function becomes ON, and the AC drive contactor 2 closes.
93	AC drive contactor 2 open	It is applicable for the switchable bypass cabinet. When motor 2 is in the AC drive control mode or in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 2 opens.
94	Mains frequency contactor 2 close	It is applicable for the switchable bypass cabinet. When motor 2 in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 2 closes.
96	AC drive contactor 3 close	It is applicable for the switchable bypass cabinet. When motor 3 is in the AC drive control mode or in the synchronous down transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 closes.
97	AC drive contactor 3 open	It is applicable for the switchable bypass cabinet. When motor 3 is in the AC drive control mode or in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 opens.
98	Mains frequency contactor 3 close	It is applicable for the switchable bypass cabinet. When motor 3 is in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 closes.
99	Mains frequency contactor 3 open	It is applicable for the switchable bypass cabinet. When motor 3 is in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 closes.
100	AC drive contactor 4 close	It is applicable for the switchable bypass cabinet. When motor 4 is in the AC drive control mode or in the synchronous down transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 closes.

Value	Function	Description
101	AC drive contactor 4 open	It is applicable for the switchable bypass cabinet. When motor 4 is in the AC drive control mode or in the synchronous down transfer process, the terminal set for this function becomes ON, and the AC drive contactor 3 opens.
102	Mains frequency contactor 4 close	It is applicable for the switchable bypass cabinet. When motor 4 is in the AC drive control mode or in the synchronous up transfer process, the terminal set for this function becomes ON, and the AC drive contactor 4 closes.
103	Mains frequency contactor 4 open	It is applicable for the switchable bypass cabinet. When motor 4 is in the AC drive control mode or in the synchronous down transfer process, the terminal set for this function becomes ON, and the AC drive contactor 4 opens.
104	Synchronous switchover contactor unlock 2	It is applicable for the synchronous switch process. It is used to break the interlock control between mains frequency contactor 2 and AC drive contactor 2.
105	Synchronous switchover contactor unlock 3	It is applicable for the synchronous switch process. It is used to break the interlock control between mains frequency contactor 3 and AC drive contactor 3.
106	Synchronous switchover contactor unlock 4	It is applicable for the synchronous switch process. It is used to break the interlock control between mains frequency contactor 4 and AC drive contactor 4.
107	Motor 3 AC drive control indication	When the motor 3 is in the AC drive control mode, the terminal set for this function becomes ON.
108	Motor 3 mains frequency control indication	When the motor 3 is in mains frequency control mode, the terminal set for this function becomes ON.
109	Motor 4 AC drive control indication	When the motor 4 is in the AC drive control mode, the terminal set for this function becomes ON.
110	Motor 4 mains frequency control indication	When the motor 4 is in mains frequency control mode, the terminal set for this function becomes ON.
112	Bypass cabinet 1 inlet contactor close	It is applicable for the automatic bypass cabinet. When the designated bypass cabinet 1 AC drive branch close is valid, the terminal set for this function becomes ON.
113	Bypass cabinet 2 inlet cable contactor close	It is applicable for the automatic bypass cabinet. When the designated bypass cabinet 2 AC drive branch close is valid, the terminal set for this function becomes ON.

Value	Function	Description
120	Motor cooling fan control	After the system is started, the terminal set for this function becomes ON to start the motor cooling fan. After the system is stopped, the terminal set for this function becomes OFF with a delay set by F8-79 (Motor cooling fan closing delay).
125	Bypass LV pre-charge resistor contactor control	The secondary LV pre-charge function is optional. According to the electrical configuration, this function controls the bypass contactor of the pre-charge resistor in the LV pre-charge circuit. When the terminal set for this function becomes ON, the pre-charge resistor of the LV pre-charge circuit is bypassed.

F5-69	DO12 delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	
F5-70	DO13 delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	
F5-71	DO14 delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	
F5-72	DO15 delay	Default	0.0s
	Setting Range	0.0s to 3600.0s	

They are used to set the delay of the AC drive when the status of DO12 to DI15 changes.

Group F6: Start/Stop Control

F6-00	Start mode		Default	0
	Setting Range	0	Direct start	
		1	Rotational speed tracking startup in the forward direction	
		2	Rotational speed tracking startup in the reverse direction	
		3	Rotational speed tracking startup in the forward/reverse direction	

The rotational speed tracking startup function allows the AC drive to detect the speed of the running motor and output the voltage corresponding to the motor frequency, minimizing the impact of applying power to the motor. When catching the spinning motor, the AC drive monitors the motor magnetic flux and starts the motor at the current motor frequency.

You can set the direction of rotational speed tracking startup in this parameter. If the motor rotating direction is known, set this parameter to 1 or 2 according to the actual direction. If the motor rotating direction is unknown, set this parameter to 3. If you set this parameter to 0, the AC drive starts directly without rotational speed tracking.

- 0: Direct start

The AC drive starts from zero frequency.

- 1: Rotational speed tracking startup in the forward direction

The AC drive detects the motor speed in the forward direction and then starts at the detected motor frequency, implementing smooth start without impacting the rotating motor.

- 2: Rotational speed tracking startup in the reverse direction

The AC drive detects the motor speed in the reverse direction and then starts at the detected motor frequency, implementing smooth start without impacting the rotating motor.

- 3: Rotational speed tracking startup in the forward/reverse direction

The AC drive detects the motor speed in the forward direction first. If the detection fails, the AC drive performs detection in the reverse direction. Then, the AC drive starts at the detected motor frequency, implementing smooth start without impacting the rotating motor.

NOTE

When Bit4 of F8-53 (Auxiliary function selection) is set to 1, rotational speed tracking startup in the forward/reverse direction is enabled by default.

F6-01	Start delay	Default	0.0 s
	Setting Range	0.0 to 60.0s	
F6-03	Startup frequency	Default	1.00 Hz
	Setting Range	0.00 to 10.00 Hz	
F6-04	Startup frequency holding time	Default	0.0 s
	Setting Range	0.0 to 100.0s	

To ensure the motor torque at startup, set a proper startup frequency. To completely establish flux at motor startup, keep the starting frequency for a certain period of time.

The starting frequency F6-03 is not limited by the frequency lower limit. However, when the set target frequency is lower than the starting frequency, the AC drive is not started but in standby mode.

During forward or reverse running, the starting frequency hold time does not work.

The starting frequency hold time is not included in the acceleration time but in the journey time of a simple PLC.

Example 1:

F0-03 = 0	The frequency source is digital setting.
F0-08 = 2.00 Hz	The digital setting frequency is 2.00 Hz.
F6-03 = 5.00 Hz	The starting frequency is 5.00 Hz.
F6-04 = 2.0s	The starting frequency hold time is 2.0s.

In this case, the AC drive works in standby mode and the output frequency of the AC drive is 0.00 Hz.

Example 2:

F0-03 = 0	The frequency source is digital setting.
F0-08 = 10.00 Hz	The digital setting frequency is 10.00 Hz.
F6-03 = 5.00 Hz	The starting frequency is 5.00 Hz.
F6-04 = 2.0s	The starting frequency hold time is 2.0s.

In this case, the AC drive accelerates to 5.00 Hz and then to the set frequency 10.00 Hz after 2.0s.

F6-07	Acceleration/ Deceleration mode		Default	0
	Setting Range	0	Linear acceleration/deceleration	
		1	Static S-curve acceleration/deceleration	

This parameter is used to set the frequency change mode during the AC drive start and stop process.

0: Linear acceleration/deceleration

The output frequency is linearly increased or decreased. HD9X/HD9XS provides 4 kinds of acceleration/deceleration time, which can be selected by multi-functional DI terminals (F4-00 to F4-08).

1: Static S-curve acceleration/deceleration

With fixed target frequency, the output frequency is increased or decreased along the S curve. It is suitable for locations when gentle start or stop is required, such as elevators or conveyors.

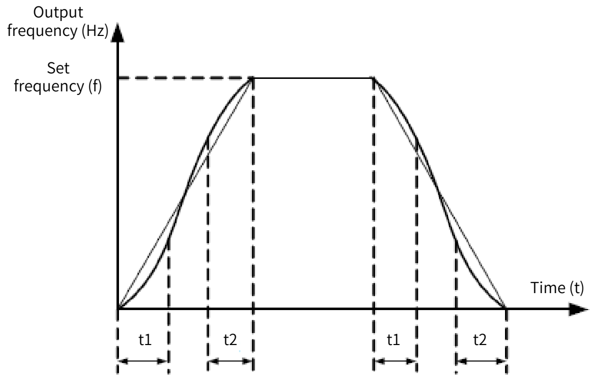


Figure 6-7 Static S curve

F6-10	Stop mode	Default	1
	Setting Range	0	Decelerate to stop
		1	Coast to stop

■ 0: Decelerate to stop

After the stop command is active, the AC drive decreases the output frequency based on the deceleration time and stops when the frequency decreases to zero.

■ 1: Coast to stop

After the stop command is active, the AC drive immediately stops the output. The motor will coast to stop based on the mechanical inertia.

F6-16	Rotational speed tracking startup current	Default	20.0%
	Setting Range	1.0% to 50.0%	

It is used to set the current for frequency scanning at rotational speed tracking startup. It is a percentage corresponding to the rated motor current.

F6-17	Rotational speed tracking startup frequency-sweep acceleration time	Default	3.00S
	Setting Range	0.01s to 5.00s	

It refers to the frequency sweep time from 1.05 times maximum frequency to 0 Hz.

F6-18	Rotational speed tracking startup frequency sweep end threshold	Default	19.0%
	Setting Range	1.0% to 50.0%	

The AC drive determines that the rotational speed tracking startup succeeds when the output voltage reaches the end threshold during rotational speed tracking startup.

In general, if the actual speed of the motor is tracked in advance, decrease F6-16 (Rotational speed tracking startup current) and increase F6-18; if the actual speed of the motor has been tracked, increase F6-16 (Rotational speed tracking startup current) and decrease F6-18.

F6-21	Synchronous switching phase offset	Default	2.0
	Setting Range	-90.0 to 90.0°	

It refers to the phase angle difference between mains frequency mains voltage and AC drive output voltage while the AC drive is switching its working mode from variable frequency to mains frequency. The higher the synchronous switching phase offset is, the higher the current is when the AC drive works with mains frequency and variable frequency simultaneously.

F6-22	Synchronous switching phase protection value	Default	1.5
	Setting Range	0.0 to 5.0°	

The AC drive determines that phase locking is successful when the difference between mains voltage phase and AC drive output voltage phase is lower than F6-22 (Synchronous switching phase protection value) for 10 ms.

F6-23	Synchronous switching frequency protection value	Default	1.0 Hz
	Setting Range	0.0 Hz to 5.0 Hz	

The AC drive determines that frequency locking is successful when the difference between mains voltage frequency and AC drive output voltage frequency is lower than F6-23 (Synchronous switching frequency protection value).

F6-24	Synchronous switching timeout time	Default	15.0s
	Setting Range	0.0 to 600.0s	

This parameter is used to set the synchronous switching timeout time. Within the set time, switching timeout fault is generated if synchronous switching is not completed.

F6-30	Quick switching		Default	0
	Setting Range	Ones: Quick up transfer	0: Disabled	
			1: Enabled	
		Tens: Quick down transfer	0: Disabled	
			1: Enabled	

This parameter is applicable for up transfer applications without reactors. When this function is enabled, the AC drive will execute the quick transfer function after receiving the variable frequency to mains frequency command or mains frequency to variable frequency command.

NOTE

This function requires correct setting of switching-on/off signal and feedback signal of the variable frequency contactor and mains frequency contactor.

F6-31	Quick up transfer fine-tuning factor	Default	0.10
	Setting Range	0.01 to 1.00	

This parameter is used to set the speed of quick switching-on frequency and phase locking. It is set to 0.10 by default.

F6-32	Shutdown lead time	Default	0.008s
	Setting Range	0.000 to 0.100s	

This parameter is used to prevent mains and variable frequency branches from simultaneously driving the motor. It is recommended to set the time to 0.5 times mains frequency cycle.

F6-33	Mains frequency contactor 1 switching-on time	Default	0.100s
	Setting Range	F6-32 (Shutdown lead time) to 10.000s	

This parameter is used to compensate the contactor actuation time during quick switching-on. After F6-33 is set to 8.008, the system will automatically switch on/off the mains frequency contactor for three times, and the software automatically saves the most suitable switching-on time in F6-33. Normally, the switching-on time ranges from 40 ms to 140 ms.

The mains frequency feedback DI and mains frequency switching-on DO must be configured onto the I/O board rather than in the PLC.

F6-34	Mains frequency contactor 2 switching-on time	Default	0.100s
	Setting Range	F6-32 (Shutdown lead time) to 10.000s	

For functional descriptions, refer to F6-33 (Mains frequency contactor 1 switching-on time).

F6-35	Mains frequency contactor 3 switching-on time	Default	0.100s
	Setting Range	F6-32 to 10.000s	

For functional descriptions, refer to F6-33 (Mains frequency contactor 1 switching-on time).

F6-36	Mains frequency contactor 4 switching-on time	Default	0.100s
	Setting Range	F6-32 to 10.000s	

For functional descriptions, refer to F6-33 (Mains frequency contactor 1 switching-on time).

Group F7: Time Parameters

F7-06	Total power-on time	Default	0 hours
	Setting Range	0h to 65535h	

This parameter displays the total power-on time of the AC drive. When the power-on time reaches the set power-on time F8-16, the multi-functional DO of the AC drive (24) outputs the ON signal.

F7-07	Total running time	Default	0 hours
	Setting Range	0h to 65535h	

This parameter displays the total running time of the AC drive. When the running time reaches the set running time F8-17, the multi-functional DO of the AC drive (12) outputs the ON signal.

F7-08	Total power consumption	Default	0 MWhs
	Setting Range	0 to 9999 MWhs	

This parameter displays the total power consumption of the AC drive in unit of MWh.

Group F8: Auxiliary Functions

F8-00	Jog running frequency	Default	2.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-01	Jog acceleration time	Default	20.0s
	Setting Range	0.0s to 6500.0s	
F8-02	Jog deceleration time	Default	20.0s
	Setting Range	0.0s to 6500.0s	

These parameters define the set frequency and acceleration/deceleration time of the AC drive in jog mode.

When running in jog mode, the system always starts by means of direct start (F6-00 = 0) and stops by means of decelerate to stop (F6-10 = 0).

F8-03	Acceleration time 2	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	
F8-04	Deceleration time 2	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	
F8-05	Acceleration time 3	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	
F8-06	Deceleration time 3	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	

F8-07	Acceleration time 4	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	
F8-08	Deceleration time 4	Default	Model dependent
	Setting Range	0. 0s to 6500.0s	

HD90S provides 4 groups of acceleration/deceleration time, including F0-17 (Acceleration time 1)/F0-18 (Deceleration time 1) and 3 groups of acceleration/deceleration time mentioned above.

Four groups of acceleration/deceleration time have the same definition. For details, refer to F0-17 (Acceleration time 1) and F0-18 (Deceleration time 1).

Different combinations of multi-functional DI terminals allow switching among these 4 groups of acceleration/deceleration time. For information on how to use them, refer to the descriptions in features of DI terminal of group F4.

F8-09	Frequency jump 1	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-10	Frequency jump 2	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-11	Frequency jump band	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-68	Frequency jump 3	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-69	Frequency jump band 3	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	

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

For details about the jump frequency and amplitude, see *Figure 6-8*.

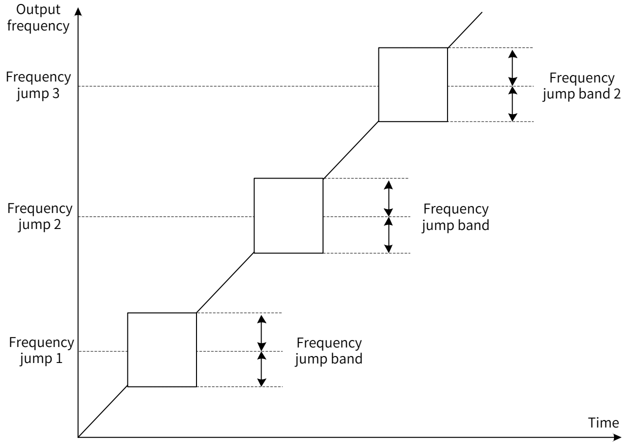


Figure 6-8 Frequency jump function

F8-13	Reverse control		Default	1
	Setting Range	0	Enabled	
		1	Disabled	

This parameter determines whether reverse RUN is allowed. In the applications where reverse RUN is prohibited, set this parameter to 1.

F8-14	Running mode when frequency reference lower than frequency lower limit		Default	0
	Setting Range	0	Run at frequency lower limit	
		1	Stop	
		2	Run at zero speed	

When the set frequency is lower than the frequency lower limit, the operating status of the AC drive can be selected through this parameter. HD90S provides three operating modes to meet different application demands.

F8-15	Droop control	Default	0.00 Hz
	Setting Range	0.00 to 10.00 Hz	

The droop rate allows a minor speed difference between the master station and slave station to avoid conflict between them. This parameter is 0 by default.

The droop rate is adjusted only when both the master station and slave station work in speed control mode. For each driving process, obtain a proper droop rate in practices. It is recommended to set F8-15 to a small value; otherwise, when the load is large, the steady state speed will be significantly reduced. This parameter is not required for the master station, and it is set for the slave station according to the field conditions.

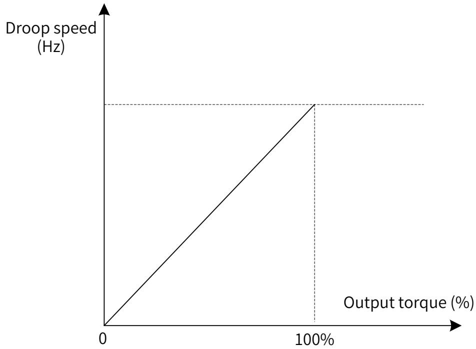


Figure 6-9 Droop speed - output torque curve

Droop speed = Synchronous frequency x Output torque x Droop rate/10

For example, if F8-15 is set to 1.00, synchronous frequency is 50 Hz, and output torque is 50%,

Droop speed = 50 Hz x 50% x 1.00/10 = 2.5 Hz

Actual frequency of the AC drive = 50 Hz – 2.5 Hz = 47.5 Hz

F8-18	Start protection selection		Default	1
	Setting Range	0	Disabled	
		1	Enabled	

This parameter determines whether to enable safety protection at drive startup.

If this parameter is set to 1 and the run command is valid when the AC drive is powered on (for example, the terminal run command is closed before power-on), the AC drive will not respond to this run command. You have to first remove the run command and the AC drive will respond after the run command is valid again.

In addition, if this parameter is set to 1 and the run command is valid when the AC drive is subject to fault reset, the AC drive will not respond to this run command. You have to remove the run command before removing the run protection status.

Setting this parameter to 1 can prevent the risk regarding response of the motor to the run command during power-on or fault reset unknowingly.

F8-19	Frequency detection value (FDT1)	Default	50.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-20	Frequency detection hysteresis (FDT1)	Default	5.0%
	Setting Range	0.0% to 100.0% (FDT1 level)	

When the running frequency is higher than the frequency detection value, the multi-functional DO of the AC drive outputs the ON signal, and when the frequency is a certain value lower than the detection value, the DO will not output the ON signal.

The above-mentioned parameters are used to set the detection value of the output frequency and the hysteresis value after the output action is removed. Among these, F8-20 is the percentage of the hysteresis frequency relative to F8-19 (Frequency detection value). The following figure shows the FDT functions. When the running frequency is higher than F8-19 (Frequency detection value), the AC drive's multi-functional DO terminal 3 (frequency level detection FDT1) outputs the ON signal. When the frequency is lower than F8-20 (Frequency detection hysteresis), the DO terminal stops outputting the ON signal.

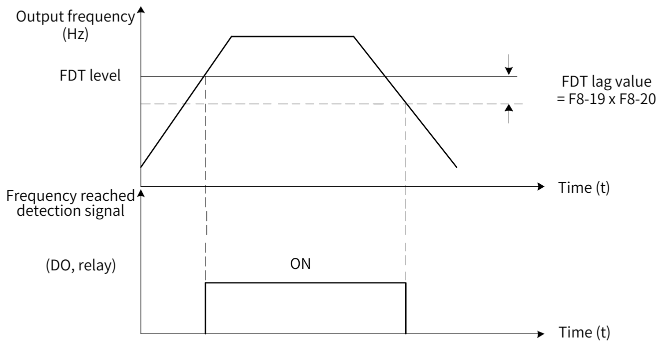


Figure 6-10 FDT level

F8-21	Detection width of target frequency reached	Default	0.0%
	Setting Range	0.0% to 100.0% (max. frequency)	

When the running frequency of the AC drive falls in the range of the target frequency (F8-21), the AC drive's multi-functional DO terminal 4 (frequency reached) outputs the ON signal. This parameter is used to set the detection range of frequency reached. This parameter is the percentage relative to the maximum frequency. The following figure shows the schematic diagram of frequency reached.

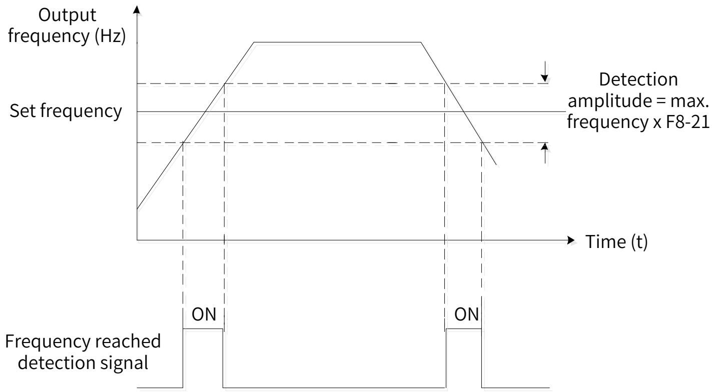


Figure 6-11 Detection range of frequency reached

F8-22	Jump frequency during acceleration/deceleration	Default	0
	Setting Range	0: Disabled; 1: Enabled	

This parameter is used to set the jump frequency to valid or not during acceleration/ deceleration.

If the setting is valid, when the running frequency falls in the range of the jump frequency range, the actual running frequency will hop over the border of the set hopping frequency. Figure 6-12 shows the schematic diagram of valid jump frequency during acceleration/deceleration.

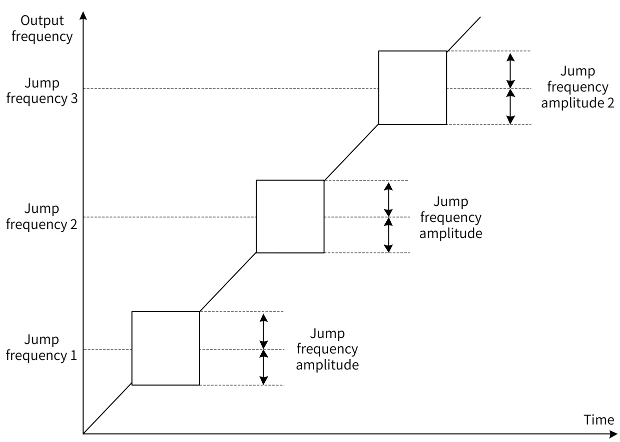


Figure 6-12 Valid jump frequency during acceleration/deceleration

F8-25	Switchover frequency of acceleration time 1 and acceleration time 2	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-26	Switchover frequency of deceleration time 1 and deceleration time 2	Default	0.00 Hz
	Setting Range	0.00 Hz to max. frequency	

This parameter is valid when motor 1 is selected and acceleration/deceleration time switching is not done through the DI terminal. It is used to automatically select a different acceleration/deceleration time when the AC drive is in operation according to the range of the running frequency rather than through the DI terminal.

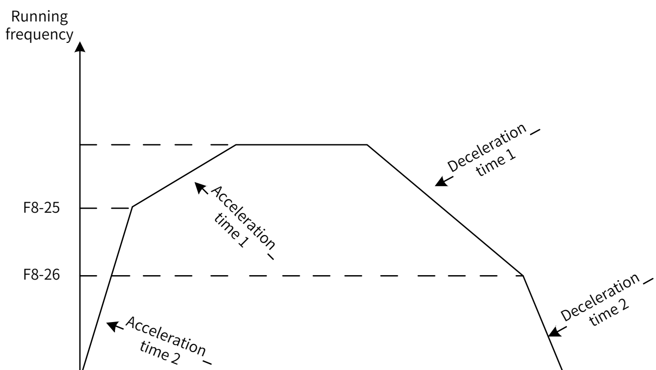


Figure 6-13 Acceleration/deceleration time switchover

Figure 6-13 shows the schematic diagram of acceleration/deceleration time switchover. In the process of acceleration, if the running frequency is lower than F8-25, acceleration time 2 is selected; if the running frequency is higher than F8-25, acceleration time 1 is selected.

In the process of deceleration, if the running frequency is higher than F8-26, deceleration time 1 is selected; if the running frequency is lower than F8-26, deceleration time 2 is selected.

F8-27	Set highest priority to JOG function	Default	0
	Setting Range	0: Disabled; 1: Enabled	

This parameter is used to set whether the highest priority is given to the jog mode.

When the highest priority is given to the jog mode, if a jog command is generated during running, the AC drive will switch to jog mode.

F8-28	Frequency detection value 2 (FTD2)	Default	50.00 Hz
	Setting Range	0.00 Hz to max. frequency	

F8-29	Frequency detection hysteresis (FDT2)	Default	5.0%
	Setting Range	0.0% to 100.0% (FDT2 level)	

When the running frequency is higher than F8-28 (Frequency detection value 2), the AC drive's multi-functional DO terminal 25 (frequency level detection FDT2) outputs the ON signal. When the running frequency is lower than F8-29 (Frequency detection hysteresis), the multi-functional DO terminal 25 stops outputting the ON signal. This frequency detection function is identical to the function of the FDT1. For details, refer to information on FDT1, i.e. instructions in parameters F8-19 [Frequency detection value (FDT1)] and F8-20 [Frequency detection hysteresis (FDT1)].

F8-30	Detection of frequency 1	Default	50.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-31	Detection width of frequency 1	Default	0.0%
	Setting Range	0.0% to 100.0% (max. frequency)	
F8-32	Detection of frequency 2	Default	50.00 Hz
	Setting Range	0.00 Hz to max. frequency	
F8-33	Detection width of frequency 2	Default	0.0%
	Setting Range	0.0% to 100.0% (max. frequency)	

When the output frequency of the AC drive falls within the positive and negative detection amplitude range (F8-31) of any frequency reached detection value (F8-30), the AC drive's multi-functional DO terminal 26 (frequency reached 1) outputs the ON signal.

When the output frequency of the AC drive falls within the positive and negative detection amplitude range (F8-33) of any frequency reached detection value (F8-32), the AC drive's multi-functional DO terminal 27 (frequency reached 2) outputs the ON signal.

HD9X/HD9XS provides two groups of any frequency reached detection parameters which are used to set the frequency value and frequency detection range respectively. Figure 6-14 is the schematic diagram of this function.

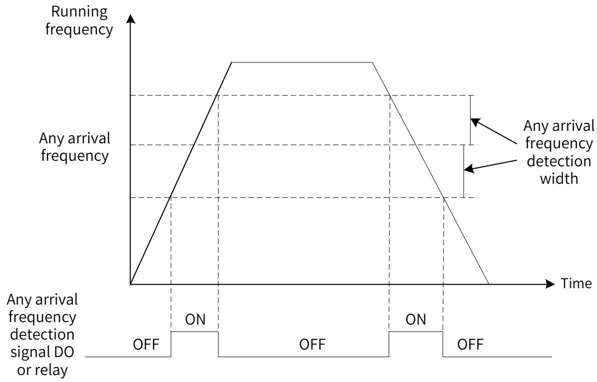


Figure 6-14 Any frequency reached detection

F8-38	Detection level of current 1	Default	100.0%
	Setting Range	0.0% to 300.0% (rated motor current)	
F8-39	Detection width of current 1	Default	0.0%
	Setting Range	0.0% to 300.0% (rated motor current)	
F8-40	Detection level of current 2	Default	100.0%
	Setting Range	0.0% to 300.0% (rated motor current)	
F8-41	Detection width of current 2	Default	0.0%
	Setting Range	0.0% to 300.0% (rated motor current)	

When the output current of the AC drive falls within the positive and negative detection width (F8-39) of any current reached (F8-38), the AC drive's multi-functional DO terminal 28 (any current reached 1) outputs the ON signal.

When the output current of the AC drive falls within the positive and negative detection width (F8-41) of any current reached (F8-40), the AC drive's multi-functional DO terminal 29 (any current reached 2) outputs the ON signal.

HD9X/HD9XS provides two groups of any current reached and detection width parameters, with its functional diagram shown in the figure below.

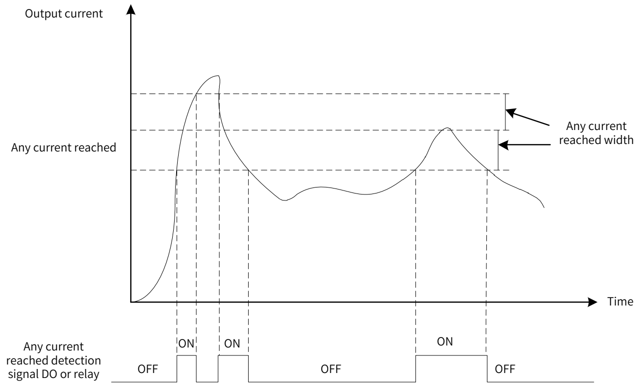


Figure 6-15 Any current reached detection

F8-52	Switching between mains frequency and variable frequency	Default	0
	Setting Range	Ones	0: Disabled
			1: Variable frequency- > mains frequency
			2: Mains frequency- > variable frequency

Setting this parameter to 1 is equivalent to valid variable frequency to mains frequency command given by the terminal. When F8-52 is set to 1, one-key soft start is available for the motor.

F8-53	Auxiliary function selection	Default	H.0011
	Setting Range	0 to FFFF	

It is used to select the auxiliary functions of the AC drive, meeting requirements of various applications. The setting is as follows:

Bit	Meaning of Value	
	0	1
BIT0	MV switch-off upon a fault	Execute MV break when there is a major fault.
BIT3	Continue running when the command source switches.	Stop running when command source switches.
BIT4	Stop if there is no RUN command after fault reset.	Keep the AC drive state before the fault occurrence after fault reset (active when the command source is three-wire control mode or communication).
BIT5	Continue running after derating.	Stop running when derated.
BIT7	Reporting fault F47 if power of the I/O board is abnormal	Not reporting fault F47 if power of the I/O board is abnormal

BIT9	Pre-charge pulse command	Pre-charge level command
BIT11	HMI precharge command	Terminal precharge command
BIT13	HMI local frequency source	Local frequency source depending on main or affiliated frequency source

F8-54	Auxiliary function selection 2	Default	H.0000
	Setting Range	0 to FFFF	

Bit	Meaning of Value	
	0	1
BIT0	Force start catching a motor function after cell bypass.	Start catching a motor function following parameter setting of F6-00 (Start mode) after cell bypass.
BIT6	RS3-Modbus and PROFIBUS interface communication value range from -30000 to 30000	RS3-Modbus and PROFIBUS interface communication percentage range from -10000 to 10000

F8-55	MV power decision proportion	Default	80%
	Setting Range	50% to 100%	

When the input voltage sampling value is higher than this parameter value, MV is applied to the whole machine and the power unit self-check logic starts. When the input voltage is low, you can reduce this parameter value appropriately.

When the input voltage sampling value is lower than the squared value of this parameter, the whole machine is identified as power failure due to MV. The power-off logic is executed without detecting the fault of the power unit again. When the input voltage falls below the squared value of this parameter during running in variable frequency mode, F09- input undervoltage fault is generated.

The other bits are reserved.

F8-57	Auxiliary function selection 2	Default	H.0000
	Setting Range	0 to H.FF12	

Ones: Bypass cabinet type selection

0: No bypass cabinet

1: Manual bypass cabinet

2: Automatic bypass cabinet

F8-58	Allowable switching-on delay	Default	300
	Setting Range	30s to 3600s	

To ensure the service life of devices, do not apply MV frequently to cascaded phase-shifting transformers and power cell bus capacitors. Therefore, F8-58 (Allowable switching-on delay) must be set. When the whole machine is powered off due to high voltage, the system will automatically start counting down and enter the "switching-on delay" mode. The system re-applies high voltage after the timer stops.

