

Goodrive600A Series

High-performance Multi-drive VFD

User Manual



Preface

Thank you for choosing Goodrive600A series variable-frequency drive (VFD).

Goodrive600A series VFDs are high-performance multi-drive products launched by INVT for high-end applications. The system adopts a modular design and integrates booksize rectifier and inverter units with uniform depth and height to form an efficient common DC bus drive system. Units are cascaded via network cables, enabling high-speed communication and coordinated control. This allows precise control of multiple loads and provides three key benefits: energy savings, simplified operation, and reduced total system cost.

Goodrive600A series VFDs integrate synchronous motor (SM) and asynchronous motor (AM) control functions, combining torque control, speed control, and position control, and deliver excellent control performance. The products adopt advanced vector control technology and the latest digital signal processors dedicated to motor control. This not only enhances system reliability and environmental adaptability, but also enables optimized functions and application flexibility through customer-specific and industry-oriented design.

In order to meet diversified customer demands, the VFD provides abundant expansion cards including programmable expansion card, PG card, communication card and I/O expansion card to achieve various functions as needed. Each unit supports up to two expansion cards, significantly enhancing system scalability and adaptability.

- **Programmable expansion card (PLC card):** Adopts the mainstream development environment for customers to carry out secondary development easily, fulfilling varied customized needs and reducing customer cost.
- **PG card:** Supports various encoders, including incremental encoders and resolvers, and employs digital filtering technology to enhance electromagnetic compatibility, ensuring stable long-distance reception of encoder signals. It also features encoder disconnection detection, effectively preventing system exceptions caused by feedback loop faults.
- **I/O card:** Used for expanding digital input/output and analog input/output, while also supporting sampling and detection from various temperature sensors.
- **Communication card:** Supports multiple communication protocols, including CANopen, PROFINET, PROFIBUS DP, and EtherCAT. CANopen is standard on this series, while other protocols require optional expansion cards. The rectifier unit is equipped with CANopen master functionality, enabling the conversion of various communication data into CANopen messages for transmission to slave devices. This simplifies the configuration of external control equipment and reduces network setup costs.

Goodrive600A series VFDs feature a booksize structure and high power density design, significantly saving installation space. The entire system undergoes comprehensive electromagnetic compatibility (EMC) optimization, meeting environmental requirements for low noise and minimal electromagnetic interference. Additionally, the products are designed to withstand harsh operating conditions, including grid fluctuations, temperature, humidity, and dust, further enhancing system reliability and durability.

This manual instructs you how to install, wire, set parameters for, diagnose and remove faults for, and maintain the VFD, and also lists related precautions. Before installing the VFD, read through this manual carefully to ensure the proper installation and running with the excellent performance and powerful functions into full play.

If the end user is a military unit or the product is used for weapon manufacturing, please comply with relevant export control regulations in the Foreign Trade Law of the People's Republic of China, and complete necessary formalities.

The manual is subject to change without prior notice.

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1 Safety precautions

1.1 What this chapter contains

Read this manual carefully and follow all safety precautions before moving, installing, operating and servicing the product. Otherwise, equipment damage or physical injury or death may be caused.

We shall not be liable or responsible for any equipment damage or physical injury or death caused due to your or your customers' failure to follow the safety precautions.

1.2 Safety definition

Danger: Severe personal injury or even death can result if related requirements are not followed.

Warning: Personal injury or equipment damage can result if related requirements are not followed.

Note: Actions taken to ensure proper running.

Trained and qualified professionals: People operating the equipment must have received professional electrical and safety training and obtained the certificates, and must be familiar with all steps and requirements of equipment installing, commissioning, running and maintaining and capable of preventing any emergencies.

1.3 Warning symbols

Warnings caution you about conditions that can result in severe injury or death and/or equipment damage and advice on how to prevent dangers. The following table lists the warning symbols in this manual.

Symbol	Name	Description	Abbreviation
 Danger	Danger	Severe personal injury or even death can result if related requirements are not followed.	
 Warning	Warning	Personal injury or equipment damage can result if related requirements are not followed.	
 Forbid	Electrostatic discharge	The PCBA may be damaged if related requirements are not followed.	
 Hot	Hot sides	Do not touch. The VFD base may become hot.	
 5 min	Electric shock	As high voltage is still present in the bus capacitor after power off, wait for at least five minutes (or 15 min / 25 min, depending on the warning symbols on the machine) after power off to prevent electric shock.	 5 min
	Read manual	Read the operation manual before operating the equipment.	
Note	Note	Actions taken to ensure proper running.	Note

1.4 Safety guidelines

	- Only trained and qualified professionals are allowed to carry out related operations. - Do not perform wiring, inspection or component replacement when power supply is applied. Ensure all the input power supplies have been disconnected before wiring or inspection, and wait for at least the time designated on the VFD or until the DC bus
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	voltage is less than 36V. The minimum waiting time is listed in the following.	
	VFD model	Minimum waiting time
	380V 1.5kW–110kW	5 minutes
	380V 132kW–315kW	15 minutes
	380V ≥355kW	25 minutes
	660V 22kW–132kW	5 minutes
	660V 160kW–355kW	15 minutes
	660V 400kW–630kW	25 minutes
	Do not refit the VFD unless authorized; otherwise fire, electric shock or other injury may result.	
	The base may become hot when the machine is running. Do not touch. Otherwise, you may get burnt.	
	The electrical parts and components inside the VFD are electrostatic sensitive. Take measures to prevent electrostatic discharge when performing related operations.	

1.4.1 Delivery and installation

	- Do not install the VFD on inflammables. In addition, prevent the VFD from contacting or adhering to inflammables. - Connect the optional braking parts (such as braking resistors, braking units or feedback units) according to the wiring diagrams. - Do not run the VFD if it is damaged or incomplete. - Do not contact the VFD with damp objects or body parts. Otherwise, electric shock may result.
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Note:

- Select appropriate tools for VFD delivery and installation to ensure the safe and proper running and avoid physical injury or death. To ensure personal safety, take mechanical protective measures like wearing safety shoes and working uniforms.
- Protect the VFD against physical shock or vibration during the delivery and installation.
- Do not carry the VFD only by its front cover as the cover may fall off.
- Install the VFD in a location inaccessible to children and the general public.
- Use the VFD in proper environments. (For details, see section 2.4 Environment checking.)
- Prevent the screws, cables and other conductive parts from falling into the VFD.
- As leakage current of the VFD during running may exceed 3.5mA, ground properly and ensure the grounding resistance is less than 20mΩ. The conductivity of PE grounding conductor is the same as that of the phase conductor (with the same cross sectional area).
- R, S, and T are the power input terminals, while U, V, and W are the output motor-connection terminals. Connect the input power cables and motor cables properly; otherwise, the VFD may be damaged.