F8-59	Input voltage filter time	Default	0.50
	Setting Range	0.00 to 10.00	

This parameter is input voltage exception detection filter time. When the valid value of the sampled input voltage is 5% higher than the rated input voltage and lower than F8-55 (MV power decision proportion), the AC drive reports F160 (Input voltage exception) and outputs the MV breaker enabling signal after the filter time.

When this parameter is set to 0.00, the input voltage exception detection function is disabled.

F8-60	Dehumidification	Default	15
	Setting Range	0 to 120 min	

The HD90S temperature and humidity sampling board can be used to collect ambient temperature and humidity inside the cabinet to check whether there is condensation inside the system and calculate the dehumidification time required. When this parameter is set to a non-zero value, the condensation removal policy is effective. When this parameter is set to 0, the condensation removal policy is forcibly turned off. It is not recommended to set this parameter to 0.

F8-63	Frequency setting proportion	Default	100.0%
	Setting Range	80.0% to 100.0%	

This parameter is used to fine tune the actual output frequency. When this parameter is set to a value lower than 100.0%, AO and displayed output frequency keep unchanged, but the frequency command actually given to the motor is the displayed output frequency x frequency setting proportion.

F8-64	Status hold time after power-off	Default	0s
	Setting Range	0 to 9s	

According to applicable Chinese standards, the MV AC drive must be capable of resuming automatically from transient power-off once powered on. This parameter is used to set the allowable maximum power-off time. When undergoing upper-intermediate power-off and resuming within the set time, the AC drive can automatically resume the running status before the upper power-off occurs.

NOTE

- To resume automatically from transient power-off once powered on, F9-09 (Fault auto reset times) and BIT4 of F8-53 (Auxiliary function selection) should be simultaneously enabled.
- Only communication setting or two-wire terminal command setting are supported.
- It is not applicable for applications with the automatic bypass cabinet.

F8-65	Specific fault output No.	Default	0
	Setting Range	0 to 65535	

When a specific fault (F8-65) occurs in the AC drive, the multi-functional terminal 84 (Designated fault output) is ON. When this parameter is set to 0, the specific fault output function is disabled.

F8-66	Auto switch to mains frequency delay	Default	5.0s
	Setting Range	0.0 to 600.0s	
F8-67	Auto switch to mains frequency signal duration	Default	30.0s
	Setting Range	1.0 to 600.0s	

When configuring the auto bypass cabinet, as the back EMF attenuation time of the motor is different from each other after the AC drive is shut down due to a fault, F8-66 must be set according to the motor's characteristics. When automatically bypassing due to a fault, the AC drive immediately stops and outputs breaking of the outlet contactor and inlet contactor in sequence. After the delay time (F8-66), the multi-functional terminal 61 (Motor 1 automatic transfer to mains frequency) becomes ON.

The output time of the multi-functional terminal 61 (Motor 1 automatic transfer to mains frequency) can be set through F8-67. The continuous output is 30s by default.

When the upper DCS protection logic needs to decide on the mains frequency switching-on according to processing conditions, the multi-functional terminal 61 (Motor 1 automatic transfer to mains frequency) outputs a signal to the DCS. The duration (F8-67) is for the mains frequency switching-on signal.

If the power grid capacity is adequate and the load cannot be stopped, you can set F8-66 to a smaller value according to the processing conditions to quickly apply the mains frequency.

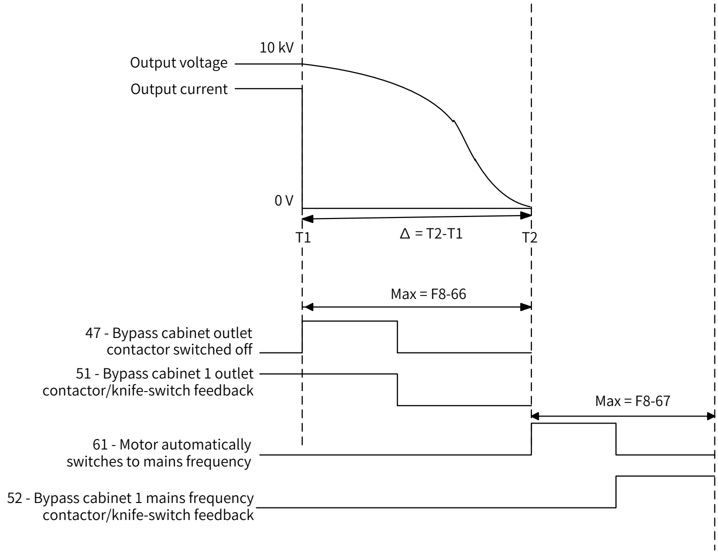


Figure 6-16 Auto switch to mains frequency signal duration

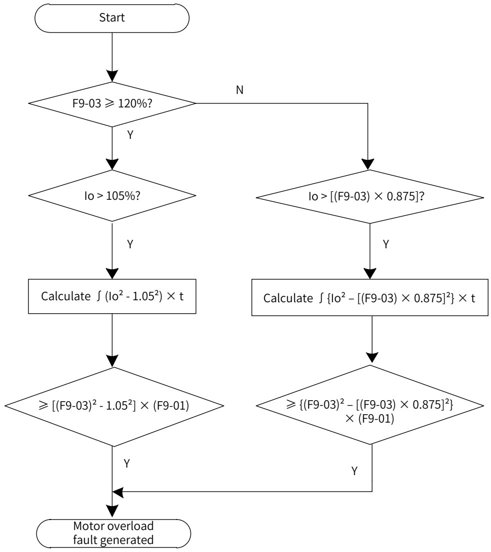
Group F9: Protections

F9-00	Motor overload software protection selection	Default	1
	Setting Range	0 to 1	
F9-01	Motor overload time	Default	60.00s
	Setting Range	0.01s to 600.00s	

F9-00 = 0: Motor overload protection function disabled, risk of motor damage due to overheat

F9-00 = 1: In this case, the AC drive checks whether the motor is overloaded according to the inverse time-lag curve of the motor overload protection.

The timing diagram for the motor overload protection logic is as below:



F9-02	Motor overload pre-warning coefficient	Default	80%
	Setting Range	50% to 100%	

This parameter is used to send a pre-warning signal to the control system through DO before the motor overload protection is activated. This pre-warning coefficient is used to determine the extent of the pre-warning before the motor overload protection is activated. The higher the value is, the less the lead time for this pre-warning is.

F9-03	Motor overload protection threshold	Default	120.0%
	Setting Range	10.0% to 220.0%	

The value 100.0% corresponds to the rated motor current. When the motor current exceeds the rated motor current x F9-00 (Motor overload software protection selection) and the time lasts F9-01 (Motor overload time), the AC drive reports the motor overload fault.

F9-06	Motor overvoltage protection threshold	Default	125.0%
	Setting Range	0.0% to 200.0%	

This parameter sets the motor overvoltage protection threshold to avoid too high back EMF. The value 100.0% corresponds to the rated motor voltage.

F9-08	Clearing time for auto fault reset count	Default	1.0h
	Setting Range	0.1 to 1000.0h	
F9-09	Fault auto reset times	Default	3
	Setting Range	0 to 20	

F9-10	DO action during auto fault reset	Default	0
	Setting Range	0: Not act 1: Act	
F9-11	Time interval of fault auto reset	Default	2.0s
	Setting Range	0.1s to 100.0s	
F9-79	Running status selection during auto fault reset	Default	0
	Setting Range	0: Hold 1: Not hold	

When F9-09 is enabled for the AC drive, it is used to set the auto reset count. F9-11 is the waiting time from fault of the AC drive to auto fault reset. When the auto fault reset times exceeds F9-09, the AC drive keeps in the fault state.

After the system works, with every F9-08 clearing time for auto fault reset count, the accumulated auto fault reset times will be automatically cleared.

According to F9-10 setting, you can choose not to output fault DO signal before auto fault reset attempts are used up.

According to F9-79 setting, you can choose to keep the DO signal unchanged before auto fault reset attempts are used up.

F9-12	Input phase loss protection selection	Default	1
	Setting Range	0 to 1	

This parameter is used to select whether to enable the input phase loss protection function.

F9-13	Output phase loss protection selection	Default	1
	Setting Range	0 to 1	

This parameter is used to select whether to enable the output phase loss protection function.

F9-14	Input current imbalance threshold	Default	40.0%
	Setting Range	0.0% to 100.0%	

The input current imbalance fault is used to detect the negative sequence component of the input current. The input current imbalance fault is generated when the negative sequence component of the input current exceeds F9-14 for 500 ms.

F9-15	Output current imbalance threshold	Default	40.0%
	Setting Range	0.0% to 100.0%	

The output current imbalance fault is used to detect the negative sequence component of the output current. The output current imbalance fault is generated when the negative sequence component of the output current exceeds F9-15 for 500 ms.

F9-17	Input voltage imbalance threshold	Default	40.0%
	Setting Range	0.0% to 100.0%	

The input voltage imbalance fault is used to detect the negative sequence component of the input voltage. The input voltage imbalance fault is generated when the negative sequence component of the input voltage exceeds F9-17 for 500 ms.

F9-24	Transformer primary connector setting	Default	0
	Setting Range	-1 to 1 -1: -5% contact 0: 0% contact 1: 5% contact	

When the neutral point of the phase-shifting transformer of the AC drive is changed to -5% or 5%, F9-24 should be set accordingly. In general, F9-24 is set accordingly only when the location of the neutral contact of the transformer is changed. Incorrect setting of F9-24 will lead to calculation deviation of input voltage and input power.

F9-27	Output voltage imbalance threshold	Default	40.0%
	Setting Range	0.0% to 100.0%	

The output voltage imbalance alarm is used to detect the negative sequence component of the output voltage. The output voltage imbalance alarm is generated when the negative sequence component of the output voltage exceeds F9-27 for 500 ms. The output voltage imbalance is an alarm level by default that can be set by the thousand's digit of F9-48 (Fault protection action selection 2).

F9-28	Low output impedance fault threshold	Default	8.0%
	Setting Range	0.0% to 100.0%	

The low output impedance fault is used to detect the negative sequence component of the output voltage. The low output impedance fault is generated when the negative sequence component of the output voltage exceeds F9-28 for 500 ms.

F9-30	AC drive overcurrent protection threshold	Default	150.0%
	Setting Range	0.0% to 180.0% (The value 100.0% corresponds to the rated output current of the AC drive.)	

During the drive running, if the instantaneous output current is greater than Rated output current of AC drive x F9-30, the AC drive reports the overcurrent fault. The value 100.0% corresponds to the rated output current of the AC drive.

F9-31	AC drive maximum output current	Default	120.0%
	Setting Range	0.0% to (F9-30-20.0)% (The value 100.0% corresponds to the rated output current of the AC drive.)	

This parameter sets the maximum output current during the drive normal running.

The setting of F9-31 is related to F9-30 (AC drive overcurrent protection threshold). When the setting of F9-30 (AC drive overcurrent protection threshold) is equal to or smaller than 20.0%, the setting range of F9-31 is 0.0% to 180.0%. When the setting of F9-30 (AC drive overcurrent protection threshold) is larger than 20.0%, the setting range of F9-31 is 0.0% to (F9-30 - 20.0%).

The value 100.0% corresponds to the rated output current of the AC drive.

F9-59	Power dip ride-through	Default	0
	Setting Range	0: Disabled 1: Enabled	
F9-38	Power dip ride-through proportional gain	Default	0.000
	Setting Range	0.000 to 1.000	
F9-39	Power dip ride-through integral gain	Default	0.000
	Setting Range	0.000 to 15.000	
F9-60	Power dip ride-through voltage recovery acceleration time	Default	60.0s
	Setting Range	0.0s to 6500.0s	
F9-61	Power dip ride-through voltage recovery deceleration time	Default	60.0s
	Setting Range	0.0s to 6500.0s	

These parameters are used for such loads as the primary fans in the power plant, category 1 auxiliary equipment (such as the coal feeder) in the power plant, cooling fan of the main transformer in the power substation, and valve cooling equipment in the converter station. After these parameters are set, the load can continue to work when a voltage dip occurs on the input power grid.

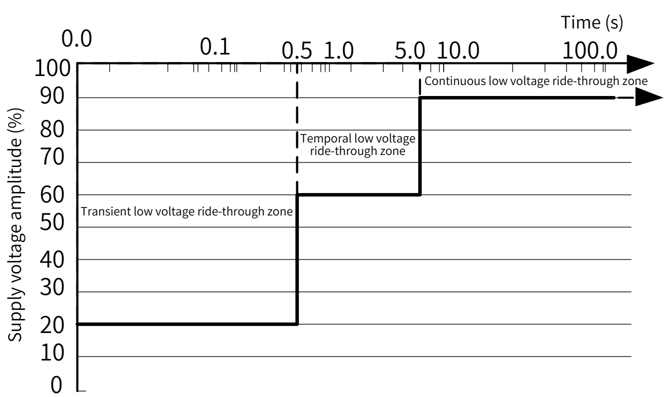


Figure 6-17 Voltage drop specifications

Table 6-1 Power dip ride-through specifications

Input Voltage (Rated Voltage of the AC Drive)	Duration of Abnormal Voltage (ms)	Requirements within This Duration
(0%, 20%)	(0,350]	The AC drive does not stop outputting square wave but generates a system alarm and minimizes the motor speed drop.
[20%, 60%)	(0,500]	
[60%, 80%)	(0,5000]	The AC drive runs continuously with slight speed drop during with-load running and generates a system alarm.
[80%, 120%)	/	The AC drive runs continuously and the speed does not drop.

F9-40	Locked-rotor frequency	Default	20.0 Hz
	Setting Range	5.0 to 50.0 Hz	
F9-41	Locked-rotor time	Default	20s
	Setting Range	0 to 400	

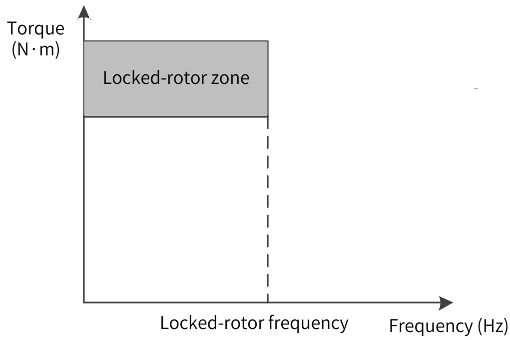


Figure 6-18 Locked-rotor zone of the motor

If all the following conditions are met, the motor locked-rotor fault is valid:

1) The output frequency of the AC drive is lower than the locked-rotor frequency set by F9-40.

2) The output torque of the AC drive reaches the torque limit. The output torque limit of the AC drive is determined by F9-31 (AC drive maximum output current). The torque limit is a basic parameter setting of the AC drive that is used to set the maximum output torque of the AC drive. The torque limit parameter indirectly affects the detection of the motor locked-rotor fault, but it is not used as the setting parameter for the motor locked-rotor fault.

3) The duration exceeds the locked-rotor time set by F9-41.

When F9-41 locked-rotor time is set to 0s, the motor locked-rotor fault detection function is disabled.

F9-42	Motor excitation fault protection threshold	Default	40.0%
	Setting Range	0.0 to 100.0	
F9-43	Motor excitation fault detection time	Default	20s
	Setting Range	0 to 400	

In vector control mode, if the difference between flux instruction value and flux feedback value exceeds F9-42 and the duration exceeds F9-43, the AC drive reports the motor excitation fault.

F9-47	Fault protection action selection 2	Default	00000
	Setting Range	Ones: motor overload (F11) 0: Coast to stop 1: Shutdown as set 2: Keep running Tens: Input phase loss (F12) (same as unit's digit) Hundreds-: Output phase loss (F13) (same as unit's digit) Thousands-: External fault (F15) (same as unit's digit) Ten thousands-: communication fault (F16) (same as unit's digit)	
F9-48	Fault protection action selection 1	Default	22201
	Setting Range	Ones-: encoder fault (F20) 0: Coast to stop 1: Switches to SVC1, keep running 2: Switches to SVC1, shutdown as set 3: Switches to SVC2, keep running 4: Switches to SVC2, shutdown as set Tens-: parameter W/R error (F21) 0: Coast to stop 1: shutdown as set Tens-: Input voltage imbalance (F120) 0: Coast to stop 1: Shutdown as set 2: Keep running Thousands-: Output voltage imbalance (F121) (same as hundred's digit) Ten thousands-: DP card communication fault (F52) (same as hundred's digit)	

F9-49	Fault protection action selection 3	Default	00000
	Setting Range	Ones-: User-defined fault 1 (F27) 0: Coast to stop 1: Shutdown as set 2: Keep running Tens-: User-defined fault 2 (F28) (same as unit's digit) Hundreds-: Accumulated power-on timeout fault (F29) (same as unit's digit) Thousands-: Load loss fault (F30) 0: Coast to stop 1: Decelerate to stop 2: Decelerate to 7% of the frequency rating of the motor and keep running; automatically recover to the set frequency and run if load loss does not happen Ten thousands-: PID feedback loss during running (F31) (same as unit's digit)	
F9-50	Fault protection action selection 4	Default	00000
	Setting Range	Ones-: Too large speed deviation (F42) 0: Coast to stop 1: Shutdown as set 2: Keep running Tens-: Motor overspeed (F43) (same as unit's digit) Hundreds-: Magnetic pole location detection failed (F51) (same as unit's digit) Thousand' position-: Reserved Ten thousands-: PLC communication error (F39) (same as unit's digit)	
F9-51	Fault protection action selection 5	Default	01012
	Setting Range	Ones-: Switching timeout fault (F163) 0: Coast to stop 1: Shutdown as set 2: Keep running Tens-: Power cell communication fault (F61) 0: Immediate shutdown and MV breaker enabled 1: Coast to stop Hundreds-: Transformer secondary side short-circuit (F93) (same as the tens position) Thousands-: Too large AC drive loss (F97) (same as the tens position) Ten thousands-: Motor cooling fan (F165) (same as unit's digit)	

F9-54	Frequency selection for continuing to run upon fault	Default	1
	Setting Range	0: Current running frequency 1: Set frequency 2: Frequency upper limit 3: Frequency lower limit 4: Alternate frequency active during an exception	
F9-55	Backup frequency upon abnormality	Default	100.0%
	Setting Range	60.0% to 100.0% (max. frequency)	

When "Coast to stop" is selected, the AC drive displays F*** and shuts down directly.

When "Shutdown as set" is selected, the AC drive displays A***, shuts down as set, and shows F*** after shutdown.

When "Keep running" is selected, the AC drive keeps running and displays A***. The running frequency is set by F9-54.

When F9-54 is set to 4 (Alternate frequency active during an exception), the AC drive runs by using the value (percentage relative to the maximum frequency) set by F9-55 as the target frequency.

F9-67	Overspeed detection level	Default	20.0%
	Setting Range	0.0% to 50.0% (max. frequency)	
F9-68	Overspeed detection time	Default	5.0s
	Setting Range	0.0s to 60.0s	

Note that this function is valid only when the AC drive runs in the FVC mode.

When the AC drive detects that the feedback frequency of the motor exceeds the maximum frequency, the resulting value beyond the range of the maximum frequency is higher than the overspeed detection value F9-67, and the duration is longer than the overspeed detection time F9-68, the AC drive is faulty or generates F43 (motor overspeed) alarm and deals with the fault or alarm according to its fault protection settings.

When the overspeed detection time is 0.0s, the overspeed fault detection is disabled.

F9-69	Detection level of speed deviation excessive	Default	20.0%
	Setting Range	0.0% to 50.0% (max. frequency)	
F9-70	Detection time of speed deviation excessive	Default	0.0s
	Setting Range	0.0s to 60.0s	

When the AC drive runs in the FVC mode, the deviation higher than the high speed deviation detection value F9-69 is detected between the motor feedback speed and the set frequency, and the duration is longer than the high speed deviation detection time F9-70, the AC drive is faulty or generates F42 (high speed deviation) alarm and deals with the fault or alarm according to its fault protection settings. When the high speed deviation detection time is 0.0s, the high speed deviation fault detection is disabled.

When the AC drive runs in SVC mode, out-of-phase is detected between the motor feedback speed and the set frequency, and the duration is longer than the high speed deviation detection time F9-70, the AC drive is faulty or generates F42 (high speed deviation) alarm and deals with the fault or alarm according to its fault protection settings.

F9-71	Fan off delay time	Default	0s
	Setting Range	0s to 36000s	

The multi-functional terminal 62 (fan auto-function) outputs ON signals to turn on the fan in dehumidification mode before the system is applied with MV or after MV is applied. After the MV is cut off, the terminal outputs OFF signals to automatically turn off the fan with a delay set by F9-71 (Fan off delay time).

The fan auto-run function is optional for the first generation of HD9x series. To enable this function, set BIT8 of F8-53 to 1.

As a standard, the MV AC drive is configured with the fan auto-run function, without the need of setting the enable control bit of F8-53.

F9-72	Auxiliary function selection 1	Default	H.003E
	Setting Range	0 to FFFF	

This parameter is used to enable or disable auxiliary function selection 1 and some fault detection functions of the AC drive. Settings are shown as below:

BIT0	Sampling phase sequence calculation	0: Disabled
		1: Enabled (same as F0-01 = 3)
BIT1	Transformer overload protection selection	0: Inverse time-lag table
		1: Inverse time-lag curve
BIT2	Current detection fault F18	0: Disabled
		1: Enabled
BIT3	Overvoltage suppression	0: Disabled
		1: Enabled
BIT4	Input sampling wiring error A181	0: Disabled
		1: Enabled
BIT5	Transformer no-load current exception F35	0: Disabled
		1: Enabled

BIT0: The sampling phase sequence calculation function refers to calculation of input voltage phase sequence, output voltage phase sequence, input current phase sequence and output current phase sequence. The phase sequence is displayed by UA-30 to UA-33. 120° indicates positive sequence and -120° indicates negative sequence.

BIT1: The inverse time-lag of transformer overload protection is as shown below:

Input Current	Overload Time
(1.2,1.5)	60s
(1.5,1.65)	20s
More than 1.65x	5s

The default setting is the inverse time-lag protection, 1.2x for 1 minute and once every 10 minutes.

For HD92-R, the setting is 1.5x for 1 minute and once every 10 minutes.

BIT2: The current detection fault refers to detection of the output current sampling Hall circuit. The fault code is F18 (current detection fault).

BIT3: The overvoltage suppression function refers to the overvoltage suppression function to prevent power cell bus overvoltage when the AC drive is decelerating. Disabling this function may lead to F66 (power unit overvoltage fault).

BIT4: The input sampling wiring error alarm refers to automatic detection of input sampling wiring errors including three-phase input voltage RST sampling line and two-phase RT input current sampling line when the AC drive is in operation.

BIT5: The enable switch for transformer no-load current exception fault detection. When the AC drive is shut down, if the input current is 30% higher than the rated input current of the AC drive and this situation lasts for more than 10s, F35 (transformer no-load current exception) is reported. This fault is identified as a major MV breaker enabling fault.

F8-24	Fan fault delay time	Default	5s
	Setting Range	0s to 60s	
F9-76	Allowable fan fault count	Default	3
	Setting Range	0 to 8	
F9-77	Maximum output current limit 1 upon fan fault	Default	70.0%
	Setting Range	0.0 to 100.0%	
F9-78	Maximum output current limit 2 upon fan fault	Default	70.0%
	Setting Range	0.0 to 100.0%	

This parameter is used by the AC drive to detect the feedback exception of the fan on the top of the cabinet. When the feedback exception exceeds this threshold continuously, F59 (fan fault) is generated from the system and effective MV breaker enabling is output. A fan redundancy function is optional for the HD9X/HD9XS series. Operating statuses of all fans equipped to the system as a standard are separately fed back to the control system for real-time detection. When the fan fault count does not exceed F9-76 and this situation lasts for F8-24 (Fan fault delay time), the system generates A89 (fan alarm) and limits the maximum output current according to the number of fan exceptions. If there is 1 fan fault, the system is derated according to the minimum value of F9-77 and F9-31 (AC drive maximum output current); if there are 2 fan faults, the system is derated according to the minimum value of F9-78 and F9-31 (AC drive maximum output current); if there are more than 2 fan exceptions, the system is derated according to the minimum value of $(F9\text{-}78)^2$ and F9-31 (AC drive maximum output current).

When the number of faulty fans exceeds F9-76 (Allowable fan fault count) and this situation lasts for F8-24 (Fan fault delay time), the AC drive generates F59 (fan fault) and outputs an MV breaker enabling signal, breaks the upper-level incoming line circuit breaker to prevent overheat and protect the phase-shifting transformer and power devices.

Group FA: PID Function

The PID (Proportional + Integral + Derivative) function uses system feedback for closed-loop control of variables such as flow, pressure, temperature, and so on. The purpose of the PID control is to keep the drive output frequency as close as possible to a desired reference through the PID adjustment.

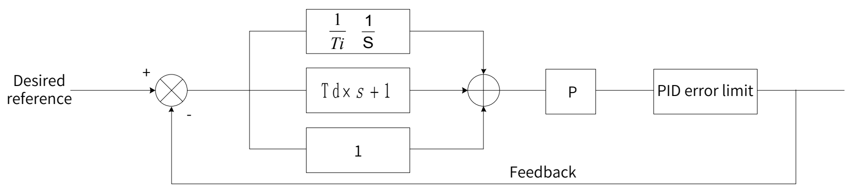


Figure 6-19 PID function

FA-00	PID reference source		Default	0
	Setting Range	0	FA-01	
		1	AI1	
		2	AI2	
		3	AI3	
		5	Communication setting	
		6	Multi-reference setting	
		7	AI4	
FA-01	PID digital setting		Default	50.0%
	Setting Range		0.0% to 100.0%	

FA-00 is used to select the setting channel of the PID reference.

The PID setting is a relative value and ranges from 0.0% to 100.0%. The PID feedback is also a relative value. The purpose of PID control is to make the PID feedback as close as possible to the PID reference.

FA-02	PID feedback source		Default	0
	Setting Range	0	AI1	
		1	AI2	
		2	AI3	
		3	AI1 - AI2	
		5	Communication setting	
		6	AI1+AI2	
		7	Maximum (|AI1|, |AI2|)	
		8	Minimum (|AI1|, |AI2|)	
		9	AI4	

This parameter selects the feedback signal channel of process PID. The PID feedback is a relative value and ranges from 0.0% to 100.0%.

FA-03	PID operation direction		Default	0
	Setting Range	0	Forward	
		1	Reverse	

Forward: When the feedback signal of PID is lower than the set value, the AC drive increases the output frequency for applications such as winding tension control.

Reverse: When the feedback signal of PID is lower than the set value, the AC drive decreases the output frequency for applications such as unwinding tension control.

Note that this function is affected by the DI function 35 (PID action direction reverse).

FA-04	PID reference and feedback range	Default	1000
	Setting Range	0 to 65535	

The PID's set feedback range is a dimensionless unit used for PID's set display U0-15 (PID reference) and PID's feedback display U0-16 (PID feedback).

The relative value of PID's set feedback is 100.0%, corresponding to the set feedback range FA-04. For example, if FA-04 is set to 2000, when PID is 100.0%, the PID's set display U0-15 (PID reference) is 2000.

FA-05	Proportional gain Kp1	Default	20.0
	Setting Range	0.0 to 100.0	
FA-06	Integral time Ti1	Default	2.00s
	Setting Range	0.01s to 10.00s	
FA-07	Differential time Td1	Default	0.000s
	Setting Range	0.00s to 10.000s	

■ Proportional gain (Kp1)

It decides the regulating intensity of the PID regulator. The higher Kp1 is, the greater the regulating intensity is. The value 100.0 indicates that when the deviation between PID feedback and PID setting is 100.0%, the adjustment amplitude of the PID regulator on the output frequency reference is the maximum frequency.

■ Integral time (Ti1)

It decides the integral regulating intensity of the PID function. The shorter the integral time is, the greater the regulating intensity is. When the deviation between PID feedback and PID reference is 100.0%, the integral regulator performs continuous adjustment for the time set in FA-06. Then the adjustment amplitude reaches the maximum frequency.

■ Derivative time (Td1)

It decides the regulating intensity of the PID regulator on the deviation change. The longer the derivative time is, the greater the regulating intensity is. Differential time is the time within which the feedback value change reaches 100.0%, and then the adjustment amplitude reaches the maximum frequency.

FA-08	PID output limit in reverse direction	Default	2.00 Hz
	Setting Range	0.00 to max. frequency	

In some cases, only when the PID output frequency is a negative value (i.e. AC drive reversed), the PID set value and PID feedback can be equal. However, too high reverse frequency is not allowed in some applications. FA-08 is used to define the reverse frequency upper limit.

NOTE

◆ When balance conditions cannot be met even after the on-site PID is adjusted to the frequency lower limit and running below the frequency lower limit is not allowed, FA-08 must be set to 0.00 Hz.
◆ When the frequency source is main+auxiliary (PID), PID reverse cut-off frequency upper limit is not limited. That is, FA-08 is invalid.

FA-09	PID deviation limit	Default	0.0%
	Setting Range	0. 0% to 100.0%	

When the difference between PID set value and feedback value is less than FA-09, PID adjustment stops. In such a way, the output frequency keeps unchanged when the difference between the set value and feedback value is small. This is very helpful for some closed-loop control applications.

FA-10	PID differential limit	Default	0.10%
	Setting Range	0.00% to 100.00%	

In a PID regulator, the role of differential is rather sensitive such that it easily leads to system oscillation. For this reason, the PID differential is generally limited to a small range. FA-10 is used to set the range of PID differential output.

FA-11	PID reference change time	Default	0.00s
	Setting Range	0.00s to 650.00s	

PID's set change time refers to the time required for changing the PID's set value from 0.0% to 100.0%.

The PID set value changes (if any) linearly according to the set change time to reduce the adverse effect of sudden change of the set value on the system.

FA-12	PID feedback filter time	Default	0.00s
	Setting Range	0.00s to 60.00s	
FA-13	PID output filter time	Default	0.00s
	Setting Range	0.00s to 60.00s	

FA-12 is used to filter the PID feedback value. This filter is favorable to reduce the effect of interference on the feedback value, but it may degrade the response capability of the process closed-loop system.

FA-13 is used to filter the PID output frequency. This filter is favorable to weaken the sudden change of output frequency of the AC drive, but it may degrade the response capability of the process closed-loop system.

FA-15	Proportional gain Kp2		Default	20.0
	Setting Range		0.0 to 100.0	
FA-16	Integral time Ti2		Default	2.00s
	Setting Range		0.01s to 10.00s	
FA-17	Differential time Td2		Default	0.000s
	Setting Range		0.00 to 10.000	
FA-18	PID parameter switchover condition		Default	0
	Setting Range	0	No switchover	
		1	Switchover using DI	
		2	Auto switchover based on deviation	
FA-19	PID deviation 1 for auto switchover		Default	20.0%
	Setting Range		0.0% to FA-20	
FA-20	PID deviation 2 for auto switchover		Default	80.0%
	Setting Range		FA-19 to 100.0%	

In some application scenarios, a group of PID parameters may fail to meet demands for the whole running process. PID parameters should be used depending on their intended use.

These parameters are used for switchover between two groups of PID parameters, of which the setting method for FA-15 to FA-17 is similar to that for FA-05 (Proportional gain Kp1) to FA-07 (Differential time Td1).

Two groups of PID parameters can be switched by using the multi-functional DI terminal, or automatically switched according to PID deviation.

If the multi-functional DI terminal is selected, the multi-functional terminal function selection must be set to 43 (PID parameter switchover). Select parameter group 1 (FA-05 to FA-07) when the terminal is invalid and parameter group 2 (FA-15 to FA-17) when the terminal is valid.

When automatic switchover is selected, if the absolute value of the deviation between the set value and the feedback value is less than FA-19, PID deviation 1 for auto switchover, parameter group 1 is selected for the PID parameter. If the absolute value of the deviation between the set value and the feedback value is higher than FA-20, PID deviation 2 for auto switchover, parameter group 2 is selected for PID parameter. When the deviation between the set value and feedback value falls in between switchover deviation 1 and switchover deviation 2, PID parameter is the linear interpolation value for two groups of PID parameters, as shown in Figure 6-20.

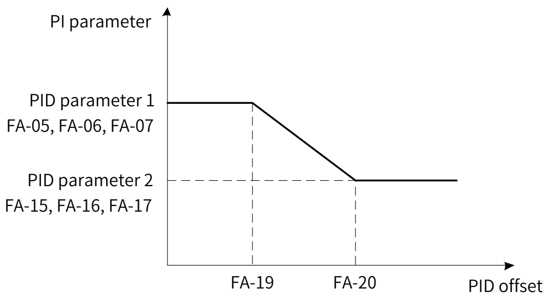


Figure 6-20 PID parameter switchover

FA-21	PID initial value	Default	0.0%
	Setting Range	0.0% to 100.0%	
FA-22	PID initial value active time	Default	0.00s
	Setting Range	0.00s to 650.00s	

When the AC drive is started, the PID output is fixed to be the PID initial value FA-21. PID starts calculation of closed-loop regulation only after the PID initial value active time FA-22 is elapsed. Figure 6-21 is the functional diagram of the PID initial value.

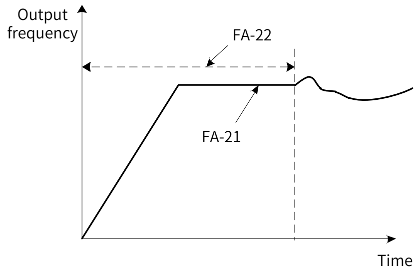


Figure 6-21 PID initial value

FA-23	Maximum deviation between two PID outputs in forward direction	Default	1.00%
	Setting Range	0.00% to 100.00%	
FA-24	Maximum deviation between two PID outputs in reverse direction	Default	1.00%
	Setting Range	0.00% to 100.00%	

These parameters are used to limit the difference between two PID outputs (at an interval of 2 ms) to suppress too fast change of PID output and therefore make the AC drive stable.

FA-23 and FA-24 correspond to the maximum values of the absolute value of output deviation in forward and reverse directions respectively.

FA-25	PID integral property		Default	00
	Setting Range	Ones	Integral separation	
		0	Invalid	
		1	Valid	
		Tens	Whether to stop integration when the output reaches the limit	
		0	Continue integration	
		1	Stop integration	

Integral separation:

If integral separation is set to valid, when integration suspension (function 22) is valid for the multi-functional positional input (DI), PID integration calculation stops. In this case, only proportional and differential actions are valid for PID.

When integral separation is set to invalid, the integral separation is invalid regardless of whether the multi-functional DI is valid.

Whether to stop integration when the output reaches the limit:

After the PID calculation output reaches the maximum or minimum value, you are free to choose to stop integral action or not. If stop integration is selected, PID integration calculation stops, which may be favorable to reduce the overshoot of PID.

FA-26	Detection level of PID feedback loss	Default	0.0%
	Setting Range	0.0%: No detection 0.1% to 100.0%	
FA-27	Detection time of PID feedback loss	Default	0.0s
	Setting Range	0.0s to 20.0s	

These parameters are used to check whether PID feedback is lost.

When the PID feedback value is less than detection level of feedback loss FA-26 and this situation persists beyond detection time of PID feedback loss FA-27, the AC drive reports F31 and deals with the error according to the selected troubleshooting method.

FA-28	PID calculation at stop		Default	0
	Setting Range	0	Disabled	
		1	Enabled	

This parameter is used to choose whether to continue PID calculation when the AC drive is shut down. In general, PID calculation stops during shutdown.

Group Fb: Fault Records

Fb-00	6th fault type	0 to 199
Fb-01	7th fault type	
Fb-02	8th fault type	
Fb-03	9th fault type	
Fb-04	10th (latest) fault type	

These parameters record the type of the latest five faults of AC drive. The value 0 indicates that there is no fault. For probable causes and solution of each fault, refer to "7 Troubleshooting".

Fb-05	Frequency upon 10th (latest) fault	Frequency at fault occurrence
Fb-06	Output current upon 10th (latest) fault	Output current at fault occurrence
Fb-07	Output voltage upon 10th (latest) fault	Output voltage at fault occurrence
Fb-08	Input current upon 10th (latest) fault	Input current at fault occurrence
Fb-09	Input voltage upon 10th (latest) fault	Input voltage at fault occurrence
Fb-10	AC drive state upon 10th (latest) fault	Drive running state at fault occurrence
Fb-11	Fault prompt of 10th (latest) fault	Fault prompt at fault occurrence

Fb-15	Frequency upon 9th fault	The same as that of Fb-05 to Fb-11
Fb-16	Output current upon 9th fault	
Fb-17	Output voltage upon 9th fault	
Fb-18	Input current upon 9th fault	
Fb-19	Input voltage upon 9th fault	
Fb-20	AC drive state upon 9th fault	
Fb-21	Fault prompt of 9th fault	
Fb-25	Frequency upon 8th fault	The same as that of Fb-05 to Fb-11
Fb-26	Output current upon 8th fault	
Fb-27	Output voltage upon 8th fault	
Fb-28	Input current upon 8th fault	
Fb-29	Input voltage upon 8th fault	
Fb-30	AC drive state upon 8th fault	
Fb-31	Fault prompt of 8th fault	

Fb-35	Frequency upon 7th fault	The same as that of Fb-05 to Fb-11
Fb-36	Output current upon 7th fault	
Fb-37	Output voltage upon 7th fault	
Fb-38	Input current upon 7th fault	
Fb-39	Input voltage upon 7th fault	
Fb-40	AC drive state upon 7th fault	
Fb-41	Fault prompt of 7th fault	
Fb-45	Frequency upon 6th fault	The same as that of Fb-05 to Fb-11
Fb-46	Output current upon 6th fault	
Fb-47	Output voltage upon 6th fault	
Fb-48	Input current upon 6th fault	
Fb-49	Input voltage upon 6th fault	
Fb-50	AC drive state upon 6th fault	
Fb-51	Fault prompt of 6th fault	
Fb-55	5th fault type	0 to 199
Fb-56	Fault prompt of 5th fault	
Fb-57	4th fault type	
Fb-58	Fault prompt of 4th fault	
Fb-59	3th fault type	
Fb-60	Fault prompt of 3rd fault	
Fb-61	2nd fault type	
Fb-62	Fault prompt of 2nd fault	
Fb-63	1st fault type	
Fb-64	Fault prompt of 1st fault	

Group FC: Multi-Reference and Simple PLC Function

The multi-reference of the MV AC drive can be used as multi-speed and simple PLC source. It is a relative value and ranges from -100.0% to 100.0%.

The simple PLC function is completely different from the user programmable function. It can only complete simple combination of multi-reference.

FC-00	Reference 0	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-01	Reference 1	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-02	Reference 2	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-03	Reference 3	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-04	Reference 4	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-05	Reference 5	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-06	Reference 6	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-07	Reference 7	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-08	Reference 8	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-09	Reference 9	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-10	Reference 10	Default	0.0 Hz
	Setting Range	-100.0% to 100.0%	
FC-11	Reference 11	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-12	Reference 12	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-13	Reference 13	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-14	Reference 14	Default	0.0%
	Setting Range	-100.0% to 100.0%	
FC-15	Reference 15	Default	0.0%
	Setting Range	-100.0% to 100.0%	

Multi-reference is suitable for multiple scenarios, such as being used as a frequency source or setting source for simple PLC.

In these application scenarios, the dimension for a multi-reference is a relative value ranging from -100.0% to 100.0%. When being used as a frequency source, it is the percentage relative to the maximum frequency F0-10 (Max. frequency). As the PLC set value is originally a relative value, multi-reference requires no dimension conversion when being used as a setting source for PLC.

Multi-reference must be selected according to different statuses of the multi-functional DI. For details, refer to the instructions in *"Group F4: Input Terminals"*.

FC-16	Simple PLC running mode		Default	0
	Setting Range	0	Stop after running for one cycle	
		1	Keep final values after running for one cycle	
		2	Repeat after running for one cycle	

The simple PLC function can be used as a frequency source or a voltage source for VF separation.

Figure 6-22 shows the schematic diagram of using the simple PLC as a frequency source. When the simple PLC is used as a frequency source, the positive or negative property of FC-00 (Reference 0) to FC-15 (Reference 15) determines the running direction. If parameter values are negative, the AC drive runs in a reverse direction.

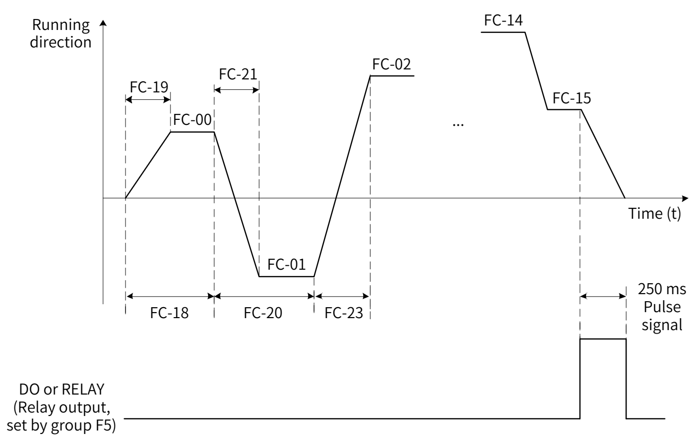


Figure 6-22 Simple PLC

When being as a frequency source, the PLC has three running modes. However, when being as a VF separation voltage source, these three running modes are unavailable. These three running modes are shown as below:

0: Stop after running for one cycle

The AC drive automatically shuts down after a single cycle and can be started only when a run command is given again.

1: Keep final values after running for one cycle

The AC drive automatically retains the last running frequency and direction after a single cycle.

2: Repeat after running for one cycle

The AC drive automatically proceeds to the next cycle after a cycle, and shuts down after a shutdown command is given.

FC-17	Simple PLC retentive selection		Default	00
	Setting Range	Ones	Retentive selection upon power failure	
		0	Non-retentive upon power failure	
		1	Retentive upon power failure	
		Tens	Retentive selection upon shutdown	
		0	Non-retentive upon power failure	
		1	Retentive upon power failure	

PLC retentive upon power failure indicates that the running phase and running frequency of the PLC before power failure are memorized and the PLC is resumed from the last memorized phase upon power-on. If non-retentive is selected, then the PLC is started from scratch upon power up.

PLC retentive upon shutdown refers to the fact that the last running phase and running frequency of the PLC are memorized and the PLC is resumed from the last memorized phase on the next boot. If non-retentive is selected, the PLC process is restarted upon startup.

FC-18	Running time of simple PLC reference 0	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-19	Acceleration/Deceleration time of simple PLC reference 0	Default	0
	Setting Range	0 to 3	
FC-20	Running time of simple PLC reference 1	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-21	Acceleration/Deceleration time of simple PLC reference 1	Default	0
	Setting Range	0 to 3	
FC-22	Running time of simple PLC reference 2	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	

FC-23	Acceleration/Deceleration time of simple PLC reference 2	Default	0
	Setting Range	0 to 3	
FC-24	Running time of simple PLC reference 3	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-25	Acceleration/Deceleration time of simple PLC reference 3	Default	0
	Setting Range	0 to 3	
FC-26	Running time of simple PLC reference 4	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-27	Acceleration/Deceleration time of simple PLC reference 4	Default	0
	Setting Range	0 to 3	
FC-28	Running time of simple PLC reference 5	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-29	Acceleration/Deceleration time of simple PLC reference 5	Default	0
	Setting Range	0 to 3	
FC-30	Running time of simple PLC reference 6	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-31	Acceleration/Deceleration time of simple PLC reference 6	Default	0
	Setting Range	0 to 3	
FC-32	Running time of simple PLC reference 7	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-33	Acceleration/Deceleration time of simple PLC reference 7	Default	0
	Setting Range	0 to 3	
FC-34	Running time of simple PLC reference 8	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-35	Acceleration/Deceleration time of simple PLC reference 8	Default	0
	Setting Range	0 to 3	
FC-36	Running time of simple PLC reference 9	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-37	Acceleration/Deceleration time of simple PLC reference 9	Default	0
	Setting Range	0 to 3	
FC-38	Running time of simple PLC reference 10	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	

FC-39	Acceleration/Deceleration time of simple PLC reference 10	Default	0
	Setting Range	0 to 3	
FC-40	Running time of simple PLC reference 11	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-41	Acceleration/Deceleration time of simple PLC reference 11	Default	0
	Setting Range	0 to 3	
FC-42	Running time of simple PLC reference 12	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-43	Acceleration/Deceleration time of simple PLC reference 12	Default	0
	Setting Range	0 to 3	
FC-44	Running time of simple PLC reference 13	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-45	Acceleration/Deceleration time of simple PLC reference 13	Default	0
	Setting Range	0 to 3	
FC-46	Running time of simple PLC reference 14	Default	0.0s (h)
	Setting Range	0 to 6500.0s (h)	
FC-47	Acceleration/Deceleration time of simple PLC reference 14	Default	0
	Setting Range	0 to 3	
FC-48	Running time of simple PLC reference 15	Default	0.0s (h)
	Setting Range	0 to 6500.05s (h)	
FC-49	Acceleration/Deceleration time of simple PLC reference 15	Default	0
	Setting Range	0 to 3	
FC-50	Time unit of simple PLC running	Default	0
	Setting Range: 0	s (second)	
	Setting Range: 1	h (hour)	

FC-51	Reference 0 source		Default	0
	Setting Range	0	FC-00	
		1	AI1	
		2	AI2	
		3	AI3	
		5	PID	
		6	Set by F0-08 (Preset frequency), modified by terminal UP/DOWN	
		7	AI4	

This parameter determines the set channel for Reference 0.

For Reference 0, in addition to setting FC-00, there are many other options that can be selected to facilitate switchover between multi-reference and other set modes. When multi-reference is used as a frequency source or the simple PLC is used as a frequency source, switchover between two frequency sources can be easily implemented.

Group Fd: Communication

Fd-00	Baud rate	Default	H.5005
	Setting Range	Ones: Modbus	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
		Tens	Reserved
		Hundreds	Reserved
		Thousands: CANlink	0: 20
			1: 50
			2: 100
			3: 125
			4: 250
			5: 500
			6: 1M

This parameter sets the data transmission rate between the host computer and the AC drive. Note that the baud rate of the host computer must be the same as that of the AC drive. Otherwise, communication will fail. The higher the baud rate is, the faster the communication will be.

Fd -01	Modbus data format	Default	0
	Setting Range	0	0: No check (8-N-2)
		1	1: Even parity check (8-E-1)
		2	2: Odd parity check (8-O-1)
		3	3: 8-N-1

This parameter sets the data format between the host computer and the AC drive. The setting on the host computer must be the same as that on the AC drive; otherwise, communication will fail.

Fd -02	Local address	Default	1
	Setting Range	1 to 247 0: Broadcast address	

When the local address is set to 0 (that is, the broadcast address), the broadcast function of the host computer is implemented.

This address is unique (except the broadcast address), which is the basis for point-to-point communication between the host computer and the AC drive.

Fd -03	Response delay	Default	2
	Setting Range	0 to 20 ms	

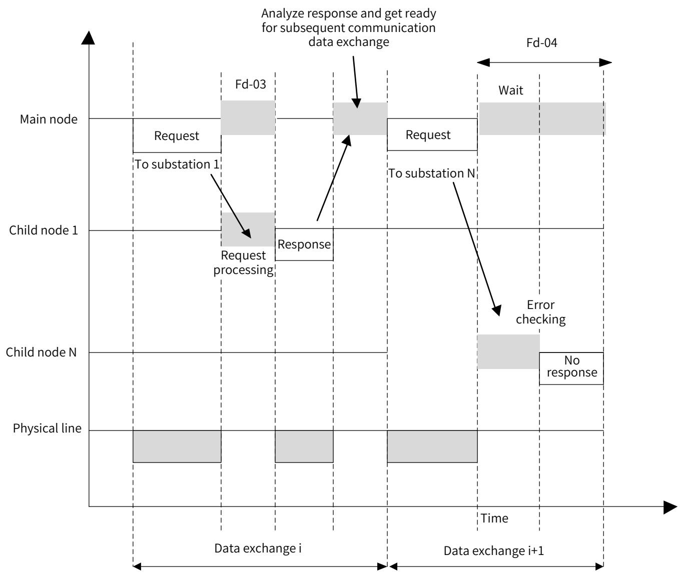


Figure 6-23 Timing of master/slave communication under various situations

This parameter sets the delay from the time when the AC drive receives the frame matching the local address to the time when the AC drive starts returning a response frame. If the response delay is shorter than the system processing time, the system processing time shall prevail. If the response delay is longer than the system processing time, the system sends data to the host computer only after the response delay time is reached.

Fd-04	Modbus communication timeout	Default	0.0
	Setting Range	0.0s: Invalid 0.1s to 60.0s	

When it is set to 0.0s, this parameter is invalid.

If this parameter is set to a non-zero value, when the AC drive does not receive the communication signal within the time set in this parameter, it will report the communication timeout fault (F16). Generally, this parameter is set to 0.0s. In applications with continuous communication, you can use this parameter to monitor the communication status.

Fd-05	Data transmission format selection	Default	1
	Setting Range	Ones: Modbus 0: Non-standard Modbus protocol 1: Standard Modbus protocol	

When the unit's digit is set to 1, the standard Modbus protocol is used; when the unit's digit is set to 0, the slave returns one more byte than in the standard Modbus protocol at the read command. For details, see "Appendix B Modbus Communication Protocol".

Fd-08	Profibus communication timeout	Default	0.0
	Setting Range	0.0s: Invalid 0.1s to 60.0s	

When this parameter is set to 0.0s, it is invalid.

When this parameter is set to a valid value, if the interval time between the current communication and the next communication exceeds the communication timeout time, the system will generate DP card COMM fault (F52) and the fault level is can be set by F9-48 (Fault protection action selection 2). In general, it is set to an invalid value. For continuously communicating systems, this parameter can be set to monitor communication status.

Group FP: User Password

FP-00	User password	Default	0
	Setting Range	0 to 65535	

If FP-00 is set to any non-zero value, the password protection function is enabled. You have to enter a correct password next time you want to access the menu; otherwise, you do not have permission to view or edit functional parameters. Therefore, remember your user password.

Setting FP-00 to 00000 will clear your user password and invalidate the password protection function.

FP-01	Parameter initialization		Default	0
	Setting Range	0	No operation	
		1	Restore factory parameters except motor parameters	

1: Restore factory parameters except motor parameters

If FP-01 is set to 1, most of functional parameters of the AC drive are restored to defaults except for all motor parameters, fault logs, F7-07 (Total running time), F7-06 (Total power-on time), total power consumption (F7-08, F7-23), group FP and A5-08 (Output voltage hardware parameter).

FP-02	Parameter display property		Default	11
	Setting Range	Ones	Selection of display of group U	
		0	Hidden	
		1	Displayed	
		Tens	Selection of display of group A	
		0	Hidden	
		1	Displayed	
		Hundreds	Selection of display of group B	
		0	Hidden	
		1	Displayed	
		Thousands	Selection of display of group C	
		0	Hidden	
		1	Displayed	

Group A0: Torque Control and Restricting Parameters

A0-00	Speed/Torque control selection		Default	0
	Setting Range	0	Speed control	
		1	Torque control	

This parameter is used to select the control mode for the AC drive: speed control or torque control. Note that the AC drive in operation cannot be switched by using this parameter.

The multi-functional DI terminal has two torque control-related functions: torque control disabled (function 29) and speed control/torque control switchover (function 46). These two terminals must be used with A0-00 to switch between speed control and torque control.

When the speed control/torque control switchover terminal is invalid, the control mode is determined by A0-00. If the speed control/torque control switchover is valid, the control mode is equivalent to negating the A0-00 value.

In any case, when the terminal with the torque control prohibited function is valid, the AC drive always runs in the speed control mode.

A0-01	Torque setting source selection in torque control mode		Default	0
	Setting Range	0	Digital setting (A0-03)	
		1	AI1	
		2	AI2	
		3	AI3	
		5	Communication setting	
		6	Min. (AI1, AI2)	
		7	Max. (AI1, AI2)	
		8	AI4	
		9	CAN	
A0-03	Torque digital setting in torque control mode		Default	150.0%
	Setting Range		-200.0% to 200.0%	

A0-01 is used to select a torque setting source. There are 10 torque setting modes.

A relative value is used for torque setting. 100.0% corresponds to the rated torque of the motor. The setting range is -200.0% to 200.0%, indicating that the maximum torque of the AC drive is 2 times of the rated torque.

When the set torque is a positive value, the AC drive runs in a forward direction.

When the set torque is a negative value, the AC drive runs in a reverse direction.

Various torque setting sources are described as below:

0: Digital setting (A0-03)

Indicates that the value set by A0-03 is directly used as the target torque.

1: AI1

2: AI2

3: AI3

8: AI4

Indicates that the target torque is determined by the analog input terminal, among which:

AI1, AI2, and AI4 are current inputs of 4.00 to 20.00 mA.

AI3 can be either voltage input of 0.00 V to 10.00 V, or current input of 4.00 to 20.00 mA, which is selected by the J6 jumper on the control panel. Simultaneously, A6-79 (AI/AO type selection) must be configured.

The correspondence curve regarding input value of AI3 and target torque can be freely selected by a user using A6-48 (AI setting curve selection 1). For details, refer to description of "Group A6: AI Curve and Pulse Parameters".

5: Communication setting

Indicates the target torque is set through RS3-MODBUS-RTU interface communication. The host computer provides this data using communication address 0x1002 in format of a value with 2 decimal places and ranging from -320.00 to +320.00%.

9: CAN

When a point-to-point communication slave computer is used and it receives data as torque setting, the host computer is used for transmitting data as the communication set value (for details, refer to "Group A8: Point-to-Point Communication").

A0-05	Maximum frequency in a forward direction in torque control mode	Default	50.00 Hz
	Setting Range	0.00 Hz to F0-10 (Max. frequency)	
A0-06	Maximum frequency in a reverse direction in torque control mode	Default	50.00 Hz
	Setting Range	0.00 Hz to F0-10 (Max. frequency)	

In torque control mode, the acceleration/deceleration time of the frequency upper limit is set in F8-07 (Acceleration time 4)/F8-08 (Deceleration time 4).

These parameters are used to set the maximum running frequency of the AC drive in a forward or reverse direction in torque control mode.

When the AC drive works in torque control mode, if the load torque is less than the motor output torque, the motor speed will be increased continuously. To prevent runaway of the mechanical system, the maximum motor speed in torque control mode must be limited.

Dynamic and continuous change of the maximum frequency of torque control can be implemented by setting the frequency upper limit.

A0-07	Torque acceleration time	Default	0.00s
	Setting Range	0.00s to 650.00s	
A0-08	Torque deceleration time	Default	0.00s
	Setting Range	0.00s to 650.00s	

In torque control mode, the difference between motor output torque and load torque determines the rate of speed variation of the motor and load. Therefore, the motor speed may change quickly, leading to noise or too large mechanical stress. Setting the acceleration/deceleration time of torque control allows smooth variation of the motor speed.

In torque control mode with low torque being enabled, it is not recommended to set the torque acceleration/deceleration time; if the torque acceleration/deceleration time is set, it is recommended to properly increase the speed filter coefficient.

For applications requiring quick torque response, set the torque acceleration/deceleration time to 0.00s.

For example, two motors are hard wired to drive the same load. To ensure even load distribution, set one AC drive as the master working in speed control mode and the other as the slave working in torque control mode. The actual output torque of the master is used as the torque instruction of the slave. In this case, the torque of the slave is required to quickly follow the master. In such a way, set the torque acceleration/deceleration time of the slave to 0.00s.

Group A5: Control Optimization Parameters

A5-00	Dead zone compensation time	Default	20.0
	Setting Range	0.0 to 50.0 us	

Adjusting this parameter will improve voltage availability. If the parameter value is too small, distortion of current waveform will be caused. It is not recommended to change this setting on the user side.

A5-08	Output voltage hardware parameter	Default	37.994
	Setting Range	0.000 to 65.535	

This parameter is the parameter for output voltage hardware sampling circuit that generally requires no editing.

A5-11	High starting torque mode	Default	0
	Setting Range	0 to 1	
A5-12	Current setting in high starting torque mode	Default	50%
	Setting Range	0 to 125%	
A5-13	Current ramp time in high starting torque mode	Default	0.5s
	Setting Range	0.0 to 5.0s	
A5-14	PLL setup time in high starting torque mode	Default	2s
	Setting Range	0 to 5s	

The high starting torque mode is mainly used for starting a brushless electrically excited synchronous motor and permanent-magnet synchronous motor. A5-12 is the output current setting of the AC drive in high starting torque mode, A5-13 is the ramp time of the output current instruction and A5-14 is the phase-locked loop time setting in high starting torque mode. In general, it is not recommended to change this setting on the user side.

A5-18	Additional function	Default	0x8001
	Setting Range	0xFFFF	

BIT0: The torque limit of input voltage is enabled. The AC drive automatically limits the output torque according to the input voltage to limit the output frequency of the AC drive.

BIT2: The speed rollback mode is enabled. This function allows the AC drive to automatically enter the speed rollback mode after its output torque reaches the limit and therefore the AC drive is not always in the status where high current is limited by the torque.

BIT15: The pre-excitation is enabled. This function is enabled to excite the motor before the AC drive is started.

A5-27	Overvoltage suppression voltage-loop proportional gain	Default	10.0
	Setting Range	0.0 to 100.0 0.0: Overvoltage suppression regulation disabled	
A5-28	Overvoltage suppression voltage-loop integral gain	Default	5.0
	Setting Range	0.0 to 100.0	

This function is valid when the overvoltage suppression function is enabled by setting BIT3 (Overvoltage suppression enabled) of F9-72 (Additional function selection 1) to 1 (Enabled). In general, overvoltage suppression voltage-loop proportional and integral gain require no regulation. Note that the higher the PI parameter is, the more severe the deformation of output current during overvoltage suppression for deceleration and braking is.

Group A6: AI Curve Parameters

A6-00	AI curve 1 minimum input	Default	4.00 mA
	Setting Range	0.00 mA to A6-02	
A6-01	Corresponding percentage of AI curve 1 minimum input	Default	0.0%
	Setting Range	-100.00% to 100.0%	
A6-02	AI curve 1 maximum input	Default	20.00 mA
	Setting Range	A6-00 to 20.00 mA	
A6-03	Corresponding percentage of AI curve 1 maximum input	Default	100.0%
	Setting Range	-100.00% to 100.0%	
A6-04	AI1 filter time	Default	0.10s
	Setting Range	0.00s to 10.00s	

A6-05	AI curve 2 minimum input	Default	4.00 mA
	Setting Range	0.00 mA to A6-07	
A6-06	Corresponding percentage of AI curve 2 minimum input	Default	0.0%
	Setting Range	-100.00% to 100.0%	
A6-07	AI curve 2 maximum input	Default	20.00 mA
	Setting Range	A6-00 to 20.00 mA	
A6-08	Corresponding percentage of AI curve 2 maximum input	Default	100.0%
	Setting Range	-100.00% to 100.0%	
A6-09	AI2 filter time	Default	0.10s
	Setting Range	0.00s to 10.00s	
A6-10	AI curve 3 minimum input	Default	4.00 mA
	Setting Range	0.00 mA to A6-12	
A6-11	Corresponding percentage of AI curve 3 minimum input	Default	-100.0%
	Setting Range	-100.00% to 100.0%	
A6-12	AI curve 3 maximum input	Default	20.00 mA
	Setting Range	A6-10 to 20.00 mA	
A6-13	Corresponding percentage of AI curve 3 maximum input	Default	100.0%
	Setting Range	-100.00% to 100.0%	

These parameters define the relationship between the analog input current and the corresponding percentage.

When the analog input current is larger than the set maximum value (for example, A6-02), the maximum value is used. When the analog input current is less than the set minimum value (for example, A6-00), the minimum value or 0.0% is used. When the analog input current is A6-11, -100% is used.

A6-04 (AI1 filter time) is used to set the software filter time of AI1. If the analog input is liable to interference, increase the AI1 filter time to stabilize the detected analog. However, increase of the AI filter time will slow the response of analog detection. Therefore, set this parameter properly based on actual conditions.

In different applications, 100.0% of analog input corresponds to different nominal values. For details, refer to the description of different applications. The following figure shows a typical setting example.

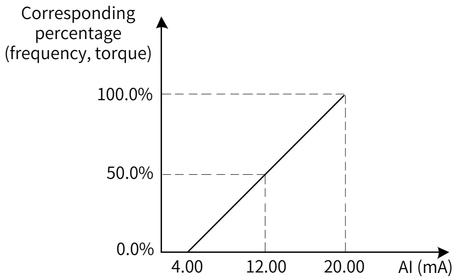


Figure 6-24 Relationship between the analog input and corresponding percentage

A6-14	AI curve 4 minimum input	Default	4.00 mA
	Setting Range	0.00 mA to A6-16	
A6-15	Corresponding percentage of AI curve 4 minimum input	Default	0.0%
	Setting Range	-100.00% to 100.0%	
A6-16	AI curve 4 inflection 1 input	Default	8.80 mA
	Setting Range	A6-14 to A6-18	
A6-17	Corresponding percentage of AI curve 4 inflection 1 input	Default	30.0%
	Setting Range	-100.00% to 100.0%	
A6-18	AI curve 4 inflection 2 input	Default	13.60 mA
	Setting Range	A6-16 to A6-20	
A6-19	Corresponding percentage of AI curve 4 inflection 2 input	Default	60.0%
	Setting Range	-100.00% to 100.0%	
A6-20	AI curve 4 maximum input	Default	20.00 mA
	Setting Range	A6-18 to 20.0 mA	
A6-21	Corresponding percentage of AI curve 4 maximum input	Default	100.0%
	Setting Range	-100.00% to 100.0%	
A6-22	AI curve 5 minimum input	Default	4.00 mA
	Setting Range	0.00 mA to A6-24	
A6-23	Corresponding percentage of AI curve 5 minimum input	Default	-100.0%
	Setting Range	-100.00% to 100.0%	
A6-24	AI curve 5 inflection 1 input	Default	9.60 mA
	Setting Range	A6-22 to A6-26	
A6-25	Corresponding percentage of AI curve 5 inflection 1 input	Default	-30.0%
	Setting Range	-100.00% to 100.0%	

A6-26	AI curve 5 inflection 2 input	Default	14.40 mA
	Setting Range	A6-24 to A6-28	
A6-27	Corresponding percentage of AI curve 5 inflection 2 input	Default	30.0%
	Setting Range	-100.00% to 100.0%	
A6-28	AI curve 5 maximum input	Default	20.00 mA
	Setting Range	A6-26 to 20.00 mA	
A6-29	Corresponding percentage of AI curve 5 maximum input	Default	100.0%
	Setting Range	-100.00% to 100.0%	

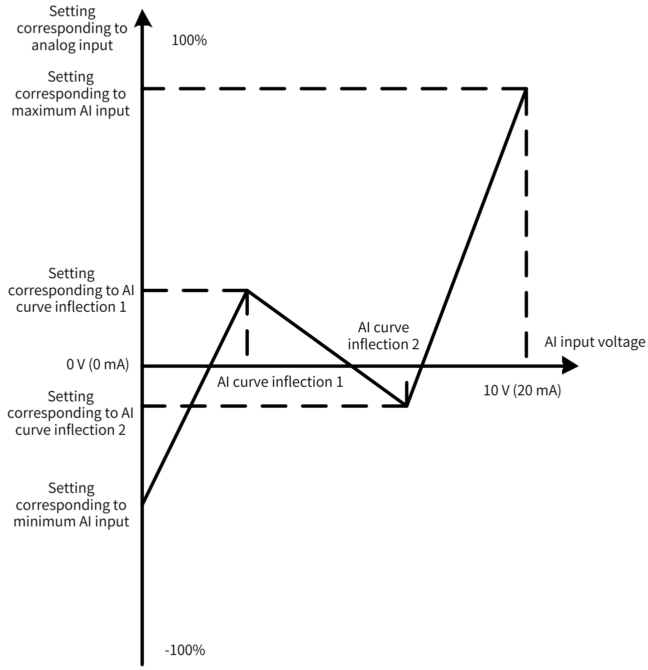


Figure 6-25 Corresponding percentage of AI voltage

In addition to line correspondence, both AI curves 4 and 5 provide curve inflection 1 and 2. This function provides more flexibility for setting the value corresponding to AI. Note that AI minimum input voltage (current), inflection 1 voltage (current), inflection 2 voltage (current) and maximum voltage (current) must be increased in sequence.