1.4.2 Commissioning and running

	- Cut off all power supplies connected to the VFD before terminal wiring, and wait for at least the time designated on the VFD after disconnecting the power supplies. - High voltage is present inside the VFD during running. Do not carry out any operation on the VFD during running except for keypad setup. - The VFD may start up by itself when P01.21=1. Do not get close to the VFD and motor.
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	• The VFD cannot be used as an "Emergency-stop device". • The VFD cannot act as an emergency brake for the motor; it is a must to install a mechanical braking device. • When driving a permanent magnet SM, besides the above-mentioned items, the following work must be done before installation and maintenance: ➢ All input power supplies have been disconnected, including the main power and control power. ➢ The permanent-magnet SM has been stopped, and the voltage at the output end of the VFD is lower than 36V. ➢ After the permanent-magnet SM has stopped, wait for at least the time designated on the VFD, and ensure the voltage between + and - is lower than 36V. ➢ During operation, it is a must to ensure the permanent-magnet SM cannot run again by the action of external load; it is recommended to install an effective external braking device or cut off the direct electrical connection between the permanent-magnet SM and the VFD.
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Note:

- Do not switch on or switch off the input power supplies of the VFD frequently.
- If the VFD has been stored without use for a long time, perform capacitor reforming (described in chapter 10 Maintenance), inspection and pilot run for the VFD before the reuse.
- Close the VFD front cover before running; otherwise, electric shock may occur.

1.4.3 Maintenance, servicing, and component replacement

	• Only trained and qualified professionals are allowed to perform maintenance, inspection, and component replacement for the VFD. • Cut off all power supplies connected to the VFD before terminal wiring, and wait for at least the time designated on the VFD after disconnecting the power supplies. • During maintenance and component replacement, take measures to prevent screws, cables and other conductive matters from falling into the internal of the VFD.
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Note:

- Use proper torque to tighten screws.
- During maintenance and component replacement, keep the VFD and its parts and components away from combustible materials and ensure they have no combustible materials adhered.
- Do not carry out insulation voltage-endurance test on the VFD, or measure the control circuits of the VFD with a megohmmeter.
- During maintenance and component replacement, take proper anti-static measures on the VFD and its internal parts.

1.4.4 Disposal

	The VFD contains heavy metals. Dispose of a scrap VFD as industrial waste.
	Dispose of a scrap product separately at an appropriate collection point but do not place it in the normal waste stream.

2 Quick startup

2.1 What this chapter contains

This chapter introduces the basic installation and commissioning rules that you need to follow to realize quick installation and commissioning.

2.2 Unpacking inspection

Check the following after receiving the product.

1. Whether the packing box is damaged or dampened. If any problems are found, contact the local INVT dealer or office.
2. Whether the model identifier on the exterior surface of the packing box is consistent with the purchased model. If any problems are found, contact the local INVT dealer or office.
3. Whether the interior surface of the packing box is abnormal, for example, in wet condition, and whether the machine's enclosure is damaged or cracked. If any problems are found, contact the local INVT dealer or office.
4. Whether the product nameplate is consistent with the model identifier on the exterior surface of the packing box. If any problems are found, contact the local INVT dealer or office.
5. Whether the accessories (including the manual, keypad, and expansion card) inside the packing box are complete. If any problems are found, contact the local INVT dealer or office.

2.3 Checking before use

Check the following before using the VFD.

1. Mechanical type of the load to be driven by the VFD to verify whether the VFD will be overloaded during work. Whether the power class of the VFD needs to be increased.
2. Whether the actual running current of the motor is less than the rated current of the VFD.
3. Whether the control accuracy required by the load is the same as that provided by the VFD.
4. Whether the grid voltage is consistent with the rated voltage of the VFD.
5. Check whether expansion cards are needed for selected functions.

2.4 Environment checking

Check the following before installing the VFD:

1. Whether the actual ambient temperature exceeds 40°C. When exceeded, derate 1% for every increase of 1°C. Do not use the VFD when the ambient temperature exceeds 50°C. Note: When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.
2. Whether the actual ambient temperature is lower than -10°C. When the temperature is lower than -10°C, use heating devices. Note: When the VFD is built in a cabinet, the ambient temperature is the temperature of air in the cabinet.
3. Whether the altitude of the application site exceeds 1000m. When exceeded, derate 1% for every increase of 100m. When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
4. Whether the actual environment humidity exceeds 90% or condensation occurs. If yes, take additional protective measures.
5. Whether there is direct sunlight or biological invasion in the environment where the VFD is to be used. If

yes, take additional protective measures.
6. Whether there is dust or inflammable and explosive gas in the environment where the VFD is to be used. If yes, take additional protective measures.

2.5 Checking after installation

Check the following after the VFD installation is complete.

1. Whether the input power cables and motor cables meet the current-carrying capacity requirements of the actual load.
2. Whether correct accessories are selected for the VFD, the accessories are correctly and properly installed, and the installation cables meet the capacity carrying requirements of all components (including the input reactor, input filter, output reactor, output filter, DC reactor, braking unit and braking resistor).
3. Whether the VFD is installed on non-flammable materials and the heat-radiating accessories (such as the reactor and braking resistor) are away from flammable materials.
4. Whether all the control cables and power cables are separately routed and whether EMC specification requirements are taken into full account during the routing.
5. Whether all grounding systems are properly grounded according to the requirements of the VFD.
6. Whether all the installation clearances of the VFD meet the requirements in the manual.
7. Whether the installation mode conforms to the instructions in the operation manual. Vertical installation is recommended whenever possible.
8. Whether the external connection terminals of the VFD are tightly fastened and the torque is appropriate.
9. Whether there are screws, cables, or other conductive items left in the VFD. If yes, get them out.

2.6 Basic commissioning

Complete the basic commissioning as follows before the actual use of the VFD:

1. According to the actual motor parameters, select the motor type, set motor parameters, and select the VFD control mode.
2. Check whether autotuning is required. If possible, de-couple the VFD from the motor load to start dynamic parameter autotuning. If the VFD cannot be de-coupled from the load, perform static autotuning.
3. Adjust the ACC/DEC time according to the actual work condition of the load.
4. Perform device commissioning by means of jogging and check whether the motor rotational direction is correct. If not, change the rotation direction by swapping any two phase wires of the motor.
5. Set all control parameters and then perform actual run.

3 Product overview

3.1 What this chapter contains

This chapter describes the basic working principle, specifications, nameplate, and models of the product.

3.2 Basic principles

The VFD is used to control asynchronous AC induction motors and permanent magnet synchronous motors. It consists of the rectifier unit and inverter unit. The rectifier unit converts 3PH AC voltage into DC voltage, and the inverter unit converts DC voltage into AC voltage that can be used by an AC motor. The 22kW–110kW rectifier units are equipped with a built-in braking unit so that the braking transistor connects the external braking resistor to the DC circuit to dissipate the feedback energy when the DC voltage exceeds the max. value. The following figure shows the schematic diagram and main circuit diagram of each unit.