A6-30	Jump point of AI1 input corresponding percentage	Default	0.0
	Setting Range	-100.0% to 100.0%	

A6-31	Jump amplitude of AI1 input corresponding percentage	Default	0.5
	Setting Range	0.0% to 100.0%	
A6-32	Jump point of AI2 input corresponding percentage	Default	0.0
	Setting Range	-100.0% to 100.0%	
A6-33	Jump amplitude of AI2 input corresponding percentage	Default	0.5
	Setting Range	0.0% to 100.0%	
A6-34	Jump point of AI3 input corresponding percentage	Default	0.0
	Setting Range	-100.0% to 100.0%	
A6-35	Jump amplitude of AI3 input corresponding percentage	Default	0.5
	Setting Range	0.0% to 100.0%	
A6-36	Jump point of AI4 input corresponding percentage	Default	0.0
	Setting Range	-100.0% to 100.0%	
A6-37	Jump amplitude of AI4 input corresponding percentage	Default	0.5
	Setting Range	0.0% to 100.0%	

Analog inputs from AI1 to AI4 allow jumping among settings. The jumping function refers to the fact that when the setting corresponding to an analog input changes around the jumping point, the setting corresponding to the analog input is fixed to be the value of the jumping point.

For example: When the voltage of AI1 fluctuates around 5.00 V from 4.90 to 5.10 V and the minimum input 10.00 V of AI1 corresponds to 100.0%, the setting corresponding to AI1 detected fluctuates between 49.0% and 51.0%. Set the jumping point of AI1 to 50.0% and the jumping amplitude of AI1 to 1.0%. Then, after AI1 is subject to processing by the jumping function, the setting corresponding to the obtained AI1 is fixed to be 50.0%. AI1 is converted into a stable input and therefore the fluctuation is eliminated.

A6-48	AI setting curve selection 1				Default
	Setting Range	Ones: AI1 curve selection	1	Curve 1	1
			2	Curve 2	
			3	Curve 3	
			4	Curve 4	
			5	Curve 5	
		Tens: AI2 curve selection	1	Curve 1	1
			2	Curve 2	
			3	Curve 3	
			4	Curve 4	
			5	Curve 5	
		Hundreds: AI3 curve selection	1	Curve 1	1
			2	Curve 2	
			3	Curve 3	
			4	Curve 4	
			5	Curve 5	
		Thousands: AI4 curve selection	1	Curve 1	1
			2	Curve 2	
			3	Curve 3	
			4	Curve 4	
			5	Curve 5	

Use A9-14 (Cell bypass type and auto reset attribute selection 2) to select an input curve mode from AI1 to AI4. For information on curve modes 1-5, refer to A6-01 (Corresponding percentage of AI curve 1 minimum input) to A6-29 (Corresponding percentage of AI curve 5 maximum input).

A6-50	Setting of AI lower than minimum input			Default	0000
	Setting Range	Ones: AI1 lower than minimum input setting	0	Setting corresponding to minimum input	
			1	0.0%	
		Tens: AI2 lower than minimum input setting	0	Setting corresponding to minimum input	
			1	0.0%	
		Hundreds: AI3 lower than minimum input setting	0	Setting corresponding to minimum input	
			1	0.0%	
		Thousands: AI4 lower than minimum input setting	0	Setting corresponding to minimum input	
			1	0.0%	

Use A6-50 to set the function when the AI input is small. When set to 0, it is fixed to be the minimum value. When set to 1, it is fixed to be 0.0%.

A6-52	AO1 function selection	Default	0
A6-53	AO2 function selection	Default	2
A6-54	AO3 function selection	Default	0
A6-55	AO4 function selection	Default	0
A6-56	AO5 function selection	Default	2

The output range of AO1 to AO5 is 4 to 20 mA.

The relationship between analog output range and corresponding functions is listed in the following table.

Value	Function	Function Corresponding to Analog Output 0.0% to 100.0%)
0	Running frequency	0 to max. output frequency
1	Target frequency	0 to max. output frequency
2	Output current	0 to 2 times of rated motor current
3	Output torque	0 to 2 times of rated motor torque
4	Output power	0 to 2 times of rated power
5	Output voltage	0 to 1.5 times of rated AC drive voltage
7	AI1	4.00 to 20.00 mA
8	AI2	4.00 to 20.00 mA
9	AI3	4.00 to 20.00 mA
10	AI4	4.00 to 20.00 mA
12	Communication setting	0.0% to100.0%
13	Motor speed	0 to motor speed corresponding to maximum output frequency
16	Excitation current	0 to 2 times of rated motor current
17	Input voltage	0 to 1.5 times of rated AC drive input voltage
18	Input current	0 to 2 times of rated AC drive input current

A6-61	AO1 zero offset coefficient	Default	20.0%
	Setting Range	-100.0% to +100.0%	
A6-62	AO1 gain	Default	0.80
	Setting Range	-100.0% to +100.0%	
A6-63	AO2 zero offset coefficient	Default	20.00%
	Setting Range	-100.0% to +100.0%	
A6-64	AO2 gain	Default	0.80
	Setting Range	-100.0% to +100.0%	
A6-65	AO3 zero offset coefficient	Default	20.0%
	Setting Range	-100.0% to +100.0%	

A6-66	AO3 gain	Default	0.80
	Setting Range	-100.0% to +100.0%	
A6-67	AO4 zero offset coefficient	Default	20.00%
	Setting Range	-100.0% to +100.0%	
A6-68	AO4 gain	Default	0.80
	Setting Range	-10.00 to +10.00	
A6-69	AO5 zero offset coefficient	Default	20.0%
	Setting Range	-100.0% to +100.0%	
A6-70	AO5 gain	Default	0.80
	Setting Range	-10.00 to +10.00	

These parameters correct the offset of the analog output zero drift and the output amplitude. They can also be used to define the required AO curve.

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

The zero offset coefficient 100% of AO1 to AO5 corresponds to 20 mA. The standard output refers to the value corresponding to the analog output of 0 to 20 mA with no zero offset or gain adjustment.

<table>
<tr><td rowspan="19">A6-79</td><td colspan="5">AI/AO type selection</td><td>Default</td></tr>
<tr><td rowspan="18">Setting Range</td><td rowspan="2">Ones</td><td rowspan="2">BIT0: AI3 type selection</td><td>0</td><td>Current input</td><td rowspan="2">0</td></tr>
<tr><td>1</td><td>Voltage input</td></tr>
<tr><td rowspan="4">Tens</td><td rowspan="2">BIT0: AO4 type selection</td><td>0</td><td>Current output</td><td rowspan="4">0</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="2">BIT1: AO5 type selection</td><td>0</td><td>Current output</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="4">Hundreds</td><td rowspan="2">BIT0: AI5 type selection</td><td>0</td><td>Current output</td><td rowspan="4">0</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="2">BIT1: AI6 type selection</td><td>0</td><td>Current output</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="8">Thousands</td><td rowspan="2">BIT0: AO6 type selection</td><td>0</td><td>Current output</td><td rowspan="8">0</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="2">BIT1: AO7 type selection</td><td>0</td><td>Current output</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="2">BIT2: AO8 type selection</td><td>0</td><td>Current output</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
<tr><td rowspan="2">BIT3: AO9 type selection</td><td>0</td><td>Current output</td></tr>
<tr><td>1</td><td>Voltage output</td></tr>
</table>

You can set the type of each analog input and output by setting A6-79. For example, when the hundreds position of A6-79 is set to "3", both AI5 and AI6 are set to voltage output; if this position is set to "2", BIT1 is 1 and BIT0 is 0, i.e. AI5 set to current output and AI6 set to voltage output.

After this parameter is set, change the jumper positions on the I/O board as follows: J6-AI3 voltage/current input selection, J8-AO4 voltage/current output selection, J5-AO5 voltage/current output selection.

<table>
<tr><td rowspan="2">A6-87</td><td>AI3 filter time</td><td>Default</td><td>0.10s</td></tr>
<tr><td>Setting Range</td><td colspan="2">0.00s to 10.00s</td></tr>
<tr><td rowspan="2">A6-88</td><td>AI4 filter time</td><td>Default</td><td>0.10s</td></tr>
<tr><td>Setting Range</td><td colspan="2">0.00s to 10.00s</td></tr>
<tr><td rowspan="2">A6-89</td><td>PLC's AI filter time</td><td>Default</td><td>1Beat</td></tr>
<tr><td>Setting Range</td><td colspan="2">1 to 250 beat</td></tr>
</table>

Input the filter time to set the software filter time of AI. When the field analog signal is subject to interference, increase the filter time to make the detected analog signal stable. However, the higher the filter time is, the slower the response rate to detect the analog signal is. How to set this filter time depends on an actual application.

<table>
<tr><td rowspan="13">A6-90</td><td colspan="5">AI break selection</td><td>Default</td></tr>
<tr><td rowspan="12">Setting Range</td><td rowspan="3">Ones: AI1 break selection</td><td>BIT0: reserved</td><td colspan="2">-</td><td rowspan="3">2</td></tr>
<tr><td rowspan="2">BIT1: AI1 break signal hold selection</td><td>0</td><td>No hold</td></tr>
<tr><td>1</td><td>Break hold</td></tr>
<tr><td rowspan="3">Tens: AI2 break selection</td><td>BIT0: reserved</td><td colspan="2">-</td><td rowspan="3">2</td></tr>
<tr><td rowspan="2">BIT1: AI2 break signal hold selection</td><td>0</td><td>No hold</td></tr>
<tr><td>1</td><td>Break hold</td></tr>
<tr><td rowspan="3">Hundreds: AI3 break selection</td><td>BIT0: reserved</td><td colspan="2">-</td><td rowspan="3">2</td></tr>
<tr><td rowspan="2">BIT1: AI3 break signal hold selection</td><td>0</td><td>No hold</td></tr>
<tr><td>1</td><td>Break hold</td></tr>
<tr><td rowspan="3">Thousands: AI4 break selection</td><td>BIT0: reserved</td><td colspan="2">-</td><td rowspan="3">2</td></tr>
<tr><td rowspan="2">BIT1: AI4 break signal hold selection</td><td>0</td><td>No hold</td></tr>
<tr><td>1</td><td>Break hold</td></tr>
</table>

Use A6-90 to set the corresponding effect when analog inputs from AI1 to AI4 are broken. If a certain bit is set to "2", the related break hold function is enabled. If the system detects that the AI value quickly falls below the threshold, the current AI is broken. If break hold is enabled, the conversion value of the analog input is held at the data before break.

Group A8: Point-to-Point Communication

A8-00	Point-to-point communication function selection	Default	0
	Setting Range	0: Disabled 1: Enabled	

Select whether the point-to-point communication function is valid.

Point-to-point communication refers to direct data communication between two or more HD9X AC drives and is implemented by using CANlink. It is used by one master, according to its own frequency or torque signal, to set the target frequency and target torque of one or several slaves.

When several AC drives are connected using CANlink, CANlink of the AC drive should be connected to a termination resistor, as shown in the figure below:

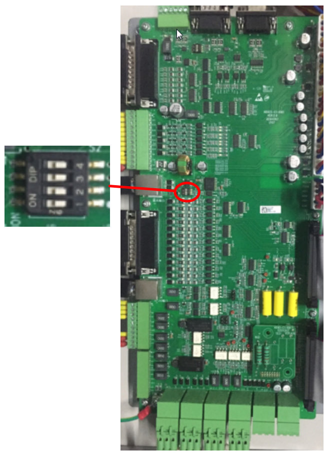


Figure 6-26 CANlink connected to a termination resistor

When point-to-point communication is valid, the CANlink communication address between the master and the slave is internally and automatically matched, without the need of any special setting.

The point-to-point communication rate is set by Fd-00 (Baud rate).

A8-01	Master/slave selection	Default	0
	Setting Range	0: Master; 1: Slave	

This parameter is used to set the AC drive as a master or slave.

The point-to-point communication requires only setting of the CANlink communication baud rate, with its communication address being automatically assigned according to active master or slave.

A8-02	Slave command following	Default	0
	Setting Range	0: Slave not following a command from the master 1: Slave following a command from the master	

When the salve works in master-slave control mode and F0-02 (Remote 1 command source selection) is set to 6 (CAN), if this parameter is set to 1, the slave follows a command from the master to run/shut down.

A8-03	Point-to-point communication data selection	Default	0
	Setting Range	0: Synchronous frequency 1: Target frequency	

In master-slave control mode, this parameter for both the master and slave is set to 0. The slave runs in torque mode and obtains the synchronous frequency from the communication between the master and slave.

In droop control mode, this parameter for both the master and slave is set to 1 and the slave obtains the target frequency that is set externally. Calculate the real-time droop frequency according to the actual torque of the slave.

A8-04	Received data zero offset (torque)	Default	0.00%
	Setting Range	-100.00% to 100.00%	
A8-05	Received data gain (torque)	Default	1.00
	Setting Range	-10.00 to 10.00	

These two parameters are used to correct the received torque data and allow a user to customize the relation of the torque instruction between the master and the slave.

If zero offset is expressed by b, gain by k, data received by the slave by x, and data actually used by y, data actually used is: y = kx + b, ranging from -100.00% to 100.00%.

A8-08	Received data zero offset (frequency)	Default	0.00%
	Setting Range	-100.00% to 100.00%	
A8-09	Received data gain (frequency)	Default	1.00
	Setting Range	-10.00 to 10.00	

These two parameters are mainly used to correct the received frequency data and allow a user to customize the relation of the frequency instruction between the master and the slave.

If zero offset is expressed by b, gain by k, data received by the slave by x, and data actually used by y, data actually used is: y = kx + b, ranging from -100.00% to 100.00%.

A8-11	Window	Default	0.5 Hz
	Setting Range	0.20 Hz to 10.00 Hz	

This parameter is valid in master-slave control mode. Setting this parameter ensures that the speed of the master is synchronized to that of the slave within the window.

Group A9: Cell Parameter

A9-00	Bypass			Default	0x0
	Setting Range	Ones	0	Invalid	
			1	Manual bypass	
			2	Automatic bypass	
			A	Hand-made bypass	

Manual bypass: For models with a cell bypass contactor, you can set A9-04 (Manual bypass setting 1) and A9-05 (Manual bypass setting 2) to bypass a specific cell.

Automatic bypass: For models with a cell bypass contactor, when the cell is faulty, a bypass command is calculated and the cell is bypassed according to configuration options of A9-13 (Cell bypass type and auto reset attribute selection 1) and A9-14 (Cell bypass type and auto reset attribute selection 2).

Hand-made bypass: For models without a cell bypass contactor, you can make cell outputs T1 and T2 short circuited after MV is applied, and set A9-04 (Manual bypass setting 1) and A9-05 (Manual bypass setting 2) to bypass a faulty cell.

A9-02	Bypass contactor closing time	Default	200 ms
	Setting Range	50 to 1000 ms	

Bypassing a contactor may generally take tens or even hundreds of milliseconds from issuing a closing command signal to true separation of the contact. If a certain cell bypass process lasts for more than the time set by A9-02, the cell bypass fails.

A9-03	Maximum back EMF attenuation time	Default	7.0s
	Setting Range	0.0 to 30.0s	
A9-04	Manual bypass setting 1	Default	0x0
	Setting Range	BIT0: A1 cell bypassed BIT1: B1 cell bypassed BIT2: C1 cell bypassed BIT3: A2 cell bypassed ... BIT15: A6 cell bypassed	
A9-05	Manual bypass setting 2	Default	0x0
	Setting Range	BIT0: B6 cell bypassed BIT1: C6 cell bypassed BIT2: A7 cell bypassed BIT3: B7 cell bypassed ... BIT15: C10 cell bypassed	

When a motor is in free shutdown mode, the motor still runs for a certain period of time due to inertia and generates a corresponding back EMF. In this case, the motor may continuously charge the bus. If a cell on a certain phase is bypassed, remaining cells may withstand too high voltage that may lead to overvoltage fault. Therefore, it is necessary to limit the charge time of a cell. A9-03 provides the maximum back EMF attenuation time of a motor. If the duration of back EMF exceeds this value, a back EMF attenuation timeout fault is generated.

<table>
<tr><td rowspan="17">A9-13</td><td colspan="5">Cell bypass type and auto reset attribute selection 1</td><td>Default</td></tr>
<tr><td rowspan="16">Setting Range</td><td rowspan="4">Ones: cell voltage selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="4">Tens: cell undervoltage selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="4">Thousands: cell overcurrent selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="4">Ten thousands: cell drive power fault selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
</table>

<table>
<tr><td rowspan="13">A9-14</td><td colspan="5">Cell bypass type and auto reset attribute selection 2</td><td>Default</td></tr>
<tr><td rowspan="12">Setting Range</td><td rowspan="4">Ones: cell overtemperature selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="4">Tens: reserved</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="4">Hundreds: cell rectification selection</td><td rowspan="2">BIT0: bypass selection</td><td>0</td><td>Disabled</td><td rowspan="4">3</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
<tr><td rowspan="2">BIT1: auto reset selection</td><td>0</td><td>Disabled</td></tr>
<tr><td>1</td><td>Enabled</td></tr>
</table>

With parameters A9-13 and A9-14, you can select which type of cell faults allows bypass or auto reset. For example, if the unit's digit of A9-13 is set to "3", when a cell has an overvoltage fault, both bypass and auto reset are allowed; if it is set to "2", only auto reset is allowed, rather than bypass; if it is set to "1", only bypass is allowed, rather than auto reset; if it is set to "0", neither bypass nor auto reset is allowed.

A9-15	Pre-charging analog selection	Default	0
	Setting Range	0: AO1 1: AO2	
A9-18	Switchover point between sections 1 and 2	Default	30.0%
	Setting Range	0 to 80%	
A9-19	Section 1 pre-charging acceleration time	Default	8.0s
	Setting Range	0.1 to 50.0s	
A9-20	Switchover point between sections 2 and 3	Default	70.0%
	Setting Range	5.0% to 78.0%	
A9-21	Section 2 pre-charging acceleration time	Default	4.0s
	Setting Range	0.5 to 50.0s	
A9-22	Section 3 pre-charging acceleration time	Default	1.0s
	Setting Range	0.0 to 10.0s	

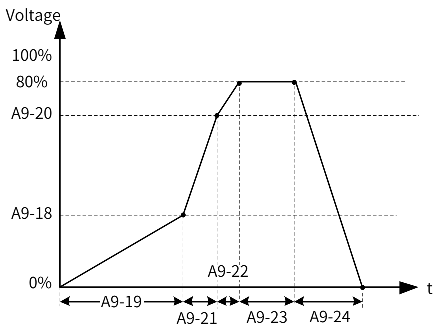


Figure 6-27 Pre-charging analog selection

A9-15 provides two analog outputs used for controlling the output voltage of the regulator during secondary pre-charging. The secondary pre-charging and boosting process can be divided into three sections. A9-18 is used to set the voltage value to be reached at the end of section 1 and A9-19 is used to set the pre-charging time for section 1. Similarly, A9-20, A9-21 and A9-22 correspond to the pre-charging times of sections 2 and 3 and the target voltage value to be reached until the voltage reaches the target voltage value at the end of section 3.

A9-23	Pre-charging duration	Default	2.0s
	Setting Range	1.0 to 10.0s	
A9-24	Pre-charging deceleration time	Default	1.5s
	Setting Range	0.0s	
A9-29	Pre-charging current detection threshold	Default	7%
	Setting Range	0 to 15%	

After secondary pre-charging and boosting, the bus voltage of a cell slowly increases.

The pre-charging deceleration process is started only after the voltage reaches the rated pre-charging voltage and keeps for the time set by A9-23. Within the pre-charging deceleration time set by A9-24, the main control board will reduce the voltage of the regulator from the rated pre-charging voltage to the minimum value.

The pre-charging process is mainly intended for slowly increasing the bus voltage and reducing the transient impact on the power grid at the moment of power-on. During this process, the system has not started working yet. Therefore, the current is greatly lower than that used for normal operation. If the transformer primary side current is larger than the set value in A9-29 during pre-charging, the current may be abnormal during pre-charging.

Group AC: AI/AO Correction

AC-00	AI1 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-01	AI1 displayed current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-02	AI1 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-03	AI1 displayed current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-04	AI2 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-05	AI2 displayed current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-06	AI2 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-07	AI2 displayed current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-08	AI3 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-09	AI3 displayed current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-10	AI3 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-11	AI3 displayed current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-12	AI4 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-13	AI4 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	

AC-14	AI4 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-15	AI4 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	

This group of parameters are used for correcting inputs entered from AI terminals to eliminate the effect of zero offset and gain at AI.

This group of parameters have been corrected before delivery. When they are restored to defaults, factory-corrected values are used. They generally require no correction in the field.

Measured current refers to actual current measured by using a measuring instrument such as a multimeter, while displayed current refers to the current value sampled by using the AC drive. For details, see current indications (U0-21, U0-22, U0-23) before AI correction of group U0.

For correction, input two voltage values into each AI terminal and enter the measured value obtained from the multimeter and the value read from group U0 into the parameters mentioned above. In this way, the AC drive will automatically calibrate the zero offset and gain of AI.

For applications where the current given by a user does not match the actual sampling current of the AC drive, it can be calibrated in the field in such a way that the sampling value of the AC drive matches the expected set value. By using AI1 as an example, the field correction method is shown below:

Set the AI1 current signal (about 5.000 mA).

Measure AI1 current value and store it into AC-00.

View the indicated value of U0-21 (AI3 current before correction) and store it into AC-01.

Set AI1 current signal (about 19.000 mA)

Measure AI1 current value and store it into AC-02.

View the indicated value of U0-21 (AI3 current before correction) and store it into AC-03.

When calibrating AI2 and AI3, view actual sampling current from U0-22 (AI4 current before correction) and U0-23 (Torque current) respectively.

AC-16	AO1 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-17	AO1 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-18	AO1 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	

AC-19	AO1 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-20	AO2 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-21	AO2 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-22	AO2 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-23	AO2 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-24	AO3 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-25	AO3 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-26	AO3 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-27	AO3 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-28	AO4 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-29	AO4 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-30	AO4 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-31	AO4 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-32	AO5 target current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-33	AO5 measured current 1	Default	Factory-corrected
	Setting Range	4.500 mA to 8.000 mA	
AC-34	AO5 target current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	
AC-35	AO5 measured current 2	Default	Factory-corrected
	Setting Range	16.000 mA to 19.999 mA	

This group of parameters are intended for calibrating AOs.

This group of parameters have been corrected before delivery. When they are restored to defaults, factory-corrected values are used. They generally require no correction in the field.

The target current refers to the theoretical output current value of the AC drive. The measured current refers to the actual output current value measured by using a measuring instrument such as a multimeter.

7 Troubleshooting

The MV AC drive provides the alarm and fault functions. When a fault occurs on the AC drive, the system indicates the fault information clearly and performs protections based on the fault/alarm grade, such as stopping, bypassing the faulty power cell, or even cutting off the medium-voltage input.

The HMI displays the specific fault/alarm, possible causes and corresponding solutions. You can determine the fault type, analyze the cause and perform troubleshooting based on the display of the HMI. If you need technical support, contact our company.

The system performs protection and stops output once a fault occurs. If the fault disappears, the fault indicator becomes OFF but the fault information is recorded. The AC drive can be re-started only after the fault is rectified and the system is reset by pressing the "Reset" button. When a critical fault occurs, the MV breaker is enabled automatically. If the MV breaker is not enabled due to other reasons, press the "Emergency stop" button on the control cabinet.

7.1 System Alarms

A05	Input overvoltage
Possible Cause	The input voltage is high.
Solution	Adjust the input voltage to the normal range.

A11	Motor overload
Possible Cause	1) Check whether the motor overload protective parameters (F9-01 to F9-03) are set improperly. 2) Check whether the load is too heavy or locked-rotor occurs on the motor. 3) The motor is abnormal. 4) The sampling of the three-phase output voltage is abnormal. 5) The control hardware is abnormal.
Solution	1) Set F9-01 to F9-03 properly. 2) Reduce the load and check the motor and mechanical conditions. 3) Check whether the motor and the three-phase winding insulation are normal. 4) Locked-rotor occurs on the motor or the output current reaches the setting upper limit. Check whether the three-phase output voltage sampling board and the three-phase output voltage sampling circuit are normal. 5) Replace the I/O board or the main control board.

A12	Power input phase loss
Possible Cause	1) The three-phase input power is abnormal. 2) The three-phase input voltage sampling board is abnormal. 3) The input voltage sampling circuit of the AC drive is abnormal. 4) The control hardware is abnormal.
Solution	1) Eliminate external faults. 2) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 3) Eliminate the fault on the three-phase input voltage sampling circuit. 4) Replace the I/O board or the main control board. Contact our company for technical support.

A13	Power output phase loss
Possible Cause	1) The cable connecting the AC drive and the motor is abnormal. 2) The outputs of the AC drive are not connected to the motor. 3) The output current sampling circuit of the AC drive is abnormal. 4) The control hardware is abnormal.
Solution	1) Eliminate external faults. 2) Connect the outputs of the AC drive to the motor. 3) Check whether the output current sampling circuit is normal. 4) Replace the I/O board or the main control board.

A15	External alarm
Possible Cause	The external fault signal is input through a multi-functional DI terminal.
Solution	Reset the operation

A16	Communication alarm
Possible Cause	1) The customer's RS485/CAN interface is abnormal. 2) The communication cable is damaged. 3) The communication parameters in group Fd are set incorrectly.
Solution	1) Check whether the customer's RS485/CAN interface works properly. 2) Check the communication cable. 3) Set the communication parameters correctly.

A20	Encoder alarm
Possible Cause	1) The parameters in group F1 are set incorrectly. 2) The cable connection between the encoder and the PG card is abnormal. 3) The PG card is abnormal. 4) The 24 V and 15 V switching-mode power supply is abnormal. 5) The encoder is abnormal. 6) The main control board is abnormal.
Solution	1) Set the parameters in group F1 correctly. 2) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 3) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 4) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board 5) Replace the encoder. 6) Replace the I/O board or the main control board.

A23	Output insulation resistance reduced
Possible Cause	1) The three-phase output voltage sampling board is abnormal. 2) The three-phase output voltage sampling circuit is abnormal. 3) The three-phase winding grounding insulation resistance of the motor is abnormal. 4) The output grounding resistance of the AC drive is abnormal. 5) The control hardware is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal. Check whether the resistance of the sampling board is correct. Check whether the wiring phase sequence is correct. Check whether the UVW three-phase output power cables are correctly connected. 2) Check whether wiring of the three-phase output voltage sampling circuit is correct and whether breaking or loose connection exists on the circuit. 3) Disconnect the cables connecting the AC drive and motor, and check whether the three-phase winding insulation resistor of the motor is normal. 4) Disconnect the cables connecting the AC drive and motor, and use a multimeter to check whether the UVW three-phase output grounding resistance of the AC drive is normal. The normal range is above megohm to infinity. 5) Replace the I/O board or main control board.

A27	User-defined alarm 1
Possible Cause	1) The user-defined alarm 1 signal is input through a multi-functional DI terminal. 2) The I/O board is abnormal.
Solution	1) Reset the operation. 2) Use another DI terminal or replace the I/O board.

A28	User-defined alarm 2
Possible Cause	1) The user-defined alarm 2 signal is input through a multi-functional DI terminal. 2) The I/O board is abnormal.
Solution	1) Reset the operation. 2) Use another DI terminal or replace the I/O board.

A29	Accumulative power-on time reached
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

A31	PID feedback lost during the AC drive running
Possible Cause	The PID feedback is smaller than the setting of FA-26 (Detection level of PID feedback loss).
Solution	Check the PID feedback signal or set FA-26 (Detection level of PID feedback loss) properly.

A36	Input current unbalanced
Possible Cause	1) The input current detection circuit is abnormal. 2) The input current sampling mutual inductors are abnormal. 3) The input side of the transformer is abnormal. 4) The control hardware is abnormal.
Solution	1) Check the input current detection circuit. Check whether the connection breaks or whether the connection is loose. 2) Check the two levels of mutual inductors are installed properly and eliminate the faults. 3) Contact our company for technical support. 4) Replace the I/O board or the main control board.

A39	PLC communication abnormal
Possible Cause	1) The PLC is not powered on. 2) The PLC does not run. 3) The communication circuit between the PLC and the main control board is abnormal.
Solution	1) Check the power supply of the PLC. 2) Confirm that the PLC is in the RUN state. 3) Check the connection of the communication circuit of the PLC.

A42	Speed feedback error too large
Possible Cause	1) The encoder parameters are set improperly. 2) The motor auto-tuning is not performed. 3) The parameter F9-69 is set improperly. 4) The cable connection between the encoder and the PG card is abnormal. 5) The PG card is abnormal. 6) The 24 V and 15 V switching-mode power supply is abnormal. 7) The main control board is abnormal. 8) The encoder is abnormal.
Solution	1) Set the encoder parameters in group F1 properly. 2) Perform the motor auto-tuning first and then operate the system. 3) Set F9-69 properly according to the actual condition. 4) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 5) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 6) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board 7) Replace the I/O board or the main control board. 8) Replace the encoder.

A43	Motor overspeed
Possible Cause	1) The encoder parameters are set improperly. 2) The motor auto-tuning is not performed. 3) The parameter F9-69 is set improperly. 4) The cable connection between the encoder and the PG card is abnormal. 5) The PG card is abnormal. 6) The 24 V and 15 V switching-mode power supply is abnormal. 7) The main control board is abnormal. 8) The encoder is abnormal
Solution	1) Set the encoder parameters in group F1 properly. 2) Perform the motor auto-tuning first and then operate the system. 3) Set F9-69 properly according to the actual condition. 4) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 5) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 6) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board 7) Replace the I/O board or the main control board. 8) Replace the encoder.

A45	Motor overheat
Possible Cause	The motor overheat alarm threshold (F9-58) is a non-zero value and any of CH1 to CH3 temperature obtained by PLC sampling is higher than the threshold.
Solution	1) Check whether disconnection of DI setting exists. 2) Check whether the load is too heavy or locked-rotor occurs on the motor. If the load is too heavy, reduce the load as required.

A46	Control power alarm
Possible Cause	1) The 24 V control power is abnormal. 2) The control power detection circuit is abnormal. 3) The DI terminal of the I/O board is abnormal. 4) The control hardware is abnormal.
Solution	1) Check whether the 24 V power is applied to the control system. 2) Check the control power detection circuit. 3) Use another DI terminal or replace the I/O board 4) Replace the I/O board or the main control board.

A51	Magnetic pole position detection failed
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

A52	DP communication alarm
Possible Cause	1) The communication between the DP card and the PLC master is interrupted. 2) The setting of the station No. of the DP card slaves exceeds the limit. 3) The communication between the DP card and the PLC communication master times out.
Solution	1) Check whether the communication connection between the DP card and the PLC master is normal and reliable. 2) Modify the station No. of the DP card slaves to the allowable range. 3) Modify the PROFIBUS-DP communication timeout time (Fd-08)

A80	Power cell overtemp.
Possible Cause	1) The ambient temperature is too high. 2) The power cell is not well ventilated. 3) The dust filter is blocked. 4) The fan is damaged. 5) The power cell control board is abnormal.
Solution	1) Lower the ambient temperature. 2) Replace the cell and contact our company for technical support. 3) Clean the dust filter. 4) Check whether the fan rotates in the reverse direction or whether the fan is damaged. 5) Replace the power cell control board.

A82	Analog break
Possible Cause	1) The analog input of AI1 to AI4 is small or breaks. 2) The actually used AI is not corresponding to the AI setting in A6-90. 3) The AI terminal is abnormal. 4) The I/O board is abnormal.
Solution	1) Check the AI connection and ensure correct wiring. 2) Make sure that the AI setting in A6-90 corresponds to the actually used AI. 3) Use another AI terminal or replace the I/O board. 4) Replace the I/O board.

A83	Power cell bypass alarm
Possible Cause	1) A power cell is bypassed. 2) The power cell bypass board feedback state is wrong. 3) The power cell control board is abnormal. 4) The power cell bypass board is abnormal.
Solution	1) View the historical log, make clear why the power cell is bypassed, and replace the power cell. 2) Re-apply the medium voltage and complete power cell self-check. Then check whether the power cell bypass board is normal on the HMI. 3) Replace the power cell control board. 4) Replace the power cell bypass board.

A84	Line-voltage contactor feedback abnormal
Possible Cause	1) The line-voltage contactor feedback signal line is wrongly connected or the feedback signal gets lost. 2) The line-voltage contactor is damaged.
Solution	1) Check the line-voltage contactor feedback signal line and ensure the line is connected correctly and securely. 2) Check whether the line-voltage contactor is normal.

A85	Transformer overload pending
Possible Cause	1) The load is too heavy or locked-rotor occurs on the motor. 2) The transformer is abnormal. 3) The power rating of the AC drive is small.
Solution	1) Reduce the load and check the motor and mechanical conditions. 2) Contact our company for technical support. 3) Replace an AC drive of a higher power rating.