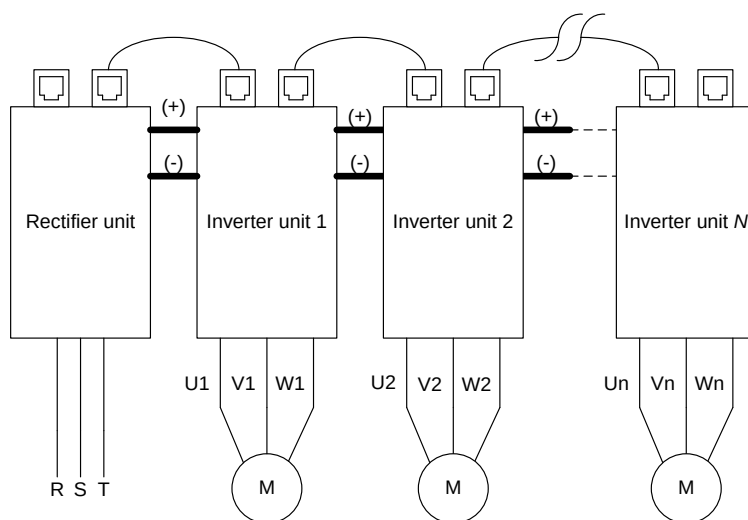


Figure 3-1 Goodrive600A system schematic

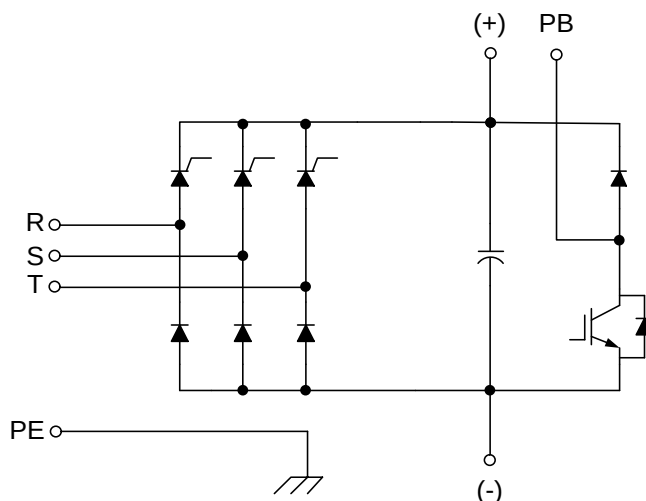


Figure 3-2 Half-controlled rectifier unit (45kW) main circuit schematic

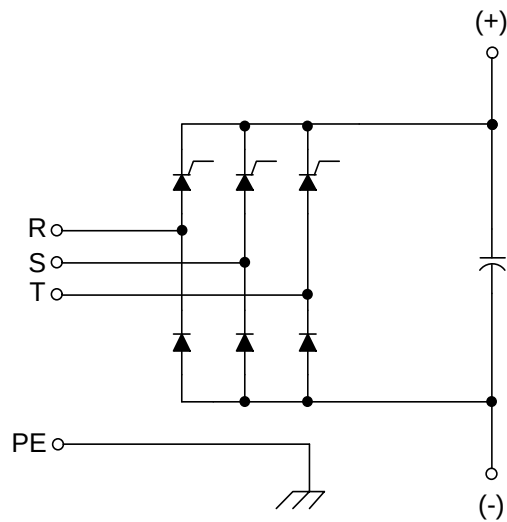


Figure 3-3 Half-controlled rectifier unit (160kW and 355kW) main circuit schematic

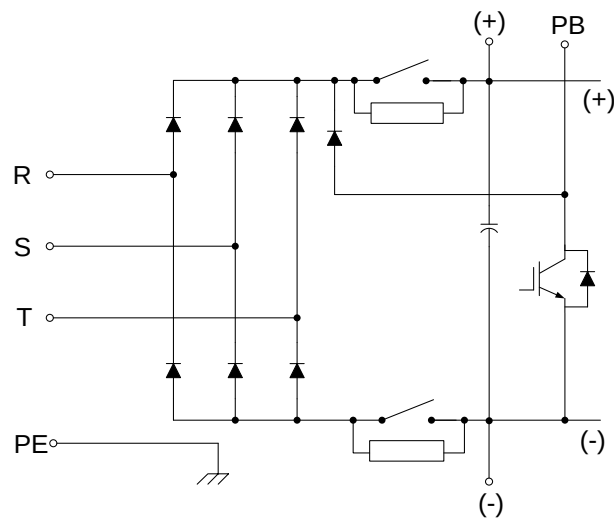


Figure 3-4 Uncontrolled rectifier unit (22kW and 110kW) main circuit schematic

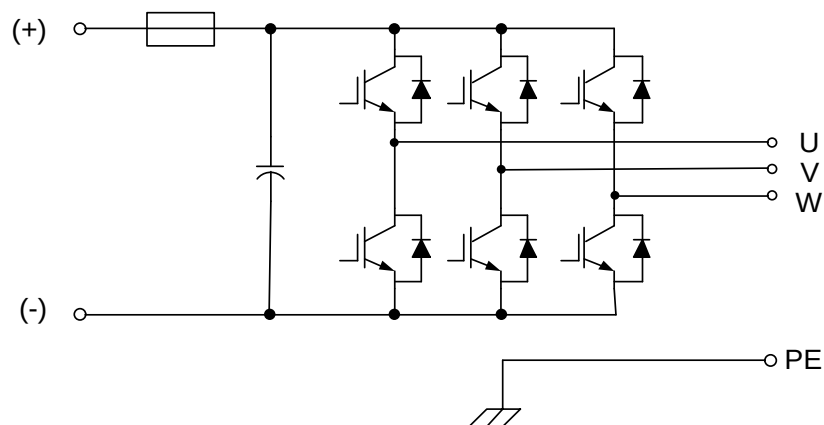


Figure 3-5 Inverter unit main circuit schematic

Note:

- The 22kW, 45kW, and 110kW rectifier units come standard with a built-in braking unit. Other rectifier unit models can be equipped with an optional external braking unit.
- The 160kW and 355kW rectifier units support the use of optional built-in input current detection module for data

analysis, which needs to be customized.

3.3 Product specifications

Table 3-1 Half-controlled rectifier unit specifications

Function		Specifications
Power input	Input voltage (V)	AC 3PH 380V (-15%)–440V (+10%) Rated voltage: 380V
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–53 (50Hz), 57–63 (60Hz)
Power output	Output voltage (V)	457Vdc–684Vdc
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
Protection functions	Protection against input voltage exceptions	Protection against input voltage exceptions, such as input phase loss, input voltage too low, three-phase imbalance of input voltage
	Braking circuit protection	Protection against braking circuit overcurrent, braking resistor short-circuit, braking transistor shoot-through, and braking overload
	Other protection functions	Such as protection against overvoltage, undervoltage, and overtemperature
Peripheral interface	Digital input	Five regular inputs. Max. frequency: 1kHz; internal impedance: 3.3kΩ Resolution: ≤ 2ms
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/250VAC, 1A/30VDC
	Communication interface	One RS485 interface, supporting the Modbus communication protocol Two CAN communication interfaces, of which CAN1 supports the CANopen communication protocol and CAN2 supports the CAN master/slave control protocol.
	Expansion interfaces	Two expansion interfaces: SLOT1 and SLOT2 Supporting communication cards and PLC cards
Others	Installation method	Wall mounting or flange installation (it is not supported by 355kW models)
	Temperature of running environment	-10°C – 50°C. Derating is required when the ambient temperature exceeds 40°C.
	IP rating	IP00
	Pollution degree	Degree 2
	Cooling method	Forced air cooling
	Braking unit	The 45kW rectifier unit comes standard with a built-in braking unit. Other rectifier unit models can be equipped with an optional external braking unit.
	EMC filter	All the series meet the IEC61800-3 C3 requirements. Optional external filters can be used to meet the IEC61800-3 C2 requirements.

Table 3-2 Uncontrolled rectifier unit specifications

Function		Specifications
Gateway-type uncontrolled rectifier unit (with gateway functionality)		
Power input	Input voltage (V)	AC 3PH 380V (-15%)–440V (+10%) Rated voltage: 380V
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–53 (50Hz), 57–63 (60Hz)
Power output	Output voltage (V)	457Vdc–684Vdc
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
Protection functions	Protection against input voltage exceptions	Supports input phase loss protection
	Braking circuit protection	Protection against braking circuit overcurrent, braking resistor short-circuit, braking transistor shoot-through, and braking overload
	Other protection functions	Such as protection against overvoltage, undervoltage, and overtemperature
Peripheral interface	Digital input	Five regular inputs. Max. frequency: 1kHz; internal impedance: 3.3k Ω Resolution: $\leq 2\text{ms}$
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
	Communication interface	One RS485 interface, supporting the Modbus communication protocol Two CAN communication interfaces, of which CAN1 supports the CANopen communication protocol and CAN2 supports the CAN master/slave control protocol.
	Expansion interfaces	Two expansion interfaces: SLOT1 and SLOT2 Supporting communication cards and PLC cards
Others	Installation method	Wall mounting or flange installation
	Temperature of running environment	-10°C – +50°C. Derating is required when the ambient temperature exceeds 40°C.
	IP rating	IP00
	Pollution degree	Degree 2
	Cooling method	Forced air cooling
	Braking unit	The 22kW and 110kW rectifier units come standard with a built-in braking unit. Other rectifier unit models can be equipped with an optional external braking unit.
	EMC filter	All the series meet the IEC61800-3 C3 requirements. Optional external filter: Meets IEC 61800-3 Category C2 requirements, and supports 3m motor cable
Non-gateway-type uncontrolled rectifier unit (without gateway functionality)		
Power input	Input voltage (V)	AC 3PH 380V (-15%)–440V (+10%) Rated voltage: 380V
	Input current (A)	See section 3.6 Product ratings.
	Input frequency (Hz)	50Hz or 60Hz; Allowed range: 47–53 (50Hz), 57–63 (60Hz)

Function		Specifications
Power output	Output voltage (V)	457Vdc–684Vdc
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
Protection functions	Input voltage abnormality protection	Supports input phase loss protection
	Braking circuit protection	Protection against braking circuit overcurrent, braking resistor short-circuit, braking transistor shoot-through, and braking overload
	Other protection functions	Such as protection against overvoltage, undervoltage, and overtemperature
Peripheral interface	Relay output	One-channel programmable relay output RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V
	Communication interface	One-channel CAN communication interface, supporting the internal CAN protocol between rectifier and inverter units
Others	Installation method	Wall mounting or flange installation
	Temperature of running environment	-10°C – 50°C. Derating is required when the ambient temperature exceeds 40°C.
	IP rating	IP00
	Pollution degree	Degree 2
	Cooling method	Forced air cooling
	Braking unit	The 22kW and 110kW rectifier units come standard with a built-in braking unit. Other rectifier unit models can be equipped with an optional external braking unit.
	EMC filter	All the series meet the IEC61800-3 C3 requirements. Optional external filter: Meets IEC 61800-3 Category C2 requirements, and supports 3m motor cable

Table 3-3 Inverter unit specifications

Function		Specifications
Power input	Input voltage (V)	350Vdc–800Vdc
	Input current (A)	See section 3.6 Product ratings.
Power output	Output voltage (V)	0– 0.7* Input voltage (V)
	Output current (A)	See section 3.6 Product ratings.
	Output power (kW)	See section 3.6 Product ratings.
	Output frequency (Hz)	0–590Hz

Function		Specifications
Technical control performance	Control mode	Space voltage vector control, sensorless vector control (SVC), and sensor vector control (FVC)
	Motor type	Asynchronous motor (AM) and permanent magnet synchronous motor (SM)
	Speed ratio	For AMs: 1:200 (SVC) For SMs: 1:200 (SVC); 1:1000 (FVC)
	Speed control accuracy	$\pm 0.2\%$ (SVC); $\pm 0.02\%$ (FVC)
	Speed fluctuation	$\pm 0.3\%$ (SVC)
	Torque response	< 20ms (SVC); < 5ms (FVC)
	Torque control accuracy	10% (SVC); 5% (FVC)
	Starting torque	For AMs: 0.25Hz/150% (SVC) For SMs: 0.25Hz/150% (SVC) 0Hz/200% (FVC)
	Overload capacity	150% of rated current for 1 minute, 180% of rated current for 10 seconds, 200% of rated current for 1 second
Running control performance	Frequency setting method	Settings can be implemented through digital, analog, pulse frequency, multi-step speed running, simple PLC, PID, Modbus communication, CANopen communication and so on. Settings can be combined and the setting channels can be switched.
	Automatic voltage regulation	The output voltage can be kept constant although the bus voltage changes.
	Fault protection	Comprehensive protection functions, such as protection against overcurrent, overvoltage, undervoltage, overtemperature, and overload; protection against communication faults and position control faults
	Speed tracking restart function	Used to implement impact-free smooth startup for rotating motors
Peripheral interface	Analog input	Two inputs. AI1: 0(2)–10V / 0(4)–20mA; AI2: -10 – +10V Resolution: $\leq 20\text{mV}$
	Analog output	One output; AO1: 0–10V/0–20mA
	Digital input	Four regular inputs; max. frequency: 1kHz; internal impedance: 3.3k Ω Resolution: $\leq 2\text{ms}$
	Digital output	One Y terminal open collector output
	Relay output	Two programmable relay outputs RO1A: NO; RO1B: NC; RO1C: common RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
	Communication interface	One RS485 interface, supporting the Modbus communication protocol One CAN1 (RJ45) communication interface, used for networking communication One CAN2 (wiring terminal) communication interface, used for master/slave synchronization control
	Expansion interfaces	Two expansion interfaces: SLOT1 and SLOT2 Supporting PG cards, PLC cards, communication cards, I/O cards and so on

Function		Specifications
Others	Installation method	Wall mounting or flange installation
	Temperature of running environment	-10°C – 50°C. Derating is required when the ambient temperature exceeds 40°C.
	IP rating	IP00
	Pollution degree	Degree 2
	Cooling method	Forced air cooling

3.4 Product nameplate

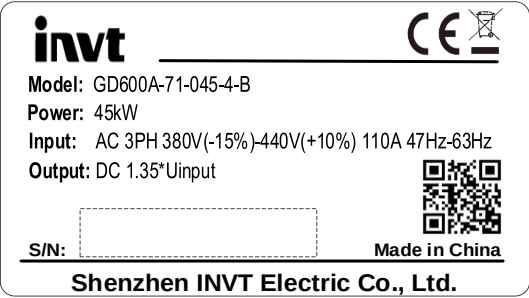


Figure 3-6 Rectifier unit nameplate

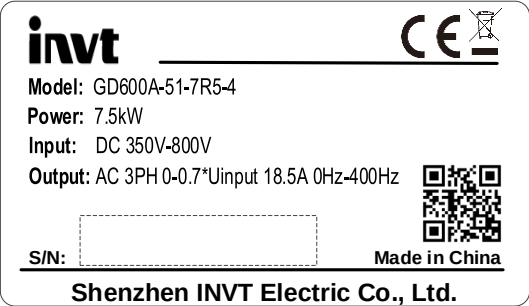


Figure 3-7 Inverter unit nameplate

Note:

- The preceding are standard product nameplate examples. The marking such as "CE" on the nameplate is marked according to actual certification conditions.
- You can scan the QR code on the nameplate to download the product manual.

3.5 Model designation code

A model designation code contains product information.