A86	Motor overload pending
Possible Cause	1) The motor protection parameters are set improperly. 2) The load is too heavy or locked-rotor occurs on the motor. 3) The motor is abnormal. 4) The three-phase output voltage sampling is abnormal. 5) The control hardware is abnormal.
Solution	1) Set F9-01 to F9-03 properly. 2) Reduce the load and check the motor and mechanical conditions. 3) Check whether the motor is normal and whether the three-phase winding insulation is normal. 4) Locked-rotor occurs on the motor or the output current reaches the setting upper limit. Check whether the three-phase output voltage sampling board and the three-phase output voltage sampling circuit are normal. 5) Replace the control hardware and contact our company for technical support.

A87	Phase-shifting transformer overtemp.
Possible Cause	1) The ambient temperature is too high (above 40°C). 2) The dust filter is blocked. 3) The gap of the transformer windscreen becomes large. 4) The fan on the cabinet roof works abnormally. 5) The AC drive overtemperature fault detection circuit signal is abnormal. 6) The temperature and humidity board is damaged. 7) The temperature and humidity board or I/O board circuit is abnormal. 8) The control hardware is abnormal.
Solution	1) Check the ambient temperature and make a record. 2) Clean the dust filter. 3) Check whether the gap of the transformer windscreen is too large. 4) Check whether the fan on the cabinet roof rotates in the reverse direction or whether the fan is damaged. 5) Check whether breaking, loose connection or wrong connection exists on the AC drive overtemperature fault detection circuit. 6) Check whether the temperature and humidity board works properly. 7) Replace the temperature and humidity board. 8) Replace the I/O board or the main control board, and contact our company for technical support.

A89	Fan alarm
Possible Cause	1) The wiring of the fan fault detection circuit is incorrect. 2) The thermal relay is faulty. 3) The fan is faulty. 4) The DI circuit of the I/O board is abnormal. 5) The control hardware is abnormal.
Solution	1) Check the fan fault detection circuit. 2) Check the setting value of the thermal relay. Check whether the thermal relay is abnormal. 3) Replace the cabinet top fan. 4) Replace the DI terminals or change the I/O board. 5) Replace the I/O board or main control board.

A120	Input voltage unbalanced
Possible Cause	1) The three-phase input voltage sampling board is abnormal. 2) The three-phase input voltage sampling circuit is abnormal. 3) The control hardware is abnormal. 4) The grid input voltage is abnormal.
Solution	1) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 3) Replace the I/O board or the main control board. 4) Check whether the grid voltage on the user input side is abnormal.

A121	Output voltage unbalanced
Possible Cause	1) The three-phase output voltage sampling board is abnormal. 2) The three-phase output voltage sampling circuit is abnormal. 3) The control hardware is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the U, V, W cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase output voltage sampling circuit. 3) Replace the I/O board or the main control board.

A123	Locked-rotor occurred on the motor
Possible Cause	1) The load is too heavy or locked-rotor occurs on the motor. 2) The power rating of the motor is small. 3) F9-40 (Locked-rotor frequency) and F9-41 (Locked-rotor time) are set incorrectly.
Solution	1) Perform motor auto-tuning and then start vector control. 2) Reduce the load and check the motor and mechanical conditions. 3) Restore F9-40 (Locked-rotor frequency) and F9-41 (Locked-rotor time) to factory settings.

A163	Switchover timeout
Possible Cause	1) Synchronous switchover timeout setting is too small. 2) The input voltage fluctuation is large.
Solution	1) Set a higher value for F6-24 (Synchronous switching timeout time). 2) Contact our company for technical support.

A165	Motor cooling fan alarm
Possible Cause	The motor cooling fan feedback is inconsistent with the cooling fan control signal, that is, the cooling fan feedback is valid when the cooling fan is not working, or the cooling fan feedback is invalid when the cooling fan is working.
Solution	1) Check whether the cooling fan feedback DI is real and whether DI disconnection exists. 2) Check whether the cooling fan control DO relay works properly and whether the motor cooling fan state is consistent with the DO state.

A180	Automatic bypass cabinet contactor alarm
Possible Cause	The mains frequency contactor fails to open properly when the automatic bypass cabinet is in the down transfer process.
Solution	1) Check whether the switch-off circuit of the mains frequency contactor in the automatic bypass cabinet is normal. 2) Check whether the feedback of the mains frequency contactor in the automatic bypass cabinet is normal.

A181	Input sampling wiring wrong
Possible Cause	1) The phase sequence of the three-phase input voltage sampling is incorrect. 2) The input current sampling phase sequence is incorrect.
Solution	1) Check whether the phase sequence from the three-phase input voltage sampling board to the I/O board input voltage sampling lines is correct. 2) Check whether the IR and IT input current sampling phase sequence is correct.

A182	Cell bypass contactor abnormal
Possible Cause	1) The cell bypass board feedback state is incorrect. 2) The cell bypass board is abnormal.
Solution	1) Restart and recheck the state of HMI and cell bypass contactor. 2) Replace the abnormal cell control board.

A183	Reactor bypass contactor abnormal
Possible Cause	Reactor bypass contactor abnormal feedback state error
Solution	Check reactor bypass contactor feedback and check the state of open/close circuit.

A184	Motor excitation fault
Possible Cause	1) The three-phase output voltage sampling board is abnormal. 2) The three-phase output voltage sampling circuit is abnormal. 3) The starting current of the catching a spinning motor setting is too big. 4) Hardware control is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the U, V, W cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase output voltage sampling circuit. 3) Set F6-16 properly, normally below the value of F1-10 (No-load current). 4) Replace the I/O board or the main control board.

A185	Poor cell communication
Possible Cause	1) The optical fiber cable of the cell is damaged. 2) Interference occurs on the optical fiber communication link power.
Solution	1) Replace the optical fiber cable. 2) Contact our company for technical support.

A186	Input voltage drop
Possible Cause	After the system is powered on, the input voltage drops abnormally but corresponding values do not exceed the ranges specified in Table 6-1.
Solution	Check whether large equipment is started or applied.

A187	Temperature and humidity sampling board disconnection
Possible Cause	1) The connection of the temperature sampling terminal of the temperature and humidity sampling board is loose. 2) The temperature sampling cable is broken or short-circuited due to damaged cable sheath.
Solution	Replace the temperature sampling cable harness.

A188	Abnormal communication of the temperature and humidity sampling board
Possible Cause	1) The power of the temperature and humidity sampling board is abnormal. 2) The communication cable between the temperature and humidity sampling board and the RS2 terminal of the main control board is damaged or incorrectly connected with the positive and negative terminals, or the cable connection is loose. 3) The RS-485 hand-in-hand wiring mode is not adopted for wiring the RS2 terminal.
Solution	1) Replace the temperature and humidity sampling board. 2) Check or replace the communication cable. 3) Change the wiring mode of the RS2 terminal to the hand-in-hand mode.

7.2 System Faults

F02	Overcurrent during acceleration
Possible Cause	1) The output current sampling circuit is abnormal. 2) The output hall is abnormal. 3) Motor parameters in group F1 are set incorrectly. The control mode is vector control but motor auto-tuning is not performed. 4) The setting of F9-30 (AC drive overcurrent protection threshold) is small. 5) The main control board is abnormal. 6) The spinning motor is started. 7) A sudden load is added during acceleration. 8) The power rating of the AC drive is small. 9) Cell output terminals T1 and T2 are connected reversely.
Solution	1) Check whether wiring of the output current sampling circuit is correct and whether breaking or loose connection exists on the circuit. Check whether the output hall is installed in the reverse direction. 2) Apply ±15 V to the output hall to check whether the M signal is connected correctly. If not, replace the output hall. 3) Set F1 group parameters correctly. Perform motor auto-tuning first and then start vector control. 4) Increase F9-30 properly. 5) Replace the main control board and re-set the AC drive parameters. 6) Enable the catching a spinning motor function or start the motor after it stops completely. 7) Remove the added load. 8) Replace an AC drive of a larger power rating. 9) Check the serial connection cable and center cable on the output side of power cells.

F03	Overcurrent during deceleration
Possible Cause	1) The output current sampling circuit is abnormal. 2) The output hall is abnormal. 3) Motor parameters in group F1 are set incorrectly. The control mode is vector control but motor auto-tuning is not performed. 4) The setting of F9-30 (AC drive overcurrent protection threshold) is small. 5) The main control board is abnormal. 6) The spinning motor is started. 7) A sudden load is added during deceleration. 8) The power rating of the AC drive is small. 9) Cell output terminals T1 and T2 are connected reversely.
Solution	1) Check whether wiring of the output current sampling circuit is correct and whether breaking or loose connection exists on the circuit. Check whether the output hall is installed in the reverse direction. 2) Apply ±15 V to the output hall to check whether the M signal is connected correctly. If not, replace the output hall. 3) Set F1 group parameters correctly. Perform motor auto-tuning first and then start vector control. 4) Increase F9-30 properly. 5) Replace the main control board and re-set the AC drive parameters. 6) Enable the catching a spinning motor function or start the motor after it stops completely. 7) Remove the added load. 8) Replace an AC drive of a larger power rating. 9) Check the serial connection cable and center cable on the output side of power cells.

F04	Overcurrent at constant speed
Possible Cause	1) The output current sampling circuit is abnormal. 2) The output hall is abnormal. 3) Motor parameters in group F1 are set incorrectly. The control mode is vector control but motor auto-tuning is not performed. 4) The setting of F9-30 (AC drive overcurrent protection threshold) is small. 5) The main control board is abnormal. 6) The spinning motor is started. 7) A sudden load is added at constant speed. 8) The power rating of the AC drive is small. 9) Cell output terminals T1 and T2 are connected reversely.
Solution	1) Check whether wiring of the output current sampling circuit is correct and whether breaking or loose connection exists on the circuit. Check whether the output hall is installed in the reverse direction. 2) Apply ±15 V to the output hall to check whether the M signal is connected correctly. If not, replace the output hall. 3) Set F1 group parameters correctly. Perform motor auto-tuning first and then start vector control. 4) Increase F9-30 properly. 5) Replace the main control board and re-set the AC drive parameters. 6) Enable the catching a spinning motor function or start the motor after it stops completely. 7) Remove the added load. 8) Replace an AC drive of a larger power rating. 9) Check the serial connection cable and center cable on the output side of power cells.

F09	Input undervoltage
Possible Cause	1) The medium voltage is not applied during the drive running. 2) The three-phase input voltage sampling board is abnormal. 3) The input voltage sampling circuit of the AC drive is abnormal. 4) The input voltage of the AC drive in not within the normal range. 5) The control hardware is abnormal.
Solution	1) Stop the running, apply the medium voltage after checking is complete, and wait until the cell self-check is complete. 2) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 3) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 4) Adjust the input voltage to the normal range. 5) Replace the I/O board or the main control board.

F10	AC drive overload
Possible Cause	1) The load is too heavy or locked-rotor occurs on the motor. 2) The transformer is abnormal. 3) The power rating of the AC drive is small.
Solution	1) Reduce the load and check the motor and mechanical conditions. 2) Contact our company for technical support. 3) Replace an AC drive of a larger power rating.

F11	Motor overload
Possible Cause	1) The motor overload protective parameters (F9-01 to F9-03) are set improperly. 2) The load is too heavy or locked-rotor occurs on the motor. 3) The motor is abnormal. 4) The sampling of three-phase output voltage is abnormal. 5) The control hardware is abnormal.
Solution	1) Set F9-01 to F9-03 properly. 2) Reduce the load and check the motor and mechanical conditions. 3) Check whether the motor is abnormal and the three-phase winding insulation is normal. 4) Locked-rotor occurs on the motor or the output current reaches the setting upper limit. Check whether the three-phase output voltage sampling board and the three-phase output voltage sampling circuit are normal. 5) Replace the I/O board or the main control board.

F12	Power input phase loss
Possible Cause	1) The three-phase input power is abnormal. 2) The three-phase input voltage sampling board is abnormal. 3) The input voltage sampling circuit of the AC drive is abnormal. 4) The control hardware is abnormal.
Solution	1) Eliminate external faults. 2) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 3) Eliminate the fault on the three-phase input voltage sampling circuit. 4) Replace the I/O board or the main control board. Contact our company for technical support.

F13	Power output phase loss
Possible Cause	1) The cable connecting the AC drive and the motor is abnormal. 2) The outputs of the AC drive are not connected to the motor.
Solution	1) Eliminate external faults. 2) Connect the outputs of the AC drive to the motor.

F15	External alarm
Possible Cause	The external fault signal is input through a multi-functional DI terminal.
Solution	Reset the operation.

F16	Communication fault
Possible Cause	1) The customer's RS485/CAN interface is abnormal. 2) The communication cable is damaged. 3) The communication parameters in group Fd are set incorrectly.
Solution	1) Check whether the customer's RS485/CAN interface works properly. 2) Check the communication cable. 3) Set the communication parameters correctly.

F18	Current detection fault
Possible Cause	1) The output hall sampling circuit is abnormal. 2) The output hall is abnormal. 3) The ±15 V power supply of the I/O board is abnormal. 4) The control hardware is abnormal.
Solution	1) Check whether breaking, loose connection or wrong connection exists on the output current sampling circuit. 2) Apply ±15 V to the output hall to check whether the M signal is connected correctly. Replace the output hall. 3) Use a multimeter to measure the ±15 V power supply of the I/O board. 4) Replace the I/O board or the main control board.

F19	Motor auto-tuning fault
Possible Cause	1) The three-phase output current sampling is abnormal. 2) The output hall is abnormal. 3) The three-phase output voltage sampling is abnormal. 4) The three-phase output voltage sampling board is abnormal. 5) The outputs of the AC drive are not connected to the motor. 6) An external force drives the motor. 7) The parameters in group F1 are not set according to the motor nameplate. 8) The control hardware is abnormal.
Solution	1) Check whether breaking, loose connection or wrong connection exists on the output current sampling circuit. 2) Apply ±15 V to the output hall to check whether the M signal is connected correctly. Replace the output hall. 3) Check whether breaking, wrong connection or loose connection exists on the three-phase output voltage sampling circuit. Check whether the U, V, W cables of the AC drive are connected properly. 4) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 5) Connect the outputs of the AC drive to the motor. 6) Cancel the external force. 7) Set the parameters in group F1 correctly. 8) Replace the I/O board or the main control board.

F20	Encoder fault
Possible Cause	1) The parameters in group F1 are set incorrectly. 2) The cable connection between the encoder and the PG card is abnormal. 3) The PG card is abnormal 4) The 24 V and 15 V switching-mode power supply is abnormal. 5) The encoder is abnormal 6) The main control board is abnormal.
Solution	1) Set the parameters in group F1 correctly. 2) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 3) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 4) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board 5) Replace the encoder. 6) Replace the I/O board or the main control board.

F21	Parameter read-write fault
Possible Cause	The EEPROM chip is damaged.
Solution	Replace the main control board.

F26	Accumulative running time reached
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

F27	User-defined fault 1
Possible Cause	1) The user-defined fault 1 signal is input through a multi-functional DI terminal. 2) The I/O board is abnormal.
Solution	1) Reset the operation. 2) Use another DI terminal or Replace the I/O board.

F28	User-defined fault 2
Possible Cause	1) The user-defined fault 2 signal is input through a multi-functional DI terminal. 2) The I/O board is abnormal.
Solution	1) Reset the operation. 2) Use another DI terminal or Replace the I/O board.

F29	Accumulative power-on time reached
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

F31	PID feedback lost during the drive running
Possible Cause	The PID feedback is smaller than the setting of FA-26.
Solution	Check the PID feedback signal or set FA-26 properly.

F32	Input impedance too small
Possible Cause	1) The three-phase input voltage sampling board is abnormal. 2) The three-phase input voltage sampling circuit is abnormal. 3) The insulation to ground of the AC drive inputs is abnormal. 4) The control hardware is abnormal. 5) The transformer is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the U, V, W cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 3) Disconnect the AC drive from the grid and then use a multimeter to measure the impedance to ground of the R, S, T inputs of the AC drive. Normally, the impedance to ground is above megohm to infinity. 4) Replace the I/O board or the main control board. 5) Contact our company for technical support.

F34	Transformer overload
Possible Cause	1) Check whether the load is too heavy or locked-rotor occurs on the motor. 2) The power rating of the AC drive is small. 3) The control hardware is abnormal. 4) The transformer is abnormal.
Solution	1) Reduce the load and check the motor and mechanical conditions. 2) Replace an AC drive of a larger power rating. 3) Replace the I/O board or the main control board. 4) Contact our company for technical support.

F35	Transformer no-load current abnormal
Possible Cause	1) The transformer is abnormal. 2) The input current detection circuit is abnormal.
Solution	1) Contact our company for technical support. 2) Contact our company for technical support.

F36	Input current unbalanced
Possible Cause	1) The input current detection circuit is abnormal. 2) The input current sampling mutual inductors are abnormal. 3) The input side of the transformer is abnormal. 4) The control hardware is abnormal.
Solution	1) Check the input current detection circuit. Check whether the connection breaks or whether the connection is loose. 2) Check the two levels of mutual inductors are installed properly and eliminate the faults. 3) Contact our company for technical support. 4) Replace the I/O board or the main control board.

F37	Input voltage exceeding the limit
Possible Cause	1) Check whether the AC drive is connected to the correct medium-voltage grid. 2) The three-phase input voltage sampling board is abnormal. 3) The three-phase input voltage sampling circuit is abnormal. 4) The control hardware is abnormal.
Solution	1) Confirm that the AC drive is connected to the correct medium-voltage grid. 2) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 3) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 4) Replace the I/O board or the main control board.

F38	Output current unbalanced
Possible Cause	1) The cables connecting the AC drive and the motor are not secure. 2) The output current sampling circuit of the AC drive is abnormal. 3) The control hardware is abnormal. 4) The parameters in group F1 are set incorrectly.
Solution	1) Check cable connection and tighten the screws. 2) Check the output current sampling circuit of the AC drive. 3) Replace the I/O board or the main control board. 4) Set the parameters in group F1 correctly.

F39	PLC communication abnormal
Possible Cause	1) The PLC is not powered on. 2) The PLC does not run. 3) The communication circuit between the PLC and the main control board is abnormal.
Solution	1) Check the power supply of the PLC. 2) Confirm that the PLC is in the RUN state. 3) Check the connection of the communication circuit of the PLC.

F41	Motor switchover fault during running
Possible Cause	1) The input of the DI terminal is abnormal. 2) The DI terminal is faulty. 3) The control hardware is abnormal.
Solution	1) Check whether the input of the DI terminal is correct. 2) Confirm that the used DI is a passive dry node. Use another DI terminal or replace the I/O board. 3) Replace the I/O board or the main control board.

F42	Speed feedback error too large
Possible Cause	1) The encoder parameters are set improperly. 2) The motor auto-tuning is not performed. 3) The speed feedback error too large detection parameters are set improperly. 4) The cable connection between the encoder and the PG card is abnormal. 5) The PG card is abnormal. 6) The 24 V and 15 V switching-mode power supply is abnormal. 7) The main control board is abnormal. 8) The encoder is abnormal
Solution	1) Set the encoder parameters in group F1 properly. 2) Perform the motor auto-tuning first and then operate the system. 3) Set F9-69 properly according to the actual condition. 4) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 5) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 6) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board. 7) Replace the I/O board or the main control board. 8) Replace the encoder.

F43	Motor overspeed
Possible Cause	1) The encoder parameters are set improperly. 2) The motor auto-tuning is not performed. 3) The speed feedback error too large detection parameters are set improperly. 4) The cable connection between the encoder and the PG card is abnormal. 5) The PG card is abnormal. 6) The 24 V and 15 V switching-mode power supply is abnormal. 7) The main control board is abnormal. 8) The encoder is abnormal.
Solution	1) Set the encoder parameters in group F1 properly. 2) Perform the motor auto-tuning first and then operate the system. 3) Set F9-69 properly according to the actual condition. 4) Connect the cable between the encoder and the PG card properly and check whether cable connection breaks or is loose according to the encoder instructions. 5) Check whether the cables of the MF38PG5 card are in good contact and whether the cables are connected properly. 6) Check whether the 24 V and 15 V switching-mode power supply. If abnormal, replace the I/O board 7) Replace the I/O board or the main control board. 8) Replace the encoder.

F44	Pre-charge fault
Possible Cause	1) The pre-charge contactor is not closed. 2) The input voltage is insufficient. 3) The pre-charge circuit is abnormal. 4) The pre-charge controller is abnormal. 5) The bus voltage cannot be charged with a power cell. 6) A cell communication fault or self-check failure occurs due to abnormal hardware. 7) Input current exists during pre-charge. 8) The control hardware is abnormal.
Solution	1) Confirm that the pre-charge contactor opens and closes normally. 2) Confirm the input voltage. 3) Check the connection of the pre-charge circuit and check whether breaking or loose connection exists. 4) Check whether the pre-charge controller runs normally. 5) Check whether the cell input wiring is correct. 6) Replace the cell optical fiber and cell control board. Then, redo pre-charge. 7) Set a smaller value of A9-29. 8) Replace the I/O board or the main control board.

F45	Motor overheat
Possible Cause	1) The external set DI function 134 (motor overtemperature feedback) is valid. 2) The motor overheat pre-warning threshold (F9-57) is a non-zero value and any of CH1 to CH3 temperature obtained by PLC sampling is higher than the threshold.
Solution	1) Check whether disconnection of DI setting exists. 2) Check whether the load is too heavy or locked-rotor occurs on the motor. If the load is too heavy, reduce the load as required.

F46	Control power fault
Possible Cause	1) The 24 V control power is abnormal. 2) The control power detection circuit is abnormal. 3) The DI terminal of the I/O board is abnormal. 4) The control hardware is abnormal.
Solution	1) Check whether the 24 V power is applied to the control system. 2) Check the control power detection circuit. 3) Use another DI terminal or replace the I/O board. 4) Replace the I/O board or the main control board.

F47	I/O board power abnormal
Possible Cause	1) The I/O board power is abnormal. 2) The control hardware is abnormal.
Solution	1) Check whether the power indicator (in the POWER STATE area) of the I/O board is normal. 2) Replace the I/O board or main control board.

F48	Interaction data fault
Possible Cause	1) The jumpers at the DSP and ARM program-burning interfaces on the main control board are handled improperly. 2) The DSP program is being burnt. 3) The main control board is abnormal.
Solution	1) Handle the jumpers at the program-burning interfaces on the main control board by default. 2) After program burning is complete, handle the jumpers by default, and then switch on the control power. 3) Replace the I/O board or the main control board.

F51	Magnetic pole position detection failed
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

F52	DP card communication fault
Possible Cause	1) The communication between the DP card and the PLC master is interrupted. 2) The setting of the station No. of the DP card slaves exceeds the limit. 3) The communication between the DP card and the PLC communication master times out.
Solution	1) Check whether the communication connection between the DP card and the PLC master is normal and reliable. 2) Modify the station No. of the DP card slaves to the allowable range. 3) Modify the PROFIBUS-DP communication timeout time (Fd-08).

F54	Excitation cabinet fault
Possible Cause	1) The multi-functional terminal 57 (excitation cabinet fault feedback) is ON. 2) The excitation command output of the excitation cabinet is inconsistent with the running status feedback of the excitation cabinet.
Solution	1) Check whether the terminal input signal is short-circuited or breaks. 2) Check whether the excitation cabinet is faulty, and reset the excitation cabinet fault. 3) Check whether excitation control command signal is interrupted, and check whether the excitation cabinet is started/stopped following the command. 4) Check whether the feedback signal cable of the excitation cabinet is disconnected.

F55	Output overvoltage
Possible Cause	1) The motor power rating and the AC drive power rating do not match. 2) The parameters in group F1 are set incorrectly.
Solution	1) Select a matching AC drive or motor. 2) Check whether the parameters in group F1 are set correctly.

F57	Phase-shifting transformer overtemp. fault
Possible Cause	1) The ambient temperature is too high (above 40°C). 2) The dust filter is blocked. 3) The gap of the transformer windscreen becomes large. 4) The fan on the cabinet roof works abnormally. 5) The AC drive overtemperature fault detection circuit signal is abnormal. 6) The temperature and humidity board is damaged. 7) The temperature and humidity board or I/O board circuit is abnormal. 8) The control hardware is abnormal.
Solution	1) Check the ambient temperature and make a record. 2) Clean the dust filter. 3) Check whether the gap of the transformer windscreen is too large. 4) Check whether the fan on the cabinet roof rotates in the reverse direction or whether the fan is damaged. 5) Check whether breaking, loose connection or wrong connection exists on the AC drive overtemperature fault detection circuit. 6) Check whether the temperature and humidity board works properly. 7) Replace the temperature and humidity board. 8) Replace the I/O board or the main control board, and contact our company for technical support.

F58	Cabinet door travel switch fault
Possible Cause	1) The cabinet door is not closed properly. 2) The cabinet door travel switch is faulty. 3) The cabinet door travel switch fault detection circuit is abnormal. 4) The DI circuit of the I/O board is abnormal. 5) The control hardware is abnormal.
Solution	1) Check the cabinet door closing condition. 2) Check the cabinet door travel switch and its contact. 3) Check whether wrong connection, breaking or loose connection exists on the cabinet door travel switch fault detection circuit. 4) Use another DI terminal or replace the I/O board. 5) Replace the I/O board or the main control board.

F59	Fan fault
Possible Cause	1) The wiring of the fan fault detection circuit is wrong. 2) The fan is faulty. 3) The DI circuit of the I/O board is abnormal. 4) The control hardware is abnormal.
Solution	1) Check the fan fault detection circuit. 2) Replace the fan on the cabinet roof. 3) Use another DI terminal or replace the I/O board. 4) Replace the I/O board or the main control board.

F120	Input voltage unbalanced
Possible Cause	1) The three-phase input voltage sampling board is abnormal. 2) The three-phase input voltage sampling circuit is abnormal. 3) The control hardware is abnormal. 4) The grid input voltage is abnormal.
Solution	1) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 3) Replace the I/O board or the main control board. 4) Check whether the grid voltage on the user input side is abnormal.

F121	Output voltage unbalanced
Possible Cause	1) The three-phase output voltage sampling board is abnormal. 2) The three-phase output voltage sampling circuit is abnormal. 3) The control hardware is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the U, V, W cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase output voltage sampling circuit. 3) Replace the I/O board or the main control board.

F122	Motor excitation fault
Possible Cause	1) The three-phase output voltage sampling board is abnormal. 2) The three-phase output voltage sampling circuit is abnormal. 3) The setting of F6-16 (Current of catching a spinning motor) is too large. 4) The control hardware is abnormal.
Solution	1) Check whether the three-phase output voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the U, V, W cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase output voltage sampling circuit. 3) Set F6-16 to the proper value that satisfies the on-site requirement. Generally, the setting of F6-16 is smaller than F1-10 (No-load current). 4) Replace the I/O board or the main control board.

F160	Input voltage abnormal
Possible Cause	1) The three-phase input voltage sampling board is abnormal. 2) The three-phase input voltage sampling circuit is abnormal. 3) The control hardware is abnormal. 4) The grid input voltage is abnormal. 5) The circuit breaker feedback is abnormal. 6) The pre-charge resistor is abnormal.
Solution	1) Check whether the three-phase input voltage sampling board is normal, whether the resistance value of the sampling board is correct, whether the phase sequence is correct, and whether the R, S, T cables of the AC drive are connected properly. 2) Check whether breaking, wrong connection or loose connection exists on the three-phase input voltage sampling circuit. 3) Replace the I/O board or the main control board. 4) Check whether the grid voltage on the user input side is abnormal. 5) Check the circuit breaker and the input signal of the I/O board are normal. 6) Check whether the pre-charge resistor is normal.

F161	Reactor overtemp.
Possible Cause	1) The reactor temperature is too high. 2) The DI circuit of the I/O board is abnormal. 3) The control hardware is abnormal.
Solution	1) Cool down the reactor. 2) Use another DI terminal or replace the I/O board. 3) Replace the I/O board or the main control board.

F162	Back EMF decay overtime fault
Possible Cause	1) Too many bypass cells. 2) The maximum back EMF decay time setting is too small. 3) The output voltage sampling circuit is abnormal.
Solution	1) Replace the faulty cell. 2) Set a higher value for A9-03 (Maximum back EMF decay time). 3) Contact our company for technical support.

F163	Switchover timeout fault
Possible Cause	1) Synchronous switchover timeout setting is too small. 2) The input voltage fluctuation is large.
Solution	1) Set a higher value for F6-24. 2) Contact our company for technical support.

F165	Motor cooling fan fault
Possible Cause	1) The wiring of the cooling fan feedback DI or cooling fan control DO is inconsistent with the parameter settings. 2) The cooling fan control DO command is interrupted or cooling fan feedback DI is disconnected.
Solution	1) Check whether the parameter settings are consistent with the wiring. 2) Check whether the DI/DO wiring circuit is correct and whether short-circuit or disconnection exists.

7.3 Power Cell Faults

F60	Power cell fault
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

F61	Power cell communication fault
Possible Cause	1) The 5 V power cables of the optical fiber board are not connected. 2) The optical fiber head has dirt. 3) The connector of the optical fiber becomes loose. 4) The optical fiber is damaged. 5) The optical fiber board is faulty. 6) The main control board is faulty.
Solution	1) Connect the 5 V power cables of the optical fiber board correctly. 2) Clean the optical fiber head. 3) Re-connect the optical fiber. 4) Replace the optical fiber. 5) Replace the power cell control board. 6) Replace the main control board.

F62	Power cell blocked
Possible Cause	1) The power device is abnormal. 2) The power cell control board is abnormal.
Solution	1) Replace a power cell of the same power rating. 2) Replace the power cell control board.

F63	Power cell overcurrent
Possible Cause	1) The power device is abnormal. 2) The power cell is abnormal.
Solution	1) Replace a power cell of the same power rating. 2) Replace the power cell control board.

F64	Cell input phase loss
Possible Cause	1) The wiring of the cell input terminal is incorrect. 2) The transformer is faulty. 3) The cell fuse is damaged. 4) The cell control board is abnormal.
Solution	1) Check that the cell input wiring is correct. 2) Contact our company for technical support. 3) Replace the fuse and eliminate all other reasons for fuse breakage. 4) Replace the control board of the faulty cell.

F66	Power cell overvoltage
Possible Cause	1) The grid voltage is very high. 2) The setting of F2-12 (Digital setting of braking torque upper limit in speed control mode) is too large. 3) The wiring of inputs of the faulty power cell is wrong. 4) The load inertia is large but the setting of the deceleration time is too short. 5) The power cell control board is abnormal. 6) The output current oscillates.
Solution	1) Lower the input voltage and adjust the transformer contact terminal to +5%. 2) Decrease F2-12 with the principle of ensuring the 50 Hz output voltage normal. 3) Check whether the wiring of inputs of the faulty power cell is abnormal. 4) Set longer deceleration time. 5) Replace the power cell control board. 6) Contact our company for technical support.

F68	Power cell overtemp.
Possible Cause	1) The ambient temperature is too high. 2) The power cell is not well ventilated. 3) The dust filter is blocked. 4) The fan is damaged. 5) The power cell control board is abnormal.
Solution	1) Lower the ambient temperature. 2) Replace the cell and contact our company for technical support. 3) Clean the dust filter. 4) Check whether the fan rotates in the reverse direction or whether the fan is damaged. 5) Replace the power cell control board.

F69	Power cell undervoltage
Possible Cause	1) The grid voltage is very low. 2) The transformer is faulty. 3) The power cell control board is abnormal.
Solution	1) Check the grid voltage and adjust the transformer contact terminal to -5%. 2) Contact our company for technical support. 3) Replace the power cell control board and contact our company for technical support.

F70	Power cell bypass fault
Possible Cause	1) The bypass contactor is faulty. 2) The control cable of the bypass contactor is wrongly connected. 3) The bypass board is faulty. 4) The power cell control board is abnormal.
Solution	1) Replace the bypass contactor. 2) Re-connect the control cable of the bypass contactor. 3) Replace the bypass board. 4) Replace the power cell control board and contact our company for technical support.

F71	Cell drive power fault
Possible Cause	Contact our company for technical support.
Solution	Contact our company for technical support.

7.4 Replacing Damaged Power Cells

All power cells are the same and do not have highly matching requirements on power devices. If a power cell is damaged, the technician of the user can replace it with a normal one by performing the following steps.

1) Stop the AC drive by remote control or pressing the emergency stop button.
2) Cut off the MV power and wait for 15 minutes until all indicators of the power cells become OFF.
3) Remove the optical fiber connector of the damaged power cell.
4) Remove the connected cables and the tightening screws of the damaged power cell.
5) Pull the damaged power cell out along the track. Handle it with care.
6) Mount a new power cell by reversing the preceding steps, perform wiring and re-power on the system.
7) Contact our company to repair the damaged power cell.