GD600A-61-110-4-B-S

① ② ③ ④ ⑤ ⑥

Figure 3-8 Model description

Field	Segment	Description	Example
Product series abbreviation	①	Product series abbreviation	GD600A: GD600A series high-performance multi-drive VFD
Unit type	②	Unit type code	51: Inverter unit 61: Uncontrolled rectifier unit 71: Half-controlled rectifier unit
Rated power	③	Power code	110: 110kW

Field	Segment	Description	Example
Voltage class	④	Voltage class code	4: AC 3PH 380V(-15%) – 440V(+10%) Rated voltage: 380V
Braking unit	⑤	Braking unit	Blank: No built-in braking unit B: Braking unit as a standard part
Order management number	⑥	Order management number	Blank: Gateway-type (with gateway functionality) S: Non-gateway-type (without gateway functionality)

3.6 Product ratings

Table 3-4 Half-controlled rectifier unit ratings

Product model	Rated power (kW)	Power supply capacity (kVA)	Input current AC (A)	Output current DC (A)	Busbar current-carrying capacity (A)	Braking current (A)
GD600A-71-045-4-B	45	76	110	135	350	47.5
GD600A-71-160-4	160	215	320	380	350	-
GD600A-71-355-4	355	433	625	766	-	-

Table 3-5 Uncontrolled rectifier unit ratings

Product model	Rated power (kW)	Power supply capacity (kVA)	Input current AC (A)	Output current DC (A)	Busbar current-carrying capacity (A)	Braking current (A)
GD600A-61-022-4-B	22	45	55	67	200	37
GD600A-61-022-4-B-S	22	45	55	67	200	37
GD600A-61-110-4-B	110	169	225	276	350	145
GD600A-61-110-4-B-S	110	169	225	276	350	145

Note:

- The input current of the rectifier unit is measured in the scenario where the input voltage is 380 V without additional external reactors.
- The 160kW and 355kW rectifier units support the use of optional built-in input-side Hall, which needs to be customized.

Table 3-6 Inverter unit ratings

Product model	Rated power (kW)	Input current DC (A)	Output current AC (A)	Carrier frequency (kHz)	Busbar current-carrying capacity (A)
GD600A-51-1R5-4	1.5	3.6	3.7	1–15 (8)	200
GD600A-51-2R2-4	2.2	5.5	5	1–15 (8)	200
GD600A-51-004-4	4	9.6	9.5	1–15 (8)	200
GD600A-51-5R5-4	5.5	14.2	14	1–15 (8)	200
GD600A-51-7R5-4	7.5	19	18.5	1–15 (8)	200
GD600A-51-011-4	11	26	25	1–15 (8)	350
GD600A-51-015-4	15	33	32	1–15 (4)	350
GD600A-51-018-4	18.5	40	38	1–15 (4)	350
GD600A-51-022-4	22	47	45	1–15 (4)	350

Product model	Rated power (kW)	Input current DC (A)	Output current AC (A)	Carrier frequency (kHz)	Busbar current-carrying capacity (A)
GD600A-51-030-4	30	62	60	1–15 (4)	350
GD600A-51-037-4	37	79	75	1–15 (4)	350
GD600A-51-045-4	45	97	92	1–15 (4)	350
GD600A-51-055-4	55	121	115	1–15 (4)	350
GD600A-51-075-4	75	158	150	1–15 (2)	350
GD600A-51-090-4	90	206	180	1–15 (2)	350
GD600A-51-110-4	110	240	215	1–15 (2)	350
GD600A-51-132-4	132	288	260	1–15 (2)	350
GD600A-51-160-4	160	350	305	1–15 (2)	350

Note:

- The rated output current of the inverter unit is the output current when the output voltage is 380V.
- The current-carrying capacity indicates the current-carrying capacity of the DC bus copper bar of a unit.
- Within the allowable input voltage range, the output current/power cannot exceed the rated output current/power.

3.7 Product structure

The following figure shows the gateway-type rectifier unit structure (taking the 380V 45kW rectifier model as an example).

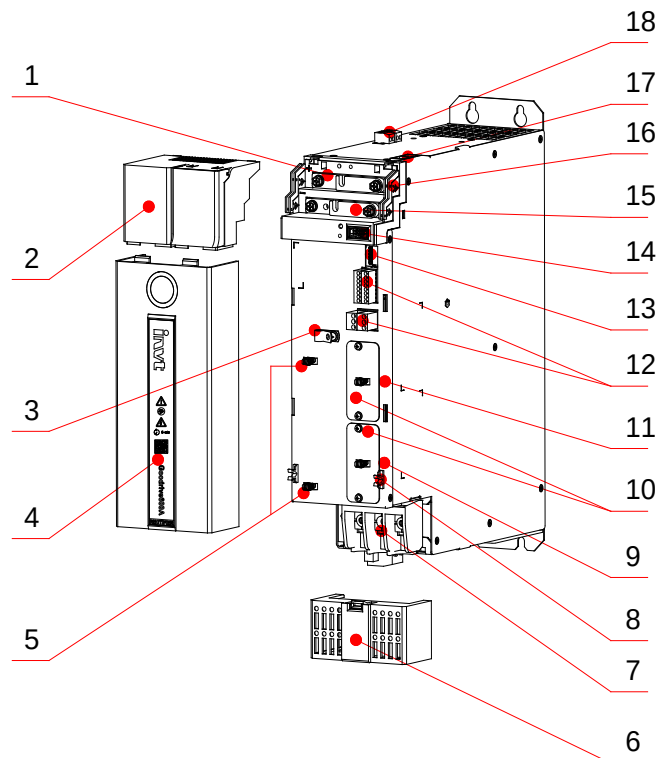


Figure 3-9 Gateway-type rectifier unit structure

No.	Name	Description
1	DC busbar	Positive and negative DC bus copper bar.
2	Upper cover (including the keypad)	Used to protect the DC high voltage output. For details about keypad operations, see section 5.4 Operation procedure.
3	Shield cable clamp	Used to fix and install the shield layer of the control cable.

No.	Name	Description
4	Middle cover	Used to protect control terminals and expansion cards.
5	Tie seat	Used to fix cables.
6	AC terminal cover	Used to protect AC input terminals and protect electric shock.
7	AC terminals	Entire machine AC inputs (R/S/T).
8	Middle cover snap-fit	Used to fix the middle cover.
9	Expansion card slot 2	Expansion card slot 2 (SLOT2).
10	Expansion card slot cover	Expansion card slot sealing plate (a standard model has no expansion card installed, and the slot is sealed with this plate).
11	Expansion card slot 1	Expansion card slot 1 (SLOT1).
12	Control terminals	Control circuit terminals on the control board.
13	Switch	DIP switch on the control board.
14	Keypad socket	Socket for connecting the keypad to the upper cover.
15	Parallel copper bar	Parallel copper bar of the rectifier unit.
16	Copper bar coverplate	Terminal coverplate for the DC bus copper bar.
17	RJ45 communication terminal	RJ45 communication terminal on the control board.
18	24V power terminal	24V power terminal on the drive board.

The following figure shows the non-gateway-type rectifier unit structure (taking the 380V 22kW rectifier model as an example).

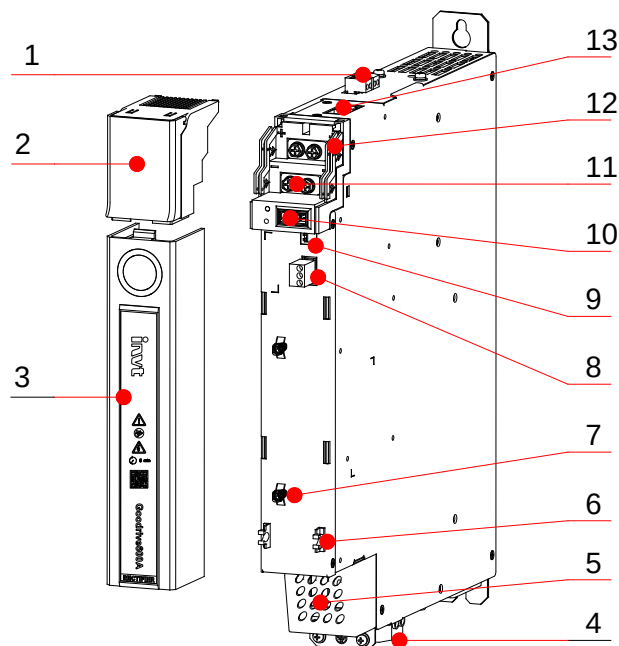


Figure 3-10 Non-gateway-type rectifier unit structure

No.	Name	Description
1	24V power terminal	24V power terminal on the drive board.
2	Upper cover (including the keypad)	Used to protect the DC high voltage output. For details about keypad operations, see section 5.4Operation procedure.
3	Middle cover	Used to protect relay terminals, DIP switches, and so on.
4	Braking terminal	Connects to the external braking resistor.
5	AC terminals	AC input; equipped with a flip cover to prevent electric shock.
6	Middle cover snap-fit	Used to fix the middle cover.
7	Tie seat	Used for relay cable fixing.
8	Relay terminals	Control board relay terminals.

No.	Name	Description
9	Switch	DIP switch on the control board.
10	Keypad socket	Socket for connecting the keypad to the upper cover.
11	DC busbar	Positive and negative DC bus copper bar.
12	Copper bar coverplate	Terminal coverplate for the DC bus copper bar.
13	RJ45 communication terminal	RJ45 communication terminal on the control board.

Note: Rectifier units are classified into half-controlled and uncontrolled types. All half-controlled units feature a gateway-type structure. Uncontrolled units are available in both gateway-type and non-gateway-type structures, where the external structure of the gateway-type uncontrolled unit is identical to that of the half-controlled unit.

The following figure shows the inverter unit structure (taking the 380V 37kW inverter model as an example).

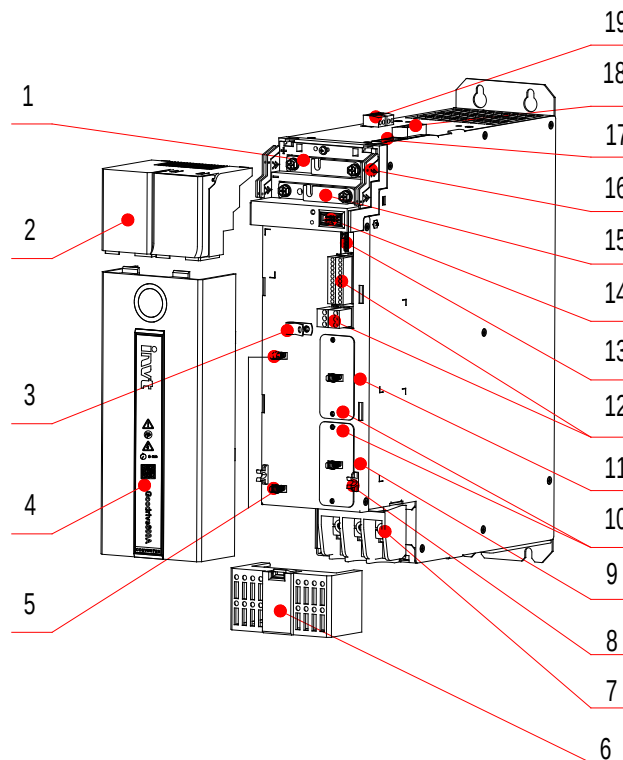


Figure 3-11 Inverter unit structure

No.	Name	Description
1	DC busbar	Positive and negative DC bus copper bar.
2	Upper cover (including the keypad)	Used to protect the DC high voltage output. For details about keypad operations, see section 5.4 Operation procedure.
3	Shield cable clamp	Used to fix and install the shield layer of the control cable.
4	Middle cover	Used to protect control terminals and expansion cards.
5	Tie seat	Used to fix cables.
6	AC terminal cover	Used to protect AC output terminals and protect electric shock.
7	AC terminals	Complete unit AC outputs (U/V/W).
8	Middle cover snap-fit	Used to fix the middle cover.
9	Expansion card slot 2	Expansion card slot 2 (SLOT2).
10	Expansion card slot cover	Expansion card slot sealing plate (a standard model has no expansion card installed, and the slot is sealed with this plate).
11	Expansion card slot 1	Expansion card slot 1 (SLOT1).
12	Control terminals	Control circuit terminals on the control board.
13	Switch	DIP switch on the control board.

No.	Name	Description
14	Keypad socket	Socket for connecting the keypad to the upper cover.
15	Parallel copper bar	Parallel copper bar of the inverter unit.
16	Copper bar coverplate	Terminal coverplate for the DC bus copper bar.
17	RJ45 communication terminal	RJ45 communication terminal on the control board.
18	STO terminal	STO terminal on the control board.
19	24V power terminal	24V power terminal on the drive board.

4 Installation and selection guidelines

4.1 System model selection

The VFD adopts a booksize design that allows flexible unit arrangement in single-row or double-row layouts. The rectifier units can be placed on the left or in the middle of the inverter units, and multiple rectifier units can also be connected in parallel.

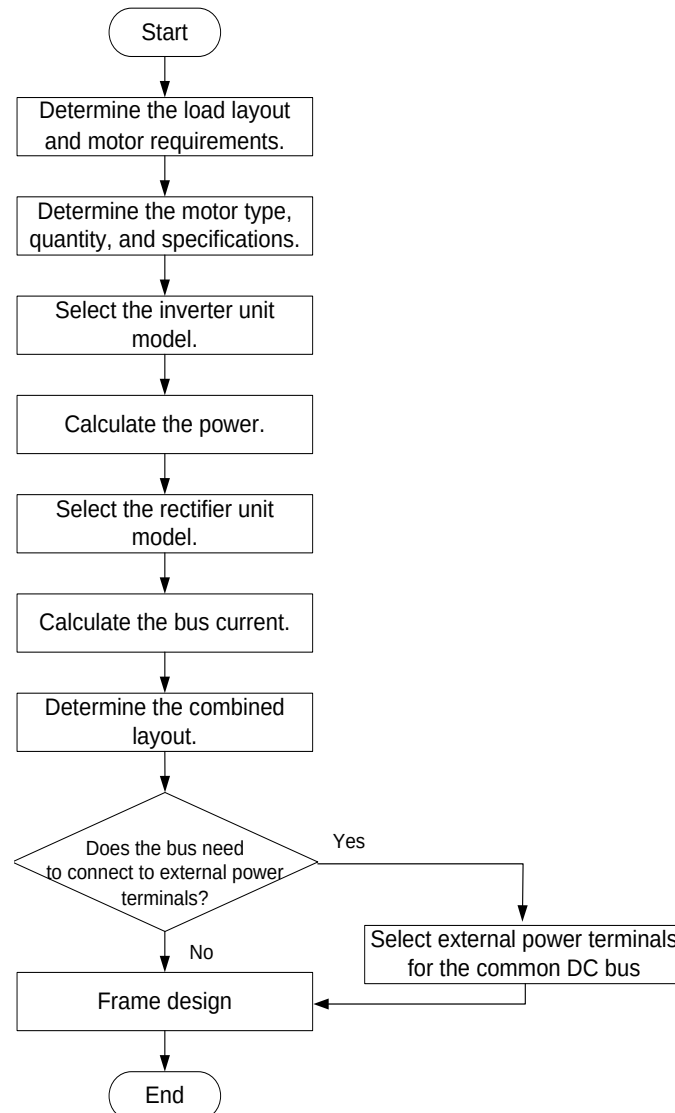
4.2 What this chapter contains

This chapter describes the mechanical installation and electrical installation of the VFD.



- Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Carry out operations according to instructions presented in chapter 1 Safety precautions. Ignoring these safety precautions may lead to physical injury or death, or device damage.
- Ensure the VFD power has been disconnected before installation. If the VFD has been powered on, disconnect the VFD power and wait for at least the time specified on the VFD, and ensure the POWER indicator is off. You are recommended to use a multimeter to check and ensure the VFD DC bus voltage is below 36V.
- The VFD installation must be designed and done according to applicable local laws and regulations. INVT does not assume any liability whatsoever for any VFD installation which breaches local laws or regulations. If recommendations given by INVT are not followed, the VFD may experience problems that the warranty does not cover.

4.2.1 System model selection



4.2.2 Load and motor selection

1. Select the appropriate motor type and quantity according to the mechanical load and operation characteristics.
2. Define technical requirements including rated power, torque, speed, starting performance, commissioning, braking, overload capacity, and temperature rise limits.
3. Select the motor rated power, rated voltage, and rated speed according to the motor product catalog.
4. Under the premise of fully satisfying the mechanical equipment load, the motor capacity is economically and reasonably selected.

$$P_n = (\sqrt{3} \times U_n \times I_n \times \cos\varphi \times \eta)$$

P_n : Rated power ; U_n : Rated voltage; I_n : Rated current; $\cos\varphi$: Power factor; η : Efficiency

4.2.3 Inverter unit selection

1. Determine the number of inverter units according to the number of motors, with the prerequisite that one motor needs one inverter unit.
2. Select the power rating and model for the inverter units according to the motor rated power.

3. For details about inverter unit specifications, see section 3.3 Product specifications.

4.2.4 Rectifier unit selection

1. Calculate the total rated power of all inverter units that have been selected.
2. Select rectifier units according to the power rating of the inverter units in the system. The coefficient varies with the number of inverter units. The rectifier unit selection formula is as follows.

$$\text{Inverter unit quantity} \leq 5: P_{\text{Rectifier}} = (P_1 + P_2 + P_3 + P_4 + P_5)$$

$$\text{Inverter unit quantity} > 5: P_{\text{Rectifier}} = 0.8 * (P_1 + P_2 + P_3 + \dots + P_{n-1} + P_n)$$

$P_1, P_2, \dots, P_{n-1}, P_n$: Inverter power. For details, see Figure 3-7 Inverter unit nameplate.

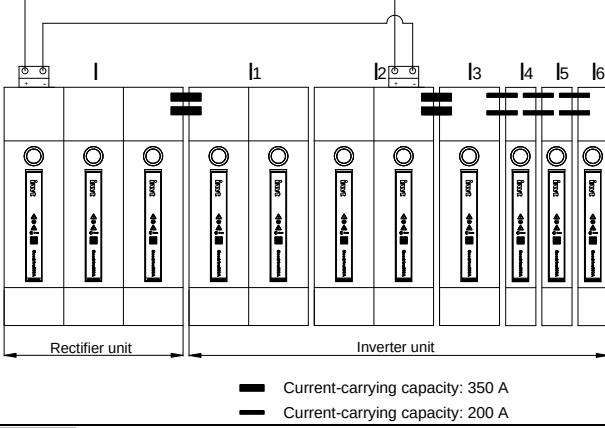
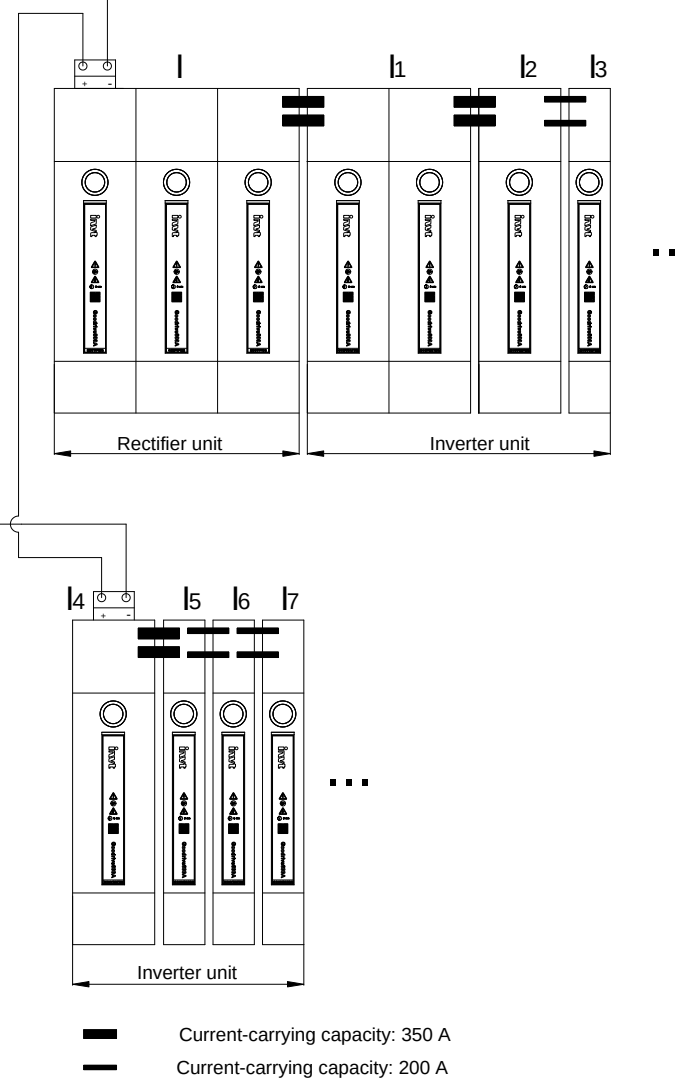
Note:

- When the mechanical equipment has demanding requirements for overload capacity, set $P_{\text{rectifier}}$ to 100%–150%; when the equipment overload capacity is low, set $P_{\text{rectifier}}$ to 60%–80%.
- Only rectifier units of the same power rating can be connected in parallel, with a maximum of 4 units. If the required power exceeds the total capacity of 4 parallel units, use rectifier units with higher power ratings for parallel connection.

4.2.5 Combined arrangement

The VFD features a booksize design with highly flexible layout options. They can be arranged in a single-row or dual-row layout. The rectifier unit can be positioned either in the middle or on either side of the inverter units.

Arrangement	Layout diagram	Requirement
Single-row layout (rectifier on the left)	I I_1 I_2 I_3 I_4 I_5 I_6 Rectifier unit Inverter unit --- Current-carrying capacity: 350 A --- Current-carrying capacity: 200 A	$I(\text{rectifier}) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)$ $I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots \leq 350\text{A}$ $I_4 + I_5 + I_6 + \dots \leq 200\text{A}$
Single-row layout (rectifier in the middle)	I_3 I_2 I_1 I I_4 I_5 I_6 Inverter unit Rectifier unit Inverter unit --- Current-carrying capacity: 350 A --- Current-carrying capacity: 200 A	$I(\text{rectifier}) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)$ $I_1 + I_2 + I_3 + \dots \leq 350\text{A}$ $I_4 + I_5 + I_6 + \dots \leq 350\text{A}$ $I_5 + I_6 + I_7 + \dots \leq 200\text{A}$ $I_3 + \dots \leq 200\text{A}$

Arrangement	Layout diagram	Requirement
Single-row layout (external DC bus connection)	 Current-carrying capacity: 350 A Current-carrying capacity: 200 A	$I(\text{rectifier}) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + \dots)$ $I_2 + I_3 + I_4 + I_5 + I_6 + \dots \leq 200A$
Double-row layout (single rectifier unit)	 Current-carrying capacity: 350 A Current-carrying capacity: 200 A	$I(\text{rectifier}) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + \dots)$ $I_1 + I_2 + I_3 + \dots \leq 350A$ $I_4 + I_5 + I_6 + I_7 + \dots \leq 200A$ $I_3 + \dots \leq 200A$

Arrangement	Layout diagram	Requirement
Double-row layout (multiple rectifier units in parallel)	— Current-carrying capacity: 350 A — Current-carrying capacity: 200 A	$I(\text{rectifier } 1) + I(\text{rectifier } 2) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + \dots)$ $I(\text{rectifier } 1) / I(\text{rectifier } 2) \approx (I_1 + I_2 + I_3 + \dots) / (I_4 + I_5 + I_6 + I_7 + \dots) \approx 1$ $I_1 + I_2 + I_3 + \dots \leq 350\text{A}$ $I_4 + I_5 + I_6 + I_7 + \dots \leq 350\text{A}$ $I_6 + I_7 + \dots \leq 200\text{A}$ $I_3 + \dots \leq 200\text{A}$
Single-row layout (single rectifier on the left)	— Current-carrying capacity: 350 A — Current-carrying capacity: 200 A	$I(\text{rectifier}) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + \dots + I_8 + I_9 + I_{10} + \dots)$ $I_1 + I_2 + I_3 + I_4 \leq 400\text{A}$ $I_2 + I_3 + I_4 \leq 350\text{A}$ $I_5 + I_6 + I_7 + \dots \leq 200\text{A}$ $I_8 + I_9 + I_{10} + \dots \leq 100\text{A}$
Single-row layout (dual-rectifier on the left)	— Current-carrying capacity: 350 A — Current-carrying capacity: 200 A	$I(\text{rectifier } 1) + I(\text{rectifier } 2) \geq 0.8 * (I_1 + I_2 + I_3 + I_4 + I_5 + I_6 + I_7 + \dots + I_8 + I_9 + I_{10} + \dots + I_{11} + I_{12} + I_{13} + \dots)$ $I_1 + I_2 + I_3 + I_4 \leq 400\text{A}$ $I_2 + I_3 + I_4 \leq 350\text{A}$ $I_5 + I_6 + I_7 + \dots \leq 400\text{A}$ $I_6 + I_7 + \dots \leq 350\text{A}$ $I_7 + \dots \leq 200\text{A}$ $I_8 + I_9 + I_{10} + \dots \leq 200\text{A}$ $I_{11} + I_{12} + I_{13} + \dots \leq 100\text{A}$

Note:

- The current-carrying capacity of the DC bus copper bars is available in two specifications: 200A and 350A. In the diagram, the thick line (■) represents the 350A copper bar, and the thin line (■) represents the 200A copper bar; for detailed specifications, see section 3.6 Product ratings. When designing the layout, calculate the current flowing through the DC bus copper bars to ensure it does not exceed their current-carrying capacity.
- Two types of external DC bus terminals are available: 100A and 200A. Select the appropriate terminal based on your current requirements, and ensure that the current carrying capacity is not exceeded during operation.

4.3 Mechanical installation

4.3.1 Installation environment

The installation environment is critical for reliable long-term operation of the VFD. Install the VFD in an environment that meets the following requirements.

Environment	Condition
Installation site	Indoor
Ambient temperature	• -10~+50°C. • When the ambient temperature exceeds 40°C, derate 1% for every increase of 1°C. • It is not recommended to use the VFD when the ambient temperature exceeds 50°C. • To improve reliability, do not use the VFD in the places where the temperature changes rapidly. • When the VFD is used in a closed space, such as control cabinet, use a cooling fan or air conditioner for cooling, preventing the internal temperature from exceeding the temperature required. • At low ambient temperatures, if the unit is powered on after a prolonged power-off period, an external heating device must be added to eliminate internal icing/frosting. Failure to do so may result in equipment damage.
Humidity	• The relative humidity (RH) of the air must be less than 90%. • Condensation is not allowed. • The max. RH cannot exceed 60% in the environment where there are corrosive gases.
Storage temperature	-30~+60°C
Running environment	Install the VFD in a place: • Away from electromagnetic radiation sources • Free from oil mist, corrosive gases, and flammable gases. • Without the chance for foreign objects such as metal powder, dust, oil and water to fall into the VFD (do not install the VFD onto combustible objects such as wood) • Free from radioactive substances and flammable substances. • Without hazardous gases or liquids. • Low-salt environment. • No direct sunlight.
Altitude	• Lower than 1000m. • When the altitude is higher than 1000m but lower than 3000m, derate by 1% for every increase of 100m. • When the installation site altitude exceeds 3000m, consult the local INVT dealer or office.
Vibration	The max. vibration acceleration cannot exceed 5.8m/s^2 (0.6g).
Installation direction	Adopt vertical installation to ensure optimal heat dissipation.

Note:

- The units must be installed in a clean and well-ventilated environment based on the housing IP rating.
- The cooling air must be clean enough and free from corrosive gases and conductive dust.

4.3.2 Installation direction

The units can be installed on the wall or in cabinets.

The units must be installed vertically. Check the installation position according to following requirements.

For details about the outline dimensions, see Appendix D Dimension drawings.

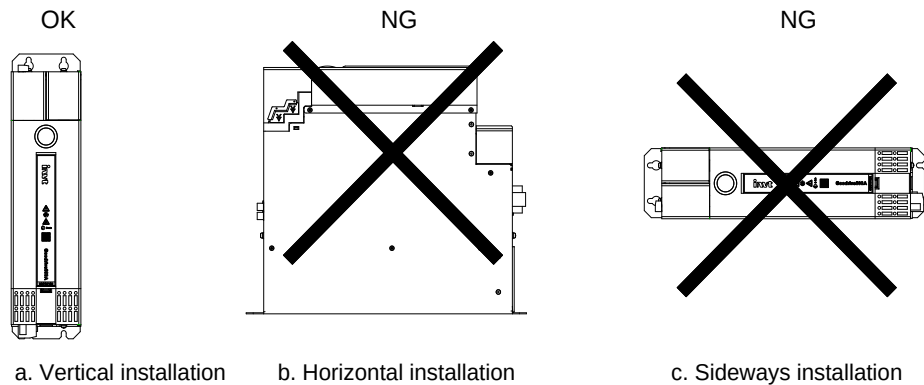


Figure 4-1 Unit installation direction

4.3.3 Installation method

The unit installation method depends on the outline dimensions:

1. Wall mounting: suitable for all rectifier