8 Maintenance and Repair

This chapter describes the precautions during maintenance and repair of the MV AC drive.

DANGER	
	◆ Never touch the terminals of the AC drive within 10 minutes after the MV input is cut off. The terminals still have residual hazardous medium voltage. ◆ Maintain and repair the AC drive only after the main circuits are cut off and power cells discharge completely (the power cell power indicator in the OFF state).

CAUTION	
	◆ Never touch the circuit board or the drive board directly with fingers because electrostatic induction may damage the integrated circuit of the circuit board. ◆ Never change wiring or remove cables connecting to the terminals at power-on. Failure to comply may result in electric shock.

8.1 Precautions During Inspection

1) Before starting the inspection, turn off the circuit breaker, pull down the knife switch and label a warning notice to prevent sudden power-on by others.

2) Ensure that the AC drive is in the stop state and the MV presence indicator is OFF.

3) After medium voltage and low voltage are cut off, perform an electrical inspection before overall inspection. For medium voltage inspection, use an electroscope of the corresponding voltage rating and wear insulated safety articles.

4) After verifying that the AC drive is de-energized, tie the input three phases of the AC drive to the ground to ensure personal safety.

5) Ground all parts of the AC drive which are liable to become energized. When inspecting a bus knife switch, an isolation switch or a load switch in the double-circuit system, pull down both bus knife switches and ground the inspected switch at both ends.

6) When installing a grounding cable, make one end of the grounding cable grounded first, and then attach the other end. When removing a grounding cable, perform the operations in a reverse sequence. For either installation or removal, wear insulated safety articles.

7) Attach the grounding cable to the place where electrical engineers can see it at any time and label a "Working" warning notice there.

8) Perform inspection only after verifying that the residual DC voltage is lower than 20 V.

8.2 Precautions on Operations

1) The MV AC drive is a hazardous medium voltage device. Any operator must strictly observe the operation instructions.
2) Power on the control power first. Switch on the MV power after MV switch-on is allowed.
3) When using the HMI, touch it slightly with fingers. Never knock it or press it with a hard object.
4) Never allow irrelevant personnel to use the HMI to avoid malfunction.
5) Never open the cabinet door during the AC drive running. Otherwise, the system will report a fault and enable the input MV breaker, and even personnel injury may be caused.

8.3 Daily Check

The influence of the ambient temperature, humidity, smoke and aging of internal components of the AC drive may cause potential faults. Therefore, it is necessary to perform daily check on the AC drive during storage and use. Check whether any abnormality occurs, for example, cooling system abnormal, overtemperature, discoloring, peculiar smell, abnormal noise and abnormal oscillation. Transcribe the input/output parameters of the AC drive and check whether they are normal regularly.

Table 8-1 Daily checklist of the AC drive

Checking Part	Item	Method	Judging Criteria	Troubleshooting Solution
Environment	◆ Dust, oil stain, water drop ◆ Ambient temperature, humidity, vibration ◆ Whether any foreign object and hazardous article exists	Observe	Ambient temperature: -10°C to 40°C Humidity: less than 95%RH	Improve the on-site environment.
Phase-shifting transformer	◆ Whether the cooling channel is blocked and whether the wire guide head is properly tightened without burnt sign ◆ Whether abnormal temperature rise occurs ◆ Whether the phase-shifting transformer is clean	Observe	No abnormality	Find the cause and eliminate the fault. Clean the phase-shifting transformer.

Checking Part	Item	Method	Judging Criteria	Troubleshooting Solution
HMI	◆ Resolution of the HMI	Observe	No abnormality	Adjust the contrast and brightness.
Frame	◆ Whether there is abnormal vibration or noise ◆ Whether screws (fastening pieces) become loose ◆ Whether the frame deforms or is damaged ◆ Whether there are dust and oil stain	Listen Observe	No abnormality	Find the cause and eliminate the fault.
Cables	◆ Whether cables discolor or deform due to overtemperature ◆ Whether the insulating layer gets worn or discolors	Observe	No abnormality	Find the overtemperature cause and eliminate the fault.
Terminals	◆ Whether any terminal is damaged	Observe	No abnormality	Replace the damaged terminal.
Filter capacitor	◆ Whether liquid leakage, discoloring, cracking and housing expansion occurs on the filter capacitor ◆ Measure electrostatic capacitance	Observe Measure with a multimeter	No abnormality Electrostatic capacitance ⩾ initial value x 0.85	Replace the capacitor.
Resistor	◆ Whether any cable breaks ◆ Whether any insulator cracks	Observe Measure with a multimeter	The resistance value is within ±10%.	Replace the resistor.
Transformer	◆ Whether there is any abnormal vibration and peculiar smell	Observe Listen Smell	No abnormality	Find the cause and eliminate the fault.

Checking Part	Item	Method	Judging Criteria	Troubleshooting Solution
PCB	◆ Whether the screw and bolt become loose ◆ Whether the PCB has peculiar smell or discolors ◆ Whether the PCB cracks, is damaged, deformed, or is corroded ◆ Whether liquid leakage or deformation occurs on the capacitor	Observe	No abnormality	Tighten the screw and bolt. Repair the PCB.
Cooling fan	◆ Whether there is abnormal vibration or noise	Observe Listen	No abnormality	Replace the fan.
Air duct	◆ Whether the air duct is blocked or adhered with foreign objects	Observe Listen	No abnormality	Clear away the foreign objects.

8.4 Periodical Repair and Maintenance

Although the MV AC drive is highly reliable and maintenance-free, we still suggest performing the followi periodical maintenance.

1) Clean the dust filters on cabinet doors periodically to ensure good heat dissipation effect.

2) The operator on duty or maintenance engineer must inspect and check the transformer periodically. Record the temperature of the transformer windings, and ensure that this temperature in normal operating condition does not exceed 80° C.

3) After the transformer is put into operation, clean it every year.

4) Check and tighten all wiring screws every six months.

5) The voltage resistance test on the AC drive has been done before delivery. Never perform such test to avoid damage to the AC drive. However, you can check the insulation condition of the system periodically.

6) Power off the system periodically and open the cabinet doors to perform checking according to Table 8-1.

■ Handling of the AC drive in de-energized state for over 90 days

If the AC drive must be stored in the de-energized (medium voltage switch-off) state for over 90 days after you received, the storage environment of the AC drive must comply with the storage environment requirements of our company.

If you do not notify our company to commission the AC drive for over six months, our company will test the AC drive during commissioning for the first time. Please provide the medium-voltage drive for commissioning.

■ Storage of spare parts

The spare parts must be stored in the environment that satisfies the requirements in section "2.1.1 Environment Requirements".

The power cells contain a great number of capacitors. Long-term storage will degrade the electrolytic capacitors. Thus, energize the AC drive once every six months, and keep energizing the drive for more than one hour each time.

It is suggested that you use a voltage regulator for energizing the drive. Connect the outputs A, B, C of the voltage regulator to the inputs R, S, T of the power cells and adjust the output voltage to 450 to 690 V. Then observe the power cell state.

■ Service life of internal components

To enable the AC drive to keep normal running, it is necessary to perform repair and maintenance based on the service life of internal components of the AC drive. Their service life is related to the operating environment and condition. The general service life of the internal components is listed in the following table.

Table 8-2 Service life of internal components

Component Name	Service Life
Cabinet top fan	3 to 5 years
Electrolytic capacitor	5 to 8 years
Fuse	10 years

■ Replacement of the air filter

The MV AC drive adopts the forced air cooling method, which causes dust accumulation around the air filters after the AC drive runs for a long time. To ensure normal heat dissipation, it is necessary to clean or replace the air filters (delivered with the AC drive) periodically. It is suggested that the air filters are cleaned every 10 days. The cleaning period depends on the actual applications and should be shortened in heavy dust scenario.

The procedure for cleaning or replacing the air filter is as follows:

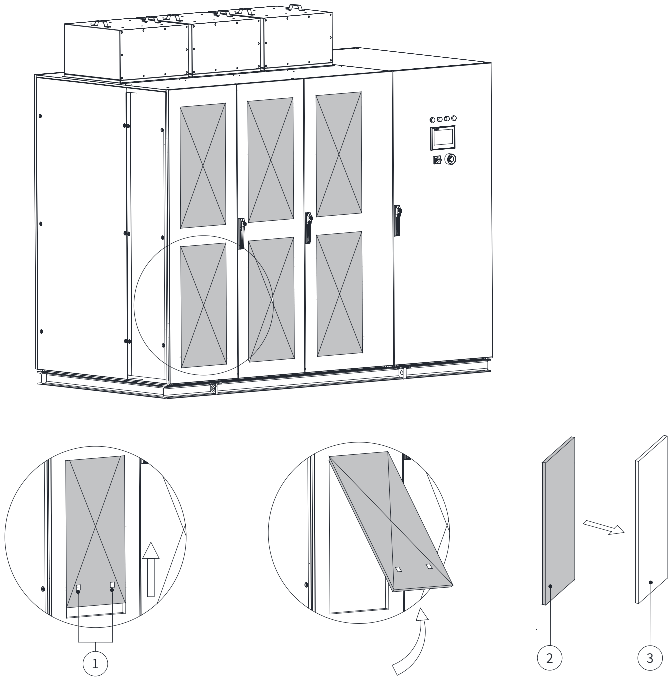


Figure 8-1 Procedure for replacing the air filter

No.	Component Name
①	Hole
②	Front frame
③	Filter mat

1) Do as followings to remove the filter, as shown in Figure 8-1.

■ Hook the two holes with fingers and pull up the filter

■ Pull out the filter frame.

■ Remove the filter frame.

2) Clear the dust on the filter by using a vacuum cleaner. If the filter cannot be cleaned, replace it.

3) Install the air filter in the reverse steps.

4) Clean or replace the air filters on all cabinet doors of the MV AC drive one by one in the same way.

8.5 Disposal

When disposing an obsolete AC drive and its components, pay attention to the following items:

- The electrolytic capacitors inside the AC drive may explode when they are burnt.
- Poisonous gas is generated when the PCB, plastic, rubber parts and epoxy board are burnt.
- Treat them as ordinary industrial waste.

Appendix A: Parameter Table

The symbols in the parameter table are described as follows:

Symbol	Meaning
☆	It is possible to modify the parameter with the MV AC drive in the stop or in the running state.
★	It is possible to modify the parameter with the MV AC drive only in the stop state.
●	The parameter cannot be modified.

A.1 Standard Parameters

Para. No.	Param. Name	Setting Range	Default	Property
Group F0: Standard Parameters				
F0-01	Motor 1 control mode	0: Sensorless vector control (SVC1) 1: Feedback vector control (FVC) 2: Voltage-type sensorless vector control (SVC2)	2	★
F0-02	Remote 1 command source selection	0: Operation panel control 1: Terminal control 1 2: Modbus-RTU 3: PROFIBUS-DP 5: PC 6: CAN	1	☆
F0-03	Main frequency setting channel selection	0: Digital setting (initial value F0-08 can be modified by keypad or terminal UP/DOWN, non-retentive at power failure) 1: Digital setting (initial value F0-08 can be modified by keypad or terminal UP/DOWN, retentive at power failure) 2: AI1 3: AI2 4: AI3 5: AI4 7: Multi-reference 8: Simple PLC 9: PID 10: PC 11: Modbus-RTU 12: PROFIBUS-DP 13: HMI 14: CAN	0	★
F0-08	Preset frequency	0.00 to F0-10 (Max. frequency)	50.00 Hz	☆
F0-09	Running direction	0: Run in the same direction 1: Run in the reverse direction	0	☆
F0-10	Max. frequency	50.00 to 600.00 Hz	50.00 Hz	★

Para. No.	Param. Name	Setting Range	Default	Property
F0-11	Setting channel of frequency reference upper limit	0: Set by F0-12 (Frequency upper limit) 1: AI1 2: AI2 3: AI3 5: Communication setting 6: AI4	0	☆
F0-12	Frequency upper limit	F0-14 (Frequency lower limit) to F0-10 (Max. frequency)	50.00 Hz	☆
F0-13	Frequency reference upper limit offset	0.00 Hz to F0-10 (Max. frequency)	0.00 Hz	☆
F0-14	Frequency lower limit	0.00 Hz to F0-12 (Frequency upper limit)	3.00 Hz	☆
F0-17	Acceleration time 1	0.0 s to 6500.0 s	80.0 s	☆
F0-18	Deceleration time 1	0.0 s to 6500.0 s	100.0 s	☆
F0-21	Frequency offset of auxiliary frequency setting channel for main and auxiliary calculation	0.00 Hz to F0-10 (Max. frequency)	0.00 Hz	☆
F0-22	Frequency reference resolution	2: 0.01 Hz	2	★
F0-23	Retentive of digital setting frequency upon stop	0: Disabled 1: Enabled	0	☆
F0-24	Motor selection	0: Motor 1 1: Motor 2 2: Motor 3 3: Motor 4	0	☆
F0-25	Acceleration/ Deceleration time base frequency	0: F0-10 (Max. frequency) 1: Frequency reference 2: 100 Hz	0	★
F0-26	Base frequency for UP/DOWN modification during running	0: Running frequency 1: Set frequency	0	★

Para. No.	Param. Name	Setting Range	Default	Property
F0-27	Binding remote 1 command source to frequency reference setting channel	Ones: Binding PC control to the frequency reference setting channel 0: No binding 1: Digital setting frequency reference 2: AI1 3: AI2 4: AI3 5: AI4 7: Multi-reference 8: Simple PLC 9: PID A: PC B: Modbus-RTU C: PROFIBUS-DP D: HMI E: CAN Tens: Binding terminal control to frequency reference setting channel Hundreds: Binding Modbus-RTU control to frequency reference setting channel Thousands: Binding PROFIBUS-DP control to frequency reference setting channel	H.0020	☆
F0-29	Remote 2 command source selection	1: Terminal control 2 0, 2 to 6: same as F0-02	1	☆
F0-30	Binding remote 2 command source to frequency reference setting channel	Tens: Binding terminal command 2 to frequency source Others: Same as F0-27	H.0030	☆
Group F1: Motor 1 Parameters				
F1-00	Motor type selection	0: General asynchronous motor 1: Variable frequency asynchronous motor 2: Electrically excited synchronous motor	0	★
F1-01	Rated motor power	1 to 65535 kW	Model dependent	★
F1-02	Rated motor voltage	1 to 65535 V	Model dependent	★
F1-03	Rated motor current	0.1 to 6553.5 A	Model dependent	★
F1-04	Rated motor frequency	0.01 Hz to maximum frequency	Model dependent	★
F1-05	Rated motor speed	1 to 65535 rpm	Model dependent	☆

Para. No.	Param. Name	Setting Range	Default	Property
F1-06	Asynchronous motor stator resistance	0.01% to 30.00%	Auto-tuned	☆
F1-08	Asynchronous motor leakage inductive reactance	0.01% to 50.00%	Auto-tuned	☆
F1-10	Asynchronous motor no-load current	0.01% to 100.00%	Auto-tuned	☆
F1-27	Encoder pulses per revolution	1 to 65535	1024	★
F1-30	A/B phase sequence of ABZ incremental encoder	0: Forward 1: Reserve	0	★
F1-36	Detection threshold of encoder signal loss	0.0%: No detection 0.0% to 70.0%	5.0%	☆
F1-37	Auto-tuning selection	0: Inactive 1: Static auto-tuning 2: Complete auto-tuning	0	★
Group F2: Motor 1 Vector Control Parameters				
F2-00	Speed loop proportional gain 1	0.000 to 1.000	0.025	☆
F2-01	Speed loop integral gain 1	0.000 to 65.535	0.050	☆
F2-02	Switch frequency 1	0.00 to F2-05	5.00	☆
F2-03	Speed loop proportional gain 2	0.00 to 1.000	0.015	☆
F2-04	Speed loop integral gain 2	0.000 to 65.535	0.025	☆
F2-05	Switch frequency 2	F2-02 to F0-10	10.00	☆
F2-08	Speed loop kf gain	0.01 to 1.00	1.00	☆

Para. No.	Param. Name	Setting Range	Default	Property
F2-09	Drive torque upper limit source in speed control mode	0: F2-10 1: AI1 2: AI2 3: AI3 5: Communication 6: Minimum (AI1, AI2) 7: Maximum (AI1, AI2) 8: AI4 100% of the values 1 to 8 corresponding to F2-10	0	☆
F2-10	Digital setting of drive torque upper limit in speed control mode	0.0% to 300.0%	120.0%	☆
F2-12	Digital setting of braking torque upper limit in speed control mode	0.0% to 150.0%	0.3%	☆
F2-13	Current loop proportional gain	0.00 to 5.00	0.50	☆
F2-14	Current loop integral gain	0.0 to 6000.0	25.0	☆
F2-23	Flux loop proportional gain	0.00 to 10.00	1.72	☆
F2-24	Flux loop integral gain	0.0 to 1200.0	2.0	☆
F2-25	Flux filter time	0.0000 to 6.5535	0.0300	☆
F2-26	Flux set value	0.000 to 10.000 PU	1.000 PU	☆
F2-27	Flux ramp time	0.0 to 5.0 s	0.5s	☆

Para. No.	Param. Name	Setting Range	Default	Property
Group F4: Input Terminals				
F4-00	DI1 function selection	0: No function 1: Forward run (FWD) 2: Reverse run (REV) 3: Three-wire control mode 4: Forward jog (FJOG) 5: Reverse jog (RJOG) 6: Terminal UP 7: Terminal DOWN 8: Coast to stop 9: Fault reset (RESET) 10: Running pause 11: External fault input 12 to 15: Multi-reference terminals 1 to 4 16: Terminal 1 for acceleration/ deceleration selection 17: Terminal 2 for acceleration/ deceleration selection 18: Frequency source switchover 19: UP and DOWN setting clear 20: Local/Remote 21: Acceleration/Deceleration inhibited 22: PID pause 23: PLC status reset 24: Transformer overtemp. fault 25: Transformer overtemp. fault 26: Cabinet door travel switch 27: Cabinet top fan state feedback 28: Remote 1/Remote 2 29: Torque control inhibited 31: Emergency stop 33: Control power normal 34: Frequency setting effective 35: Reverse PID operation direction 37: Emergency switch-off 38: PID integral disabled 39: Switchover between main frequency reference X and preset frequency reference 40: Switchover between auxiliary frequency reference Y and preset frequency 41: Motor selection 1 42: Motor selection 2 43: PID parameter switchover 44: User-defined fault 1 45: User-defined fault 2 46: Speed control/Torque control switchover	1031	●
F4-01	DI2 function selection		1025	●
F4-02	DI3 function selection		1024	●
F4-03	DI4 function selection		1026	●
F4-04	DI5 function selection		27	●
F4-05	DI6 function selection		1020	●
F4-06	DI7 function selection		33	●
F4-07	DI8 function selection		0	★
F4-08	DI9 function selection		1	★
F4-09	DI10 function selection		1003	★
F4-10	DI11 function selection		9	★
F4-11	DI12 function selection		28	★
F4-12	DI13 function selection		58	★
F4-13	DI14 function selection		1060	★

<table>
<tr><th>Para. No.</th><th>Param. Name</th><th>Setting Range</th><th>Default</th><th>Property</th></tr>
<tr><td>F4-14</td><td>DI15 function selection</td><td rowspan="9">48: AC drive enabled (detected only during start-up)
50: Bypass cabinet 1 inlet contactor/knife-switch feedback
51: Bypass cabinet 1 outlet contactor/knife-switch feedback
52: Bypass cabinet 1 mains frequency contactor/knife-switch feedback
53: Variable frequency contactor feedback
54: Mains frequency contactor feedback
56: Excitation cabinet ready
57: Excitation cabinet faulty
58: Forward run 2 (FWD)
59: Reverse run 2 (REV)
60: Three-wire control mode 2
61: Pre-charge command
62: Power controller faulty
63: Crossflow fan state feedback
66: Bypass cabinet 2 inlet contactor/knife-switch feedback
67: Bypass cabinet 2 outlet contactor/knife-switch feedback
68: Bypass cabinet 2 mains frequency contactor/knife-switch feedback
69: Pre-charge contactor feedback
71: Process ready
72: Water cooling system faulty
73: Inlet circuit breaker/contactor feedback
74: Auto switching-on enabled
75: Sync switching-on instruction
76: Sync switching-off instruction
78: Reserved
79: Reactor overtemperature
80: Reactor bypass contactor feedback
81: Pre-charge resistor bypass contactor feedback
82: Excitation cabinet runtime feedback
83: Bypass cabinet switching-on instruction
85: Bypass cabinet switching-off instruction
86-91: Fans 2-7 faulty
92: Pre-charge switch-off command
93: Motor 3 selection
94: Motor 4 selection
95: Variable frequency contactor 2 feedback
96: Mains frequency contactor 2 feedback
97: Variable frequency contactor 3 feedback
98: Mains frequency contactor 3 feedback
99: Variable frequency contactor 4 feedback
100: Mains frequency contactor 4 feedback
101-104: Soft starters 1-4 started</td><td>0</td><td>★</td></tr>
<tr><td>F4-15</td><td>DI16 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-16</td><td>DI17 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-17</td><td>DI18 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-18</td><td>DI19 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-19</td><td>DI20 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-20</td><td>DI21 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-21</td><td>DI22 function selection</td><td>0</td><td>★</td></tr>
<tr><td>F4-22</td><td>DI23 function selection</td><td>0</td><td>★</td></tr>
</table>

Para. No.	Param. Name	Setting Range	Default	Property
F4-23	DI24 function selection	105-108: Soft starters 1-4 stopped 110: Bypass cabinet 1 variable frequency branch switched on 111: Bypass cabinet 2 variable frequency branch switched on 112: Bypass cabinet 2 down transfer command 113: Grounding knife switch feedback 114: Heating and dehumidification feedback 128: Cooling fan feedback 134: Motor overtemperature feedback 135: Bypass cabinet power feedback The terminal input is set in the range from 0 to 1135. If the thousands position is 1, the signal is normally closed and valid; the lower 3 digits indicate the selected function of the terminal input. A value higher than 135 will void this function. For example, 1009 indicates that the terminal functions to reset a fault and the signal type is normally closed.	0	★
F4-24	DI25 function selection		0	★
F4-25	DI26 function selection		0	★
F4-66	DI filter time	0.000 s to 1.000 s	0.030 s	☆
F4-67	DI9 delay	0.0 s to 3600.0 s	0.0 s	☆
F4-71	DI16 replacement selection	0 to 7 0, 1: Used as DI16 2 to 7: Used as DI2 to DI7	0	★
F4-72	DI17 replacement selection	0 to 7: same as above	0	★
F4-73	Terminal command mode	Ones: Terminal command channel 1 0: Two-wire mode 1 1: Two-wire mode 2 2: Three-wire mode 1 3: Three-wire mode 2 Tens: Terminal command channel 2, same as above	H.22	★

Para. No.	Param. Name	Setting Range	Default	Property
Group F5: Output Terminals				
F5-01	DO1 function selection	0: No output 1: AC drive running 2: Fault (stop upon fault) 5: Zero-speed running 6: Motor overload pre-warning 7: AC drive overload pre-warning 11: PLC cycle completed 12: Accumulative running time reached 14: Torque limited 15: Ready 16: AI1 > AI2 17: Frequency upper limit reached 18: Frequency lower limit reached (related to running) 23: AC drive zero-speed running 24: Accumulative power-on time reached 40: MV switch-on allowed 41: MV breaker enable 42: AC drive running contactor output 44: Main power indication 45: Alarm output 46: HMI reset 47: Bypass cabinet outlet contactor switched off 49: Excitation cabinet excitation command 52: Variable frequency contactor switched on 53: Variable frequency contactor switched off 54: Mains frequency contactor switched on 55: Mains frequency contactor switched off 58: Power controller running command 59: Power controller contactor control 60: Pre-charge contactor switched on 61: Motor 1 automatically switching to mains frequency 62: Fan auto run 63: Pre-charge contactor switched off 64: Switchgear 2MV breaker enable 65: Motor 2 automatically switching to mains frequency	1041	★
F5-02	DO2 function selection		40	★
F5-03	DO3 function selection		44	★
F5-04	DO4 function selection		15	★
F5-05	DO5 function selection		1	★
F5-06	DO6 function selection		1001	★
F5-07	DO7 function selection		2	★
F5-08	DO8 function selection		45	★
F5-09	DO9 function selection		46	★
F5-10	DO10 function selection		0	★
F5-11	DO11 function selection		0	★
F5-12	DO12 function selection		0	★
F5-13	DO13 function selection		0	★
F5-14	DO14 function selection		0	★

Para. No.	Param. Name	Setting Range	Default	Property
F5-15	DO15 function selection	66: Motor 1 variable frequency indication 67: Motor 1 mains frequency indication 68: Switching-on ready 69: Switching-off ready 70: Synchronous switching contactor unlocked 71: Switching-on process indication 72: Switching-off process indication 75: Heater ON 76: Pre-charge resistor bypass contactor switched off 77: Pre-charge resistor bypass contactor switched on 78: Reactor bypass contactor switched off 79: Reactor bypass contactor switched on 80: Motor 2 variable frequency indication 81: Motor 2 mains frequency indication 82: Remote 1/remote 2 indication 83: Switchgear 2 switch-on allowed 84: Specific fault output 87: Bypass cabinet 1 outlet contactor switched on 88: Bypass cabinet inlet contactor switched off 89: Bypass cabinet 1 mains frequency contactor switched off 90: Bypass cabinet 2 outgoing line contactor switched on 91: Bypass cabinet 2 mains frequency contactor switched off 92: Variable frequency contactor 2 switched on 93: Variable frequency contactor 2 switched off 94: Mains frequency contactor 2 switched on 95: Mains frequency contactor 2 switched off 96: Variable frequency contactor 3 switched on 97: Variable frequency contactor 3 switched off 98: Mains frequency contactor 3 switched on 99: Mains frequency contactor 3 switched off 100: Variable frequency contactor 4 switched on 101: Variable frequency contactor 4 switched off 102: Mains frequency contactor 4 switched on 103: Mains frequency contactor 4 switched off 104-106: Synchronous switching contactor unlocked 2-4 107: Motor 3 variable frequency indication 108: Motor 3 mains frequency indication 109: Motor 4 variable frequency indication 110: Motor 4 mains frequency indication 112: Bypass cabinet 1 inlet contactor switched on	0	★
F5-16	DO16 function selection		0	★
F5-17	DO17 function selection		0	★
F5-18	DO18 function selection		0	★
F5-19	DO19 function selection		0	★
F5-20	DO20 function selection		0	★
F5-21	DO21 function selection		0	★
F5-22	DO22 function selection		0	★
F5-23	DO23 function selection		0	★
F5-24	DO24 function selection		62	★
F5-25	DO25 function selection		0	★
F5-26	DO26 function selection		0	★
F5-27	DO27 function selection		0	★
F5-28	DO28 function selection		0	★
F5-28	DO29 function selection		0	★
F5-30	DO30 function selection		0	★
F5-31	DO31 function selection		0	★
F5-32	DO32 function selection		0	★

Para. No.	Param. Name	Setting Range	Default	Property
F5-33	DO33 function selection	113: Bypass cabinet 2 inlet contactor switched on 115: Output contactor switched off 120: Motor cooling fan control 125: Bypass LV pre-charge resistor contactor control The terminal input is set in the range from 0 to 1125. If the thousands position is 1, the signal is a type of normally closed output; the lower 2 digits indicate the selected function of the terminal output. For example, for 01 and 1001, 01 indicates that the terminal has output when the AC drive operates, and 1001 indicates that the terminal has output when the AC drive does not operate.	0	★
F5-34	DO34 function selection		0	★
F5-53	Terminal function selection Y14	0 to 120	0	★
F5-54	Terminal function selection Y15	0 to 120	0	★
F5-55	Terminal function selection Y16	0 to 120	0	★
F5-56	Terminal function selection Y17	0 to 120	0	★
F5-57 to F5-68	Terminal function selection Y00 to terminal function selection Y13	0 to 120	0	★
F5-69	DO12 delay	0.0 s to 3600.0 s	0.0 s	★
F5-70	DO13 delay	0.0 s to 3600.0 s	0.0 s	★
F5-71	DO14 delay	0.0 s to 3600.0 s	0.0 s	★
F5-72	DO15 delay	0.0 s to 3600.0 s	0.0 s	★
Group F6: Start/Stop Control				
F6-00	Start mode	0: Direct start 1: Catching a spinning motor in the forward direction 2: Catching a spinning motor in the reverse direction 3: Catching a spinning motor in the forward/reverse direction	0	☆
F6-01	Start delay	0.0 s to 60.0 s	0.0 s	☆
F6-07	Acceleration/ Deceleration mode	0: Linear acceleration/deceleration 1: Static S-curve acceleration/deceleration	0	★

Para. No.	Param. Name	Setting Range	Default	Property
F6-10	Stop mode	0: Decelerate to stop 1: Coast to stop	1	☆
F6-16	Current of catching a spinning motor	1.0 to 50.0%	20.0%	☆
F6-17	Rotational speed tracking startup frequency-sweep acceleration time	0.01s to 5.00 s	3.00 s	☆
F6-18	Rotational speed tracking startup frequency sweep end threshold	1.0% to 50.0%	19.0%	☆
F6-21	Synchronous switching phase offset	-90.0 to 90.0°	2.0°	☆
F6-22	Synchronous switching phase protection value	0.0 to 5.0°	1.5°	☆
F6-23	Synchronous switching frequency protection value	0.0 Hz to 5.0 Hz	1.0 Hz	☆
F6-24	Synchronous switching timeout time	0.0 to 600.0 s	50.0 s	★

Para. No.	Param. Name	Setting Range	Default	Property
F6-25	Auxiliary function for synchronous switching	BIT0-Synchronous switching alarm: It can be set to 1 (A84 mains and variable frequency contactor abnormal alarm shielded) only when no mains or variable frequency contactor feedback setting is available in the synchronous switching application scenario. BIT1-Both synchronous switching and automatic bypass upon system fault valid: Usually applicable to scenarios where one AC drive is equipped with two automatic bypass cabinets, one active motor and one standby motor and the motor is required to run continuously. When this bit is set to 1, bumpless motor switching is realized and mains frequency can be switched on when a fault occurs on the motor controlled by the AC drive. BIT2-AC drive contactor switch-on timing in synchronous switching application: When this bit is set to 0, the AC drive outputs a switch-on command to the frequency output subcircuit after receiving a valid startup command; the AC drive outputs the switch-off command to the frequency output subcircuit after receiving a valid stopping command and stopping output. When it is set to 1, the AC drive outputs the switch-on command to the frequency output subcircuit after the AC drive is powered on and the system is ready; the AC drive outputs the switch-off command to the frequency output subcircuit after a major system fault occurs or the system is disconnected from the MV. BIT3-Mains frequency contactor switch-off control: When it is set to 1, if the current active motor is running with mains frequency and a valid stopping command is given to the AC drive, the AC drive outputs a switch-off command to the mains frequency contactor between the power grid and motor to stop the motor with mains frequency.	0x0	☆

Para. No.	Param. Name	Setting Range	Default	Property
F6-30	Quick switching	Ones-: Quick switching-on 0: Disabled 1: Quick switching-on Tens-: Quick switching-off 0: Off 1: Quick switching-off	0	☆
F6-31	Quick switching-on fine-tuning factor	0.01 to 1.00	0.10	☆
F6-32	Shutdown lead time	0.000 to 0.100 s	0.008s	☆
F6-33	Mains frequency contactor 1 switching-on time	F6-32 to 10.000 s	0.100 s	☆
F6-34	Mains frequency contactor 2 switching-on time	F6-32 to 10.000 s	0.100 s	☆
F6-35	Mains frequency contactor 3 switching-on time	F6-32 to 10.000 s	0.100 s	☆
F6-36	Mains frequency contactor 4 switching-on time	F6-32 to 10.000 s	0.100 ss	☆
Group F7: Time and Display Parameters				
F7-06	Total power-on time	0 to 65535 h	-	●
F7-07	Total running time	0 to 65535 h	-	●
F7-08	Accumulated power consumption (MWh)	0 to 9999	-	●
F7-23	Accumulated power consumption (ten millions of watt-hours)		-	●
Group F8: Auxiliary Functions				
F8-00	Jog running frequency	0.00 Hz to max. frequency	5.00	☆

Para. No.	Param. Name	Setting Range	Default	Property
F8-01	Jog acceleration time	0.0 s to 6500.0 s	80.0	☆
F8-02	Jog deceleration time	0.0 s to 6500.0 s	100.0	☆
F8-03	Acceleration time 2	0.0 s to 6500.0 s	80.0	☆
F8-04	Deceleration time 2	0.0 s to 6500.0 s	100.0	☆
F8-05	Acceleration time 3	0.0 s to 6500.0 s	80.0	☆
F8-06	Deceleration time 3	0.0 s to 6500.0 s	100.0	☆
F8-07	Acceleration time 4	0.0 s to 6500.0 s	80.0	☆
F8-08	Deceleration time 4	0.0 s to 6500.0 s	100.0	☆
F8-09	Frequency jump 1	0.00 Hz to max. frequency	0.00 Hz	☆
F8-10	Frequency jump 2	0.00 Hz to max. frequency	0.00 Hz	☆
F8-11	Frequency jump band	0.00 Hz to max. frequency	0.00 Hz	☆
F8-13	Reverse control	0: Enabled 1: Disabled	1	☆
F8-14	Running mode when frequency reference lower than frequency lower limit	0 to 2	0	☆
F8-15	Droop control	0.00 Hz to 10.00 Hz	0.00	☆
F8-18	Start protection selection	0 to 1	1	☆
F8-19	Frequency detection value (FDT1)	0.00 Hz to max. frequency	50.00	☆
F8-20	Frequency detection hysteresis (FDT1)	0.0% to 100.0% (FDT1 level)	5.0	☆
F8-21	Detection width of target frequency reached	0.0% to 100.0% (max. frequency)	0.0	☆

Para. No.	Param. Name	Setting Range	Default	Property
F8-22	Jump frequency during acceleration/ deceleration	0 to 1	0	☆
F8-24	Fan fault delay time	0 s to 60 s	5	☆
F8-25	Switchover frequency of acceleration time 1 and acceleration time 2	0.00 Hz to max. frequency	0.00	☆
F8-26	Switchover frequency of deceleration time 1 and deceleration time 2	0.00 Hz to max. frequency	0.00	☆
F8-27	Set highest priority to JOG function		0	☆
F8-28	Frequency detection value 2 (FTD2)	0.00 Hz to max. frequency	50.00	☆
F8-29	Frequency detection hysteresis (FDT2)	0.0% to 100.0% (FDT2 level)	5.0	☆
F8-30	Detection of frequency 1	0.00 Hz to max. frequency	50.00	☆
F8-31	Detection width of frequency 1	0.0% to 100.0% (max. frequency)	0.0	☆
F8-32	Detection of frequency 2	0.00 Hz to max. frequency	50.00	☆
F8-33	Detection width of frequency 2	0.0% to 100.0% (max. frequency)	0.0	☆
F8-38	Detection level of current 1	0.0% to 300.0% (rated motor current)	100.0	☆
F8-39	Detection width of current 1	0.0% to 300.0% (rated motor current)	0.0	☆
F8-40	Detection level of current 2	0.0% to 300.0% (rated motor current)	100.0	☆
F8-41	Detection width of current 2	0.0% to 300.0% (rated motor current)	0.0	☆

Para. No.	Param. Name	Setting Range	Default	Property
F8-52	Switching between mains frequency and variable frequency	0 to 2	0	☆
F8-53	Auxiliary function selection	0 to H.FFFF	H.0011	☆
F8-54	Auxiliary function selection 2	0 to H.FFFF	H.0000	☆
F8-55	MV power decision proportion	50% to 100%	80	☆
F8-57	Auxiliary function selection 2	0 to H.FF12	H.0000	☆
F8-58	Allowable switching-on delay	30 s to 3600 s	300	☆
F8-59	Input voltage filter time	0.00 to 10.00	0.50	☆
F8-60	Dehumidification	0 min: Off 0 min to 120 min	15	☆
F8-63	Frequency setting proportion	80.0% to 100.0%	100.0	☆
F8-64	Status hold time after power-off	0s: No hold 0 s~9s	0	☆
F8-65	Specific fault output No.	0: Invalid 1 to 65535	0	☆
F8-66	Auto switch to mains frequency delay	0.0 to 600.0 s	5.0	☆
F8-67	Auto switch to mains frequency signal duration	1.0 to 600.0 s	30.0	☆
F8-68	Frequency jump 3	0.00 Hz to max. frequency	0.00	☆
F8-69	Frequency jump band 3	0.00 Hz to max. frequency	0.00	☆
F8-79	Motor cooling fan closing delay	0 to 7200	0	☆

Para. No.	Param. Name	Setting Range	Default	Property
Group F9: Protections				
F9-00	Motor overload software protection selection	0: Disabled 1: Direct inverse time-lag 2: Constant 3: Decay inverse time-lag	1	☆
F9-01	Motor overload time	0.01s to 600.00 s	60.00 s	☆
F9-02	Motor overload pre-warning coefficient	50% to 100%	80%	☆
F9-03	Motor overload protection threshold	10.0% to 220.0%	120.0%	☆
F9-06	Motor overvoltage protection threshold	0.0% to 200.0%	125.0%	☆
F9-08	Clearing time for auto fault reset count	0.1 to 1000.0h	1.0	☆
F9-09	Fault auto reset times	0 to 20	0	☆
F9-10	DO action during auto fault reset	0 to 1	0	☆
F9-11	Time interval of fault auto reset	0.1s to 100.0s	2.0 s	☆
F9-12	Input phase loss protection selection	0: Disabled 1: Enabled	1	☆
F9-13	Output phase loss protection selection	0: Disabled 1: Enabled	1	☆
F9-14	Input current imbalance threshold	0.0% to 100.0%	40.0%	☆
F9-15	Output current imbalance threshold	0.0% to 100.0%	40.0%	☆
F9-17	Input voltage imbalance threshold	0.0: Disabled 0.1 to 100.0%	40.0%	☆

Para. No.	Param. Name	Setting Range	Default	Property
F9-24	Transformer primary connector setting	-1 to 1	0	☆
F9-27	Output voltage imbalance threshold	0.0 OFF 0.1 to 100.0%	40.0%	☆
F9-28	Low output impedance fault threshold	0.0% to 100.0%	8.0%	☆
F9-30	AC drive overcurrent protection threshold	0.0% to 180.0% (100.0% indicates the rated output current of the AC drive.)	150.0%	☆
F9-31	AC drive maximum output current	0.0% to (F9-30-20.0%) (100.0% indicates the rated output current of the AC drive.)	120.0%	☆
F9-38	Power dip ride-through proportional gain	0.000 to 1.000	0.000	☆
F9-39	Power dip ride-through integral gain	0.000 to 15.000	0.000	☆
F9-40	Locked-rotor frequency	5.0 to 50.0 Hz	10.0 Hz	☆
F9-41	Locked-rotor time	0 to 400 s	20 s	☆
F9-42	Motor excitation fault protection threshold	0.0 to 100.0%	40.0%	☆
F9-43	Motor excitation fault detection time	0 to 200 s	20 s	☆
F9-47	Fault protection action selection 1	0 to 22222	00000	☆
F9-48	Fault protection action selection 2	0 to 22214	22201	☆
F9-49	Fault protection action selection 3	0 to 22222	00000	☆
F9-50	Fault protection action selection 4	0 to 22222	00000	☆
F9-51	Fault protection action selection 5	0 to 21112	01012	☆

Para. No.	Param. Name	Setting Range	Default	Property
F9-54	Frequency selection for continuing to run upon fault	0 to 4	1	☆
F9-55	Backup frequency upon abnormality	60.0% to 100.0% (max. frequency)	100.0	☆
F9-59	Power dip ride-through	0: Disabled 1: Enabled	0	☆
F9-60	Power dip ride-through voltage recovery acceleration time	0.0 s to 6500.0 s	60.0 s	☆
F9-61	Power dip ride-through voltage recovery deceleration time	0.0 s to 6500.0 s	60.0 s	☆
F9-67	Overspeed detection level	0.0% to 50.0% (max. frequency)	20.0%	☆
F9-68	Overspeed detection time	0.0 s to 60.0 s	5.0%	☆
F9-69	Detection level of speed deviation excessive	0.0% to 50.0% (max. frequency)	20.0%	☆
F9-70	Detection time of speed deviation excessive	0.0 s to 60.0 s	0 s	☆
F9-71	Fan off delay time	0 s to 36000 s	0	☆

Para. No.	Param. Name	Setting Range	Default	Property
F9-72	Additional function selection 1	BIT0: Sampling phase sequence calculation 0: Disabled 1: Enabled (same as F0-01 = 3) BIT1: Transformer overload protection selection 0: Inverse time-lag table 1: Inverse time-lag curve BIT2: Current detection fault (F018) 0: Disabled 1: Enabled BIT3: Overvoltage suppression enabled 0: Disabled 1: Enabled BIT4: Input sampling wiring fault (A181) 0: Disabled 1: Enabled BIT5: Transformer no-load current fault (F35) 0: Disabled 1: Enabled BIT6-15: Reserved	0x003E	☆
F9-74	Specific fault enable 1	0 to 0xFFFF	0x0000	☆
F9-75	Auto reset times for a specific fault	1 to 65535	20	☆
F9-76	Allowable fan fault count	0 to 4	0	☆
F9-77	Maximum output current limit 1 upon fan fault	0.0 to 100.0	70	☆
F9-78	Maximum output current limit 2 upon fan fault	0.0 to 100.0	70	☆
F9-79	Running status selection during auto fault reset	0 to 1	0	☆
Group FA: Process Control PID Function				
FA-00	PID reference source	0: FA-01 1: AI1 2: AI2 3: AI3 5: Communication setting 6: Multi-reference 7: AI4	0	☆

Para. No.	Param. Name	Setting Range	Default	Property
FA-01	PID digital setting	0.0% to 100.0%	50.0%	☆
FA-02	PID feedback source	0: AI1 1: AI2 2: AI3 3: AI1 - AI2 4: Pulse setting (DI18) 5: Communication setting 6: AI1 + AI2 7: Maximum (|AI1|, |AI2|) 8: Minimum (|AI1|, |AI2|) 9: AI4	0	☆
FA-03	PID operation direction	0 to 1	0	☆
FA-04	PID reference and feedback range	0 to 65535	1000	☆
FA-05	Proportional gain Kp1	0.0 to 100.0	20.0	☆
FA-06	Integral time Ti1	0.01s to 10.00s	2.00 s	☆
FA-07	Differential time Td1	0.00s to 10.000s	0.000 s	☆
FA-08	PID output limit in reverse direction	0.00 to max. frequency	2.00	☆
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	0.00 to 650.00 s	0.00	☆
FA-12	PID feedback filter time	0.00 to 60.00 s	0.00	☆
FA-13	PID output filter time	0.00 to 60.00 s	0.00	☆
FA-15	Proportional gain Kp2	0.0 to 100.0	20.0	☆
FA-16	Integral time Ti2	0.01s to 10.00 s	2.00	☆
FA-17	Differential time Td2	0.000 s to 10.000 s	0.000	☆
FA-18	PID parameter switchover condition	0 to 2	0	☆

Para. No.	Param. Name	Setting Range	Default	Property
FA-19	PID deviation 1 for auto switchover	0.0% to FA-20	20.0	☆
FA-20	PID deviation 2 for auto switchover	FA-19 to 100.0%	80.0	☆
FA-21	PID initial value	0.0% to 100.0%	0.0	☆
FA-22	PID initial value active time	0.00 to 650.00 s	0.00	☆
FA-23	Maximum deviation between two PID outputs in forward direction	0.0% to 100.0%	1.0	☆
FA-24	Maximum deviation between two PID outputs in reverse direction	0.0% to 100.0%	1.0	☆
FA-25	PID integral property	0 to 11	00	☆
FA-26	Detection level of PID feedback loss	0.0%: No detection 0.1% to 100.0%	0	☆
FA-27	Detection time of PID feedback loss	0.0 s to 20.0 s	1	☆
FA-28	PID calculation at stop	0 to 1	0	☆
Group Fb: Fault Records				
Fb-00	6th fault type	–	–	●
Fb-01	7th fault type	–	–	●
Fb-02	8th fault type	–	–	●
Fb-03	9th fault type	–	–	●
Fb-04	10th (latest) fault type	–	–	●
Fb-05	Frequency upon 10th (latest) fault	–	–	●
Fb-06	Current upon 10th (latest) fault	–	–	●
Fb-07	Output voltage upon 10th (latest) fault	–	–	●

Para. No.	Param. Name	Setting Range	Default	Property
Fb-08	Input current upon 10th (latest) fault	–	–	●
Fb-09	Input voltage upon 10th (latest) fault	–	–	●
Fb-10	AC drive state upon 10th (latest) fault	–	–	●
Fb-11	Fault prompt of 10th (latest) fault	–	–	●
Fb-15	Frequency upon 9th fault	–	–	●
Fb-16	Output current upon 9th fault	–	–	●
Fb-17	Output voltage upon 9th fault	–	–	●
Fb-18	Input current upon 9th fault	–	–	●
Fb-19	Input voltage upon 9th fault	–	–	●
Fb-20	AC drive state upon 9th fault	–	–	●
Fb-21	Fault prompt of 9th fault	–	–	●
Fb-25	Frequency upon 8th fault	–	–	●
Fb-26	Output current upon 8th fault	–	–	●
Fb-27	Output voltage upon 8th fault	–	–	●
Fb-28	Input current upon 8th fault	–	–	●
Fb-29	Input voltage upon 8th fault	–	–	●
Fb-30	AC drive state upon 8th fault	–	–	●
Fb-31	Fault prompt of 8th fault	–	–	●
Fb-35	Frequency upon 7th fault	–	–	●

Para. No.	Param. Name	Setting Range	Default	Property
Fb-36	Output current upon 7th fault	–	–	●
Fb-37	Output voltage upon 7th fault	–	–	●
Fb-38	Input current upon 7th fault	–	–	●
Fb-39	Input voltage upon 7th fault	–	–	●
Fb-40	AC drive state upon 7th fault	–	–	●
Fb-41	Fault prompt of 7th fault	–	–	●
Fb-45	Frequency upon 6th fault	–	–	●
Fb-46	Output current upon 6th fault	–	–	●
Fb-47	Output voltage upon6th fault	–	–	●
Fb-48	Input current upon 6th fault	–	–	●
Fb-49	Input voltage upon 6th fault	–	–	●
Fb-50	AC drive state upon 6th fault	–	–	●
Fb-51	Fault prompt of 6th fault	–	–	●
Fb-55	5th fault type	–	–	●
Fb-56	Fault prompt of 5th fault	–	–	●
Fb-57	4th fault type	–	–	●
Fb-58	Fault prompt of 4th fault	–	–	●
Fb-59	3th fault type	–	–	●
Fb-60	Fault prompt of 3rd fault	–	–	●
Fb-61	2nd fault type	–	–	●
Fb-62	Fault prompt of 2nd fault		–	●
Fb-63	1st fault type		–	●
Fb-64	Fault prompt of 1st fault		–	●

Para. No.	Param. Name	Setting Range	Default	Property
Group FC: Multi-Reference and Simple PLC Function				
FC-00	Reference 0	-100.0% to 100.0%	0.0%	☆
FC-01	Reference 1	-100.0% to 100.0%	0.0%	☆
FC-02	Reference 2	-100.0% to 100.0%	0.0%	☆
FC-03	Reference 3	-100.0% to 100.0%	0.0%	☆
FC-04	Reference 4	-100.0% to 100.0%	0.0%	☆
FC-05	Reference 5	-100.0% to 100.0%	0.0%	☆
FC-06	Reference 6	-100.0% to 100.0%	0.0%	☆
FC-07	Reference 7	-100.0% to 100.0%	0.0%	☆
FC-08	Reference 8	-100.0% to 100.0%	0.0	☆
FC-09	Reference 9	-100.0% to 100.0%	0.0	☆
FC-10	Reference 10	-100.0% to 100.0%	0.0	☆
FC-11	Reference 11	-100.0% to 100.0%	0.0	☆
FC-12	Reference 12	-100.0% to 100.0%	0.0	☆
FC-13	Reference 13	-100.0% to 100.0%	0.0	☆
FC-14	Reference 14	-100.0% to 100.0%	0.0	☆
FC-15	Reference 15	-100.0% to 100.0%	0.0	☆
FC-16	Simple PLC running mode	0 to 2	0	☆
FC-17	Simple PLC retentive selection	0 to 11	00	☆
FC-18	Running time of simple PLC reference 0	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-19	Acceleration/ Deceleration time of simple PLC reference 0	0 to 3	0	☆
FC-20	Running time of simple PLC reference 1	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-21	Acceleration/ Deceleration time of simple PLC reference 1	0 to 3	0	☆
FC-22	Running time of simple PLC reference 2	0.0 s (h) to 6553.5s (h)	0.0	☆

Para. No.	Param. Name	Setting Range	Default	Property
FC-23	Acceleration/ Deceleration time of simple PLC reference 2	0 to 3	0	☆
FC-24	Running time of simple PLC reference 3	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-25	Acceleration/ Deceleration time of simple PLC reference 3	0 to 3	0	☆
FC-26	Running time of simple PLC reference 4	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-27	Acceleration/ Deceleration time of simple PLC reference 4	0 to 3	0	☆
FC-28	Running time of simple PLC reference 5	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-29	Acceleration/ Deceleration time of simple PLC reference 5	0 to 3	0	☆
FC-30	Running time of simple PLC reference 6	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-31	Acceleration/ Deceleration time of simple PLC reference 6	0 to 3	0	☆
FC-32	Running time of simple PLC reference 7	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-33	Acceleration/ Deceleration time of simple PLC reference 7	0 to 3	0	☆
FC-34	Running time of simple PLC reference 8	0.0 s (h) to 6553.5s (h)	0.0	☆

Para. No.	Param. Name	Setting Range	Default	Property
FC-35	Acceleration/ Deceleration time of simple PLC reference 8	0 to 3	0	☆
FC-36	Running time of simple PLC reference 9	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-37	Acceleration/ Deceleration time of simple PLC reference 9	0 to 3	0	☆
FC-38	Running time of simple PLC reference 10	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-39	Acceleration/ Deceleration time of simple PLC reference 10	0 to 3	0	☆
FC-40	Running time of simple PLC reference 11	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-41	Acceleration/ Deceleration time of simple PLC reference 11	0 to 3	0	☆
FC-42	Running time of simple PLC reference 12	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-43	Acceleration/ Deceleration time of simple PLC reference 12	0 to 3	0	☆
FC-44	Running time of simple PLC reference 13	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-45	Acceleration/ Deceleration time of simple PLC reference 13	0 to 3	0	☆
FC-46	Running time of simple PLC reference 14	0.0 s (h) to 6553.5s (h)	0.0	☆

Para. No.	Param. Name	Setting Range	Default	Property
FC-47	Acceleration/ Deceleration time of simple PLC reference 14	0 to 3	0	☆
FC-48	Running time of simple PLC reference 15	0.0 s (h) to 6553.5s (h)	0.0	☆
FC-49	Acceleration/ Deceleration time of simple PLC reference 15	0 to 3	0	☆
FC-50	Time unit of simple PLC running	0 to 1	0	☆
FC-51	Reference 0 source	0 to 7	0	☆
Group Fd: Communication				
Fd-00	Baud rate	H.0001 to 6009	H.5005	☆
Fd-01	Modbus data format	0 to 3	0	☆
Fd-02	Local address	1 to 247 0: Broadcast address	1	☆
Fd-03	Response delay	0 to 20 ms	2	☆
Fd-04	Modbus communication timeout	0.0s: Invalid 0.1s to 60.0s	0.0	☆
Fd-05	Data transmission format selection	0 to 11	1	☆
FD-08	Profibus communication timeout	0.0s: Invalid 0.1s to 30.0s	0.0	☆
Group FP: User Password				
FP-00	User password	0 to 65535	0	☆
FP-01	Parameter initialization	0 to 1	0	★
FP-02	Parameter display property	Ones: Selection of display of group U Tens: Selection of display of group A Hundreds: Selection of display of group B Thousands: Selection of display of group C 0: Hidden 1: Displayed	11	☆

Para. No.	Param. Name	Setting Range	Default	Property
Group A0: Torque Control Parameters				
A0-00	Speed/Torque control selection	0: Speed control 1: Torque control		★
A0-01	Torque setting source selection in torque control mode	0: Digital setting (A0-03) 1: AI1 2: AI2 3: AI3 5: Communication setting 6: Min. (AI1, AI2) 7: Max. (AI1, AI2) 8: AI4 9: CAN	0	★
A0-03	Driving torque upper limit digital setting	-200.0% to 200.0%	150.0%	☆
A0-05	Maximum frequency in a forward direction in torque control mode	0.00 Hz to max. frequency	50.00 Hz	☆
A0-06	Maximum frequency in a reverse direction in torque control mode	0.00 Hz to max. frequency	50.00 Hz	☆
A0-07	Torque control acceleration time	0.0 s to 6500.0 s	0.0 s	☆
A0-08	Torque control deceleration time	0.0 s to 6500.0 s	0.0 s	☆
Group A5: Control Optimization Parameters				
A5-00	Dead zone compensation time	0.0 to 50.0 us	20.0 us	☆
A5-08	Output voltage hardware parameter	0.000 to 65.535	37.994	☆
A5-11	High starting torque mode	0: Disabled 1: Enabled	0	☆
A5-12	Current setting in high starting torque mode	0 to 125%	50%	☆

Para. No.	Param. Name	Setting Range	Default	Property
A5-13	Current ramp time in high starting torque mode	0.0 to 5.0 s	0.5s	☆
A5-14	PLL setup time in high starting torque mode	0 to 5s	2s	☆
A5-18	Optimization enable selection	BIT0: Torque limit of input voltage 0: Disabled 1: Enabled BIT15: Pre-excitation 0: Disabled 1: Enabled	0x8001	☆
A5-27	Overvoltage suppression voltage-loop proportional gain	0.0 to 100.0	1.0	☆
A5-28	Overvoltage suppression voltage-loop integral gain	0.0 to 100.0	0.2	☆
Group A6: AI Curve Parameters				
A6-00	AI curve 1 minimum input	0.00 mA to A6-02	4.00 mA	☆
A6-01	Corresponding percentage of AI curve 1 minimum input	-100.00% to 100.0%	0.0%	☆
A6-02	AI curve 1 maximum input	A6-00 to 20.00 mA	20.00 mA	☆
A6-03	Corresponding percentage of AI curve 1 maximum input	-100.00% to 100.0%	100.0%	☆
A6-04	AI1 filter time	0.00s to 10.00s	0.10 s	☆
A6-05	AI curve 2 minimum input	0.00 mA to A6-07	4.00 mA	☆
A6-06	Corresponding percentage of AI curve 2 minimum input	-100.00% to 100.0%	0.0%	☆
A6-07	AI curve 2 maximum input	A6-00 to 20.00 mA	20.00 mA	☆

Para. No.	Param. Name	Setting Range	Default	Property
A6-08	Corresponding percentage of AI curve 2 maximum input	-100.00% to 100.0%	100.0%	☆
A6-09	AI2 filter time	0.00s to 10.00s	0.10 s	☆
A6-10	AI curve 3 minimum input	0.00 mA to A6-12	4.00 mA	☆
A6-11	Corresponding percentage of AI curve 3 minimum input	-100.0% to +100.0%	-100.0%	☆
A6-12	AI curve 3 maximum input	A6-10 to 20.00 mA	20.00 mA	☆
A6-13	Corresponding percentage of AI curve 3 maximum input	-100.0% to +100.0%	100.0%	☆
A6-14	AI curve 4 minimum input	0.00 mA to A6-16	4.00	☆
A6-15	Corresponding percentage of AI curve 4 minimum input	-100.0% to +100.0%	0.0	☆
A6-16	AI curve 4 inflection 1 input	A6-14 to A6-18	8.80	☆
A6-17	Corresponding percentage of AI curve 4 inflection 1 input	-100.0% to +100.0%	30.0	☆
A6-18	AI curve 4 inflection 2 input	A6-16 to A6-20	13.60	☆
A6-19	Corresponding percentage of AI curve 4 inflection 2 input	-100.0% to +100.0%	60.0	☆
A6-20	AI curve 4 maximum input	A6-18 to 20.00 mA	20.00	☆
A6-21	Corresponding percentage of AI curve 4 maximum input	-100.0% to +100.0%	100.0	☆
A6-22	AI curve 5 minimum input	0.00 mA to A6-24	4.00 mA	☆

Para. No.	Param. Name	Setting Range	Default	Property
A6-23	Corresponding percentage of AI curve 5 minimum input	-100.0% to +100.0%	-100.0%	☆
A6-24	AI curve 5 inflection 1 input	A6-22 to A6-26	9.60 mA	☆
A6-25	Corresponding percentage of AI curve 5 inflection 1 input	-100.0% to +100.0%	-30.0%	☆
A6-26	AI curve 5 inflection 2 input	A6-24 to A6-28	14.40 mA	☆
A6-27	Corresponding percentage of AI curve 5 inflexion 2 input	-100.0% to +100.0%	30.0%	☆
A6-28	AI curve 5 maximum input	A6-26 to 20.00 mA	20.00 mA	☆
A6-29	Corresponding percentage of AI curve 5 maximum input	-100.0% to +100.0%	100.0%	☆
A6-30	Jump point of AI1 (DSP)input corresponding percentage	-100.0% to 100.0%	0.0	☆
A6-31	Jump amplitude of AI1 (DSP) input corresponding percentage	0.0% to 100.0%	0.5	☆
A6-32	Jump point of AI2 (DSP) input corresponding percentage	-100.0% to 100.0%	0.0	☆
A6-33	Jump amplitude of AI2 (DSP) input corresponding percentage	0.0% to 100.0%	0.5	☆
A6-34	Jump point of AI3 (ARM) input corresponding percentage	-100.0% to 100.0%	0.0%	☆

Para. No.	Param. Name	Setting Range	Default	Property
A6-35	Jump amplitude of AI3 (ARM) input corresponding percentage	0.0% to 100.0%	0.5%	☆
A6-36	Jump point of AI4 (ARM) input corresponding percentage	-100.0% to 100.0%	0.0%	☆
A6-37	Jump amplitude of AI4 (ARM) input corresponding percentage	0.0% to 100.0%	0.5%	☆
A6-48	AI setting curve selection 1	1111 to 5555	1111	☆
A6-50	Setting of AI lower than minimum input	0 to 1111	0000	☆
A6-52	AO1 function selection	0: Running frequency 1: Target frequency 2: Output current 3: Output torque 4: Output power 5: Output voltage 7: AI1 8: AI2 9: AI3 10: AI4 12: Communication setting 13: Motor speed 16: Exciting current 17: Input voltage 18: Input current	0	☆
A6-53	AO2 function selection		2	☆
A6-54	AO3 function selection		0	☆
A6-55	AO4 function selection		0	☆
A6-56	AO5 function selection		2	☆
A6-57	AO6 (PLC) output selecttion		0	☆
A6-58	AO7 (PLC) output selecttion		0	☆
A6-59	AO8 (PLC) output selecttion		0	☆
A6-60	AO9 (PLC) output selecttion		0	☆
A6-61	AO1 zero offset coefficient	-100.0% to 100.0%	20.0%	☆
A6-62	AO1 gain	-10.00 to 10.00	0.80	☆
A6-63	AO2 zero offset coefficient	-100.0% to 100.0%	20.0%	☆
A6-64	AO2 gain	-10.00 to 10.00	0.80	☆

Para. No.	Param. Name	Setting Range	Default	Property
A6-65	AO3 zero offset coefficient	-100.0% to 100.0%	20.0%	☆
A6-66	AO3 gain	-10.00 to 10.00	0.80	☆
A6-67	AO4 zero offset coefficient	-100.0% to 100.0%	20.0%	☆
A6-68	AO4 gain	-10.00 to 10.00	0.80	☆
A6-69	AO5 zero offset coefficient	-100.0% to 100.0%	20.0%	☆
A6-70	AO5 gain	-10.00 to 10.00	0.80	☆
A6-71	AO6 zero offset coefficient	-100.0% to 100.0%	0.0	☆
A6-72	AO6 gain	-10.00 to 10.00	1.00	☆
A6-73	AO7 zero offset coefficient	-100.0% to 100.0%	0.0	☆
A6-74	AO7 gain	-10.00 to 10.00	1.00	☆
A6-75	AO8 zero offset coefficient	-100.0% to 100.0%	0.0	☆
A6-76	AO8 gain	-10.00 to 10.00	1.00	☆
A6-77	AO9 zero offset coefficient	-100.0% to 100.0%	0.0	☆
A6-78	AO9 gain	-10.00 to 10.00	1.00	☆
A6-79	AI/AO type selection	0x0 to 0xFF31	0x0	☆
A6-87	AI3 filter time	0.00 s to 10.00 s	0.10	☆
A6-88	AI4 filter time	0.00 s to 10.00 s	0.10	☆
A6-89	PLC's AI filter time	1 to 250 beat	1	☆
A6-90	AI break selection	0 to 0x3333	0x2222	☆
Group A8: Point-to-Point Communication				
A8-00	Point-to-point communication function selection	0 to 1	0	☆
A8-01	Master/slave selection	0 to 1	0	☆
A8-02	Slave command following	0 to 1	0	☆
A8-03	Point-to-point communication data selection	0 to 1	0	☆

Para. No.	Param. Name	Setting Range	Default	Property
A8-04	Received data zero offset (torque)	-10.00% to 10.00%	0.00	★
A8-05	Received data gain (torque)	-10.00 to 10.00	1.00	★
A8-08	Received data zero offset (frequency)	-10.00% to 10.00%	0.00	★
A8-09	Received data gain (zero offset)	-10.00 to 10.00	1.00	★
A8-11	Window	0.00 to 10.00 Hz	0.00 Hz	☆
Group A9: Cell Parameters				
A9-00	Bypass	0x0 to 0x1 A	0x0	☆
A9-02	Bypass contactor closing time	50 to 1000ms	200	☆
A9-03	Maximum back EMF attenuation time	0.0 to 30.0	7.0	☆
A9-04	Manual bypass setting 1	0 to 0xFFFF	0x0	☆
A9-05	Manual bypass setting 2	0 to 0xFFFF	0x0	☆
A9-13	Cell bypass type and auto reset attribute selection 1	0 to 33333	33333	☆
A9-14	Cell bypass type and auto reset attribute selection 2	0 to 33333	33333	☆
A9-15	Pre-charging analog selection	0 to 1	0	☆
A9-18	Switchover point between sections 1 and 2	0% to 80%	30	☆
A9-19	Section 1 pre-charging acceleration time	0.1 to 50.0 s	8.0	☆
A9-20	Switchover point between sections 2 and 3	5% to 78%	70	☆

Para. No.	Param. Name	Setting Range	Default	Property
A9-21	Section 2 pre-charging acceleration time	0.5 to 50.0 s	4.0	☆
A9-22	Section 3 pre-charging acceleration time	0.0 to 10.0 s	1.0	☆
A9-23	Pre-charging duration	1.0 s to 10.0 s	2.0	☆
A9-24	Pre-charging deceleration time	0.0 s to 5.0 s	1.5	☆
A9-29	Pre-charging current detection threshold	0% to 15%	7	☆
Group AC: AI/AO Correction				
AC-00	AI1 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-01	AI1 displayed voltage 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-02	AI1 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-03	AI1 displayed current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-04	AI2 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-05	AI2 displayed current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-06	AI2 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-07	AI2 displayed current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-08	AI3 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-09	AI3 displayed current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-10	AI3 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-11	AI3 displayed current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-12	AI4 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-13	AI4 displayed current 1	4.500 mA to 8.000 mA	Factory-corrected	☆

Para. No.	Param. Name	Setting Range	Default	Property
AC-14	AI4 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-15	AI4 displayed current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-16	AO1 target current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-17	AO1 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-18	AO1 target current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-19	AO1 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-20	AO2 target current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-21	AO2 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-22	AO2 target current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-23	AO2 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-24	AO3 target current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-25	AO3 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-26	AO3 target current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-27	AO3 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-28	AO4 target current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-29	AO4 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-30	AO4 target current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-31	AO4 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-32	AO5 target current 1	4.500 mA to 8.000 mA	Factory-corrected	☆
AC-33	AO5 measured current 1	4.500 mA to 8.000 mA	Factory-corrected	☆

Para. No.	Param. Name	Setting Range	Default	Property
AC-34	AO5 target current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
AC-35	AO5 measured current 2	16.000 mA to 19.999 mA	Factory-corrected	☆
Group CE: Factory Test				
CE-10	Machine self-test	0 to 65535	0	☆

A.2 Monitoring Function Parameters

Para. No.	Param. Name	Min. Unit
Group U0: Monitoring Parameters		
U0-00	Running frequency	0.01 Hz
U0-01	Frequency reference	0.01 Hz
U0-02	Input current	0.1 A
U0-03	Output voltage	1 V
U0-04	Output current	0.1 A
U0-05	Output power	1 kW
U0-06	Output torque	0.1%
U0-07	Input voltage	1 V
U0-08	Input frequency	0.1 Hz
U0-09	AI3 current	0.01 mA
U0-10	AI4 current	0.01 mA
U0-11	AI5 sampling	0.01 mA
U0-12	AI6 sampling	0.01 mA
U0-13	System status	1
U0-15	PID reference	1
U0-16	PID feedback	1
U0-17	PLC stage	1
U0-19	Feedback speed	0.1 Hz
U0-21	AI3 current before correction	0.001 mA
U0-22	AI4 current before correction	0.001 mA
U0-23	Torque current	1
U0-24	Input power	1 kW
U0-25	Reactive power	1 kW
U0-26	Upper frequency limit	0.01 Hz
U0-28	Communication reference	0.01%
U0-29	Encoder feedback speed	0.01 Hz

Para. No.	Param. Name	Min. Unit
U0-30	Main frequency X display	0.01 Hz
U0-31	Auxiliary frequency Y display	0.01 Hz
U0-34	Control mode	1
U0-35	Target torque	0.1%
U0-41	DI status visualization 1	1
U0-42	DI status visualization 2	1
U0-43	DI status visualization 3	1
U0-44	DI status visualization 4	1
U0-45	DO status visualization 1	1
U0-46	DO status visualization 2	1
U0-47	DO status visualization 3	1
U0-48	DO status visualization 4	1
U0-49	Input level state	1
U0-50	Input level state	1
U0-51	Output level state	1
U0-52	Output level state	1
U0-53	AO4 output	0.01 mA
U0-54	AO5 output	0.01 mA
U0-55	AO6 output	0.01 mA
U0-56	AO7 output	0.01 mA
U0-57	Ambient temperature of control cabinet	1°C
U0-58	AO8 output	0.01 mA
U0-59	AO9 output	0.01 mA
U0-61	AI1 current	0.01 mA
U0-62	AI2 current	0.01 mA
U0-63	Input level state	1
U0-64	Output level state 2	1
U0-65	Output level state	1
U0-66	AO1 output	0.01 mA
U0-67	AO2 output	0.01 mA
U0-68	AO3 output	0.01 mA
U0-69	AI1 voltage before correction	0.001 mA
U0-70	AI2 voltage before correction	0.001 mA
U0-71	Max. cell temperature	1°C

Para. No.	Param. Name	Min. Unit
U0-72	Min. cell temperature	1°C
U0-75	Ambient humidity inside the cabinet	0.1%
U0-76	Ambient temperature inside the cabinet	0.1°C
U0-77	DI status visualization 5	1
U0-78	DI status visualization 6	1
U0-79	DO status visualization 5	1
U0-80	DO status visualization 6	1
U0-81	PLC 4PT sampling temperature CH1	0.1°C
U0-82	PLC 4PT sampling temperature CH2	0.1°C
U0-83	PLC 4PT sampling temperature CH3	0.1°C
U0-84	PLC 4PT sampling temperature CH4	0.1°C
U0-86	Phase A temperature of phase-shifting transformer	0.1°C
U0-87	Phase B temperature of phase-shifting transformer	0.1°C
U0-88	Phase C temperature of phase-shifting transformer	0.1°C
U0-90	Accumulated power consumption (low order)	1 MWh
U0-91	Accumulated power consumption (high order)	1 ten millions of watt-hours
Group U1: Product Parameters		
U1-00	Software version No.	0.001
U1-01	Software version No.1 (ARM)	00.0.01
U1-02	Software version No.2 (DSP)	00.0.01
U1-03	Software version No.3 (FPGA)	00.0.01
U1-04	Software version No.4 (PLC)	00.0.01
U1-05	Software version No.5 (HMI)	00.0.01
U1-06	A1CPLD version No.	1

Para. No.	Param. Name	Min. Unit
U1-07	B1CPLD version No.	1
U1-08	C1CPLD version No.	1
U1-09	A2CPLD version No.	1
U1-10	B2CPLD version No.	1
U1-11	C2CPLD version No.	1
U1-12	A3CPLD version No.	1
U1-13	B3CPLD version No.	1
U1-14	C3CPLD version No.	1
U1-15	A4CPLD version No.	1
U1-16	B4CPLD version No.	1
U1-17	C4CPLD version No.	1
U1-18	A5CPLD version No.	1
U1-19	B5CPLD version No.	1
U1-20	C5CPLD version No.	1
U1-21	A6CPLD version No.	1
U1-22	B6CPLD version No.	1
U1-23	C6CPLD version No.	1
U1-24	A7CPLD version No.	1
U1-25	B7CPLD version No.	1
U1-26	C7CPLD version No.	1
U1-27	A8CPLD version No.	1
U1-28	B8CPLD version No.	1
U1-29	C8CPLD version No.	1
U1-40	DP card type No.	0.01
U1-41	DP card software version No.	0.01
U1-42	FPGA product version No.	0.001
U1-43	Temperature and humidity sampling board version No.	0.01
Group U2 : Cell State		
U2-30	A1 temperature	1°C
U2-31	B1 temperature	1°C
U2-32	C1 temperature	1°C
U2-33	A2 temperature	1°C
U2-34	B2 temperature	1°C

Para. No.	Param. Name	Min. Unit
U2-35	C2 temperature	1°C
U2-36	A3 temperature	1°C
U2-37	B3 temperature	1°C
U2-38	C3 temperature	1°C
U2-39	A4 temperature	1°C
U2-40	B4 temperature	1°C
U2-41	C4 temperature	1°C
U2-42	A5 temperature	1°C
U2-43	B5 temperature	1°C
U2-44	C5 temperature	1°C
U2-45	A6 temperature	1°C
U2-46	B6 temperature	1°C
U2-47	C6 temperature	1°C
U2-48	A7 temperature	1°C
U2-49	B7 temperature	1°C
U2-50	C7 temperature	1°C
U2-51	A8 temperature	1°C
U2-52	B8 temperature	1°C
U2-53	C8 temperature	1°C
U2-62	A1 bus voltage	1 V
U2-63	B1 bus voltage	1 V
U2-64	C1 bus voltage	1 V
U2-65	A2 bus voltage	1 V
U2-66	B2 bus voltage	1 V
U2-67	C2 bus voltage	1 V
U2-68	A3 bus voltage	1 V
U2-69	B3 bus voltage	1 V
U2-70	C3 bus voltage	1 V
U2-71	A4 bus voltage	1 V
U2-72	B4 bus voltage	1 V
U2-73	C4 bus voltage	1 V
U2-74	A5 bus voltage	1 V
U2-75	B5 bus voltage	1 V
U2-76	C5 bus voltage	1 V

Para. No.	Param. Name	Min. Unit
U2-77	A6 bus voltage	1 V
U2-78	B6 bus voltage	1 V
U2-79	C6 bus voltage	1 V
U2-80	A7 bus voltage	1 V
U2-81	B7 bus voltage	1 V
U2-82	C7 bus voltage	1 V
U2-83	A8 bus voltage	1 V
U2-84	B8 bus voltage	1 V
U2-85	C8 bus voltage	1 V
Group U3: Simple Communication Data		
U3-00	Summary of fault and alarm data	1
U3-12	Number of power cells installed per phase	1
U3-14	Fault subcode	1
U3-18	Current valid motor code	1
U3-70	DI status visualization 7	1
U3-71	DI status visualization 8	1
U3-72	DO status visualization 7	1
U3-73	DO status visualization 8	1

Appendix B Modbus Communication Protocol

The AC drive provides the RS485 communication interface and supports the Modbus-RTU communication protocol so that the user can implement centralized control, such as setting running commands and parameters and reading working status and fault information of the AC drive.

B.1 About the Protocol

This protocol defines the content and format of transmitted messages during serial communication, including master polling (or broadcasting) format and master coding method (parameter for the action, transmission data, and error check). The slave uses the same structure in the response, including action confirmation, data returning 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.

B.1.1 Application

The AC drive is connected to a "single-master multi-slave" PC/PLC control network with the RS485 bus.

B.1.2 Bus Structure

1) Hardware interface mode

The I/O interface board provides the RS3+ and RS3- hardware interfaces.

NOTE

Use the STP cable for communication and avoid using parallel lines to protect the communication signals from suffering external interference.

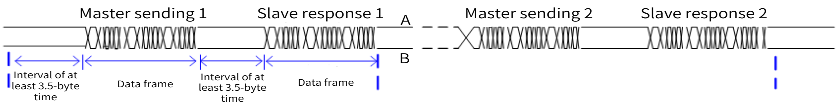
2) Topological structure

The system consists of a single master and multiple slaves. In the network, each communication device has a unique slave address. A device is the master (a PC, PLC or HMI) and initiates communication to perform parameter read or write operations on slaves. The other devices (slaves) provide data to respond to the query or operations from the master. At the same moment, either the master or the slave transmits data and the other can only receive data.

The address range of the slaves is 1 to 247. A slave address must be unique in the network.

3) Transmission mode

The asynchronous serial and half-duplex transmission mode is used. During asynchronous serial communication, data is sent frame by frame in the form of message. In the Modbus-RTU protocol, an interval of at least 3.5-byte time marks the end of the previous message. A new message starts to be sent after this interval.



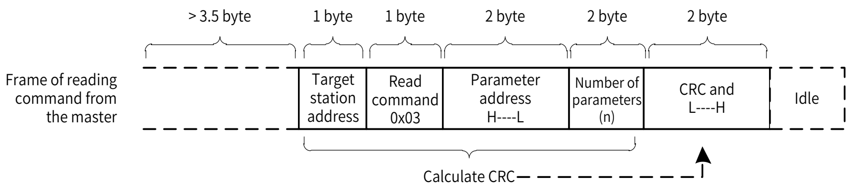
The communication protocol used by the MV AC drive is the Modbus-RTU slave communication protocol, which allows the MV AC drive to provide data to respond to the "query/command" from the master or execute the action according to the "query/command" from the master.

The master can be a PC, an industrial device, or a PLC. The master can communicate with a single slave or send broadcast messages to all slaves. For the "query/command" from the master, the slave needs to return a response frame.

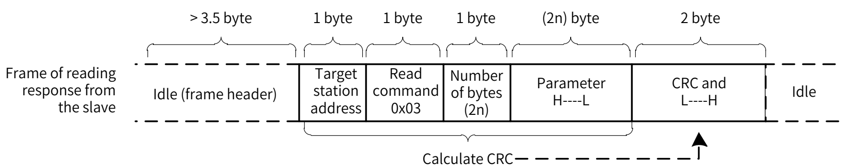
B.2 Communication Data Format

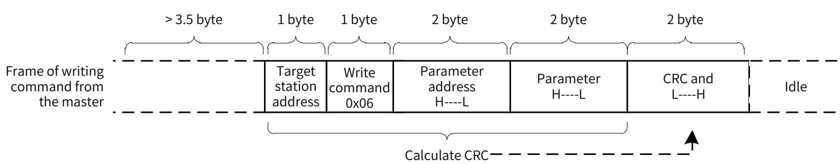
The MV AC drive supports reading and writing of word-type parameters only. The reading command is 0x03 and the writing command is 0x06. It does not support reading and writing of bytes or bits.

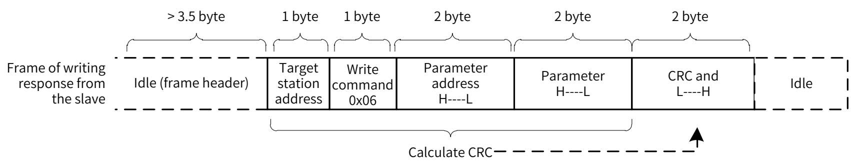
The Modbus communication data format of the MV AC drive is as follows:



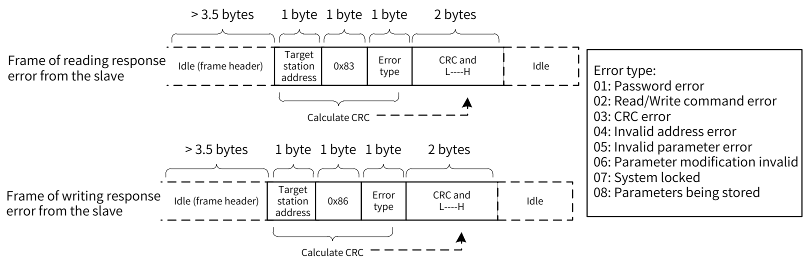
In theory, the host computer can read several consecutive parameters (n can reach up to 100) but the last parameter it reads must not jump to the next parameter group. Otherwise, an error occurs on the response.







If the slave detects a communication frame error or the reading/writing failure is caused by other reasons, an error frame will be returned as follows:



The frame format is described in the following table.

Frame Header (START)	Greater than the 3.5-byte transmission idle time
Slave Address (ADR)	Communication address: 1 to 247
Command Code (CMD)	03: Read slave parameters 06: Write slave parameters
Parameter Address (H)	It is the internal parameter address of the AC drive, expressed in hexadecimal format. The parameters include functional parameters and non-functional parameters (such as running state and running command). For details, see the definition of address. During transmission, low-order bytes follow the high-order bytes.
Parameter Address (L)	
Number of Parameters (H)	It is the number of parameters read by this frame. If it is 1, it indicates that one parameter is read. During transmission, low bytes follow high bytes. In the present protocol, only one parameter is read once, and this field is unavailable.
Number of Parameters (L)	
Data (H)	It is the response data or data to be written. During transmission, low-order bytes follow the high-order bytes.
Data (L)	
CRC CHK high bytes	It is the detection value (CRC16 verification value). During transmission, low-order bytes follow the high-order bytes.
CRC CHK low bytes	
END	It is 3.5-byte transmission time.

■ CRC check

In the Modbus-RTU mode, a message includes a CRC-based error-check field. The CRC field checks the content of the entire message. The CRC field is two bytes, containing a 16-bit binary value. The CRC field is calculated by the transmitting device, and then added to the message. The receiving device recalculates a CRC value after receiving the message, and compares the calculated value with the CRC value in the received CRC field.

The CRC is first stored to 0xFFFF. Then a procedure is invoked to process the successive 8-bit byte in the message and the value in the register. Only the eight bits in each character are used for the CRC. The start bit, stop bit and the parity bit do not apply to the CRC.

During generation of the CRC, each eight-bit character is in exclusive-OR (XOR) with the content in the register. Then the result is shifted in the direction of the least significant bit (LSB), with a zero filled into the most significant bit (MSB) position. The LSB is extracted and examined. If the LSB was a 1, the register then performs XOR with a preset value. If the LSB was a 0, no XOR is performed. This process is repeated until eight shifts have been performed. 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, after all the bytes of the message have been applied, is the CRC value.

The CRC is added to the message from the low-order byte followed by the high-order byte. The CRC simple function 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）;
}
```

NOTE

Never modify the parameters that are only for the factory use or for monitoring.

B.3 Definition of Communication Parameter Addresses

You can implement control and monitoring of the AC drive, and view and modify the control, monitoring and function parameters through the communication protocol on the RS485 terminal.

The communication data of the AC drive is classified into parameter data and non-parameter data. The latter includes the running commands, running states, running parameters and alarm information.

B.3.1 Parameter Data

The parameter data of the AC drive are the important function parameters of the AC drive, as shown below:

Parameter Data	Group F	F0, F1, F2, F4, F5, F6, F8, F9, FA, FC, Fd
	Group A	A6

For descriptions of the parameters, see "Appendix A: Parameter Table". When reading the parameter data through communication, the communication address of the parameter data is defined as follows:

For the parameter data in groups F and A, the highest eight bits in the communication address indicate the parameter group No., and the lowest eight bits indicate the parameter identifying No. in the group.

For example,

The communication address of parameter F0-27 is F01BH, amongst which F0H indicates the parameter group No. F0 and 1BH is the hexadecimal equivalent converted from the parameter identifying No. 27 in the group F0.

The communication address of parameter Fd-05 is FD05, amongst which FDH indicates the parameter group No. Fd and 05H is the hexadecimal equivalent converted from the parameter identifying No. 5 in the group Fd.

B.3.2 Non-parameter Data

Non-parameter Data	State Data (Read-only)	Parameters in group U0, AC drive fault description, AC drive running state, and user-modified parameters
	Control Parameters (Write-only)	Control commands, communication setting value, frequency reference

1) State parameters

■ Monitoring parameters in group U

For the description of monitoring data in group U, see *"Appendix A: Parameter Table"*. The communication address is defined as follows:

The highest eight bits in the communication address of group U0 is 70H, and the lowest eight bits indicate parameter identifying No. in group U0.

For example, the communication address of U0-23 is 7017H.

■ Read AC drive state (read-only)

The communication address of reading the AC drive running state is 3000H. You can obtain the current AC drive running state by reading the data through this address on the RS485 terminal.

The communication address is defined as follows:

State Word Address	State Word Function
3000H	0001: Forward RUN
	0002: Reverse RUN
	0003: Stop

■ Read AC drive fault description (read-only)

The communication address of reading the AC drive fault description is 8000H. You can obtain the current AC drive fault code by reading the data through this address on the host computer.

For description of fault codes, see *"7 Troubleshooting"*.

AC Drive Fault Address	AC Drive Fault Information
8000H	Range: 0 to 199

2) Control parameters

■ Frequency reference

The frequency reference here indicates the setting when the frequency reference setting channel is communication. The communication address is 1000H. When you set this communication address on the RS485 terminal, the data range is -30000 to 30000.

Parameter Address	Parameter Description
1000H	Frequency reference (decimal): -30000 to 30000

■ Communication setting

The communication setting is mainly used as the setting channel of torque upper limit, PID reference and PID feedback. The communication address is 1002H. When you set this communication address on the RS485 terminal, the data range is -30000 to 30000.

Parameter Address	Parameter Description
1002H	Communication setting (decimal): -30000 to 30000

■ Control commands (write-only)

When the control mode is remote RS485 terminal, you can implement control of the AC drive such as run/stop through the communication address 2000H. The control commands are defined as follows:

State Word Address	State Word Function
2000H	0001: Forward run
	0002: Reverse run
	0005: Coast to stop
	0006: Stop according to the stop mode
	0007: Fault reset

Appendix C PROFIBUS-DP Extension Card

C.1 Overview

The PROFIBUS-DP card is designed to connect the MV AC drive to the PROFIBUS-DP bus, and enables the MV AC drive to be a slave in the bus, controlled by the master.

The PROFIBUS-DP card complies with the international PROFIBUS field bus standard. It helps to save the hardware and installation charge and cost of construction, and is more flexible if you use the PROFIBUS-DP bus in the system.

C.2 Hardware Layout and Interface Descriptions

CAUTION	
	◆ The PROFIBUS-DP card must be embedded into the MV AC drive. Before installing the card, switch off the MV power and the control power, wait for approximately 10 minutes until all power cell indicators go off. ◆ After inserting the PROFIBUS-DP card into the AC drive, fix the card with screws to protect the signal sockets from being damaged due to the pulling force of external signal cables.

The hardware layout of the PROFIBUS-DP card is as follows:

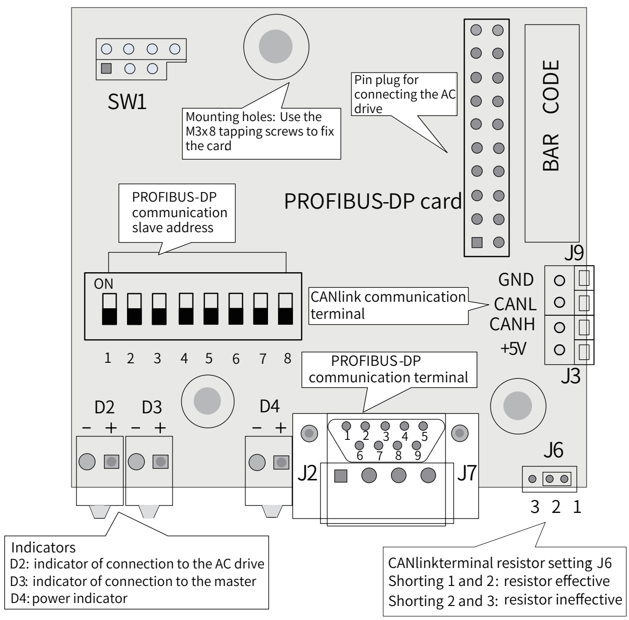


Figure C-1 Hardware layout of the PROFIBUS-DP card

1) DIP switch Description

Table C-1 DIP switch description and address setting

<table>
<tr><th>DIP Switch Bit</th><th>Function</th><th>Description</th></tr>
<tr><td>1 to 8</td><td>PROFIBUS-DP communication slave address</td><td>The 8-bit binary DIP switch can set state addresses of 0 to 124.
For example:<table><tr><th>Address</th><th>DIP switch setting</th></tr><tr><td>0</td><td>0000 0000</td></tr><tr><td>7</td><td>0000 0111</td></tr><tr><td>20</td><td>0001 0100</td></tr><tr><td>124</td><td>0111 1100</td></tr></table></td></tr>
</table>

2) Port description

■ Description of PROFIBUS 9-Pin Port

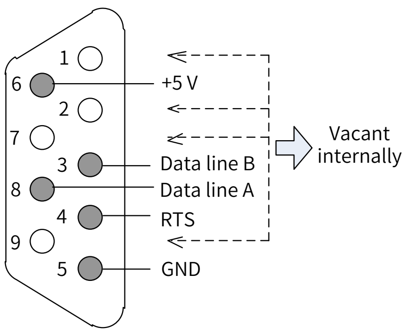


Figure C-2 PROFIBUS 9-pin port

■ Description of Terminals and Jumpers

Table C-2 Terminal and jumper description

Type	Terminal	Terminal Name	Function Description
PROFIBUS communication terminal (J2)	1, 2, 7, 9	NC	Vacant internally
	3	Data line B	Data line positive
	4	RTS	Request of sending signal
	5	GND	Isolation 5 V power ground
	6	+5V	Isolation 5 V power supply
	8	Data line A	Data line negative

Type	Terminal	Terminal Name	Function Description
CANlink communication terminals (J3, J9)	+5V	Power supply	Isolation 5 V power supply
	CANH	CAN positive input	Data line positive
	CANL	CAN negative input	Data line negative
	GND	Power ground	Isolation 5 V power ground
Program write-in	SW1	Program write-in	It is the commissioning interface. Never use it.
Jumper	J6	CANlink terminal resistor matching selection	1 and 2 shorted: matching the terminal resistor 2 and 3 shorted: not matching the terminal resistor
Indicators [1]	D4 in red	Power supply indicator	Steady on: indicates that the AC drive is powered on. Off: indicates that the AC drive is not powered on or the PROFIBUS-DP card is installed improperly.
	D3 in yellow	PROFIBUS-DP card and master communication indicator	Steady on: indicates normal communication between the PROFIBUS-DP card and the master. Off: indicates no communication between the PROFIBUS-DP card and the master (check the PROFIBUS cable connection and station No. setting). Flashing: indicates that the master does not operate or wrong communication between the PROFIBUS-DP card and the master.
	D2 in green	DP card and drive communication indicator	Steady on: indicates normal communication between the PROFIBUS-DP card and the AC drive. Steady off: indicates that communication between the PROFIBUS-DP card and the AC drive fails (check the baud rate setting). Flashing: indicates that interference exists on the communication between the PROFIBUS-DP card and the AC drive or the extension card address is not within the range of 1 to 125.

[1] The indicator color does not match the indicator SN in some products. The indicator SN shall prevail and is D2, D3, and D4 from left to right, as shown in Figure C-1.

■ Connecting to the PROFIBUS-DP master

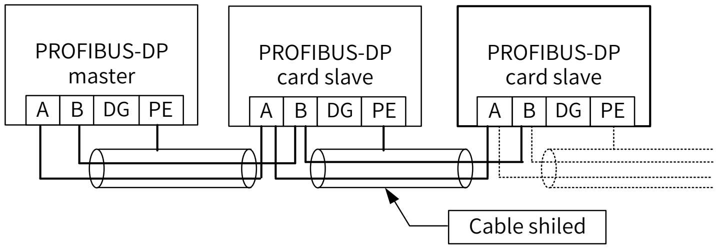


Figure C-3 Connecting to the PROFIBUS-DP master

The PROFIBUS-DP card provides only one type of DB9 for connecting the PROFIBUS-DP master. The DB9 is the standard Siemens DB9 socket and requires the PEs of the system to be grounded reliably. If the used baud rate is high, restrict the communication cable lead length strictly according to the Siemens DB9 standard.

The length of the communication cable varies with different setting of the baud rate of the master. The following table describes the requirements on the baud rate and the communication cable.

Table C-3 Baud rate and cable length requirements

Baud Rate (Kbps)	Max. Length of Lead A (m)	Max. Length of Lead B (m)
9.6	1200	1200
19.2	1200	1200
187.5	600	600
500	200	200
1500	100	70
3000	100	Not supported
6000	100	Not supported
12000	100	Not supported

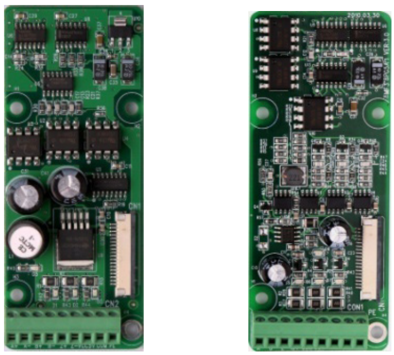
Appendix D Common Encoder Extension Cards

D.1 Overview

The AC drive provides multiple types of encoder extension cards (PG cards) for your choice. The PG card is necessary for closed-loop vector control. Select a proper PG card according to the encoder output mode. The PG card models are listed in the following table.

PG Card	Description	Others
PG card 1	Differential input PG card with frequency dividing output	Terminal wiring
PG card 2	OC input PG card with 1:1 frequency dividing output	Terminal wiring

D.2 Physical Appearance



PG1 PG5

Figure D-1 Physical appearance

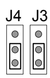
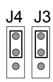
CAUTION	
	◆ Install/Remove the PG card on the condition that the AC drive is switched off completely. ◆ Connect the PG card to the J21 on the main control board by using the 18-pin FFC (make sure of proper installation and buckling the card in place).

The following table describes the specification, terminals and jumpers of the PG cards.

Table D-1 Description of specification, terminals and jumpers (PG1)

Differential PG card (PG1)		
PG1 Specification		
User interface		Oblique terminal block
Clearance		3.5 mm
Screw		Flathead
Pluggable		No
Cable specification		16 to 26 AWG
Max. frequency		500 kHz
Differential input limit		⩽ 7 V
PG1 Terminals		
No.	Mark	Description
1	A+	Encoder output signal A positive
2	A-	Encoder output signal A negative
3	B+	Encoder output signal B positive
4	B-	Encoder output signal B negative
5	Z+	Encoder output signal Z positive
6	Z-	Encoder output signal Z negative
7	5V	Provide 5 V/100 mA power supply externally
8	COM	Power ground
9	PE	Shield connecting point

Table D-1 Description of specification, terminals and jumpers (PG5)

OC PG Card (PG5)		
PG5 Specification		
User interface		Oblique terminal block
Clearance		3.5 mm
Screw		Flathead
Pluggable		No
Cable specification		16 to 26 AWG
Max. frequency		100 kHz
PG5 Terminals		
No.	Mark	Description
1	A	Encoder output signal A
2	B	Encoder output signal B
3	Z	Encoder output signal Z
4	15V	Provide 5 V/100 mA power supply externally
5	COM	Power ground
6	COM	Power ground
7	A1	PG card frequency dividing (1:1) output signal A
8	B1	PG card frequency dividing (1:1) output signal B
9	PE	Shield connecting point
PG5 Jumpers		
J3, J4	Jumper Position	Description
	Shoring pins 2 and 3	Supporting the "pulse + direction" function
	Shorting pins 1 and 2	Not supporting the "pulse + direction" function (default setting)

Appendix E Design Standards

Standard	Name
GB 156-2007	Standard voltage
GB/T 1980-2005	Standard frequencies
GB/T 2423.10	Environmental testing for electric and electronic products-Part 2: Test methods-Test Fc: Vibration (sinusoidal)
GB/T 4588.1-1996	Sectional specification: single and double sided printed boards with plain holes
GB/T 4588.2-1996	Sectional specification: single and double sided printed boards with plated-through holes
GB 7678-1987	Semiconductor self-commutated converters
GB 10233-2005	Basic testing method for low-voltage switchgear and control gear assemblies
GB12668.3-2003/ IEC 61800-3:1996	Adjustable speed electrical power drive systems - Part 3: EMC product standard including specific test methods
GB/T 15139-94	General technical standard for electrical equipment structure
GB/T 13422-92	Power semiconductor converters electrical test methods
GB 12326	Power quality-voltage fluctuation and flicker
GB 1094.1-1094.5	Power transformer
IEC 60076	Power transformer
GB 6450	Dry-type power transformers
GB/T 10228	Specification and technical requirements for dry-type power transformers
GB 17211	Loading guide for dry-type power transformers
GB/T 14549-1993	Quality of electric energy supply harmonics in public supply network
GB/T 12668.4-2006/ IEC 61800-4:2002	Adjustable speed electrical power drive systems, Part 4: General requirements-rating specifications for AC power drive systems above 1,000 VAC and not exceeding 35 kV
GB/T 3797-2005	Electrical control assemblies
GB/T 2900.18-2008	Electrotechnical terminology - Low voltage apparatus
GB/T 3859.1-1993	Semiconductor convertors-Specification of basic requirements
GB/T 3859.2-1993	Semiconductor convertors-Application guide
GB/T 3859.3-1993	Semiconductor convertors - Transformers and reactors
GB 4208-2008	Degrees of protection provided by enclosure (IP code)
GB/T 16935.1-2008	Insulation coordination for equipment within low-voltage systems - Part 1: Principles, requirements and test
IEC 60721-3-1:1997	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities- Section 1: Storage

Standard	Name
IEC 60721-3-2:1997	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities- Section 2: Transportation
IEC 60721-3-3:2008	Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities- Section 3: Stationary use at weather protected locations
IEC 61000-2-4:2002	Electromagnetic compatibility EMC) – Part 2-4: Environment; Compatibility levels in industrial plants for low-frequency conducted disturbances
IEC 61000-4-7:2002	Electromagnetic compatibility (EMC) - Part 4-7: Testing and measurement techniques - General guide on harmonics and inter-harmonics measurements and instrumentation, for power supply systems and equipment connected thereto
GB/T 13534-2009/IEC 60757:1983	Code for designation of colors
IEC Guide 106:1989	Guide for specifying environmental conditions for equipment performance rating
GB/T 16927.1-1997	High-voltage test techniques, Part 1: General test requirements
GB/T 16927.1-1997	High-voltage test techniques, Part 2: Measurement system
DC/T474.2-1002	Field insulation experiment guide-DC high-voltage test
DC/T474.2-1002	Field insulation experiment guide-AC high-voltage test
DL/T994-2006	High-voltage AC drive for fan and water pump in fossil fuel power plants
GB/T 12668.4-2006	Adjustable speed electrical power drive systems, Part 4: General requirements-rating specifications for AC power drive systems above 1,000 VAC and not exceeding 35 kV
GB156-2003	Standard voltage (neq IEC60038:1983)
GB191	Package storage and transportation mark (eqv ISO 180)
GB/T 2423.1	Environmental testing for electric and electronic products, Part 2 Test method test A Low temperature test
GB/T 2423.2	Environmental testing for electric and electronic products, Part 2 Test method test B High temperature test
GB/T 2423.23	Basic environmental testing procedures for electric and electronic products
GB/T 12668.3	Speed regulating motor drive system, Part 3: Product electromagnetic compatibility standard and features
GB/T3859.1-1993	Speed regulating motor drive system, Part 3: Product electromagnetic compatibility standard and its designated testing techniques.

INOVANCE Warranty Agreement

1) Inovance provides an 18-month free warranty to the equipment itself from the date of manufacturing for the failure or damage under normal use conditions.
2) Within the warranty period, maintenance will be charged for the damage caused by the following reasons:
   a. Improper use or repair/modification without prior permission
   b. Fire, flood, abnormal voltage, natural disasters and secondary disasters
   c. Hardware damage caused by dropping or transportation after procurement
   d. Operations not following the user instructions
   e. Damage out of the equipment (for example, external device factors)
3) The maintenance fee is charged according to the latest Maintenance Price List of Inovance.
4) If there is any problem during the service, contact Inovance's agent or Inovance directly.
5) Inovance reserves the rights for explanation of this agreement.

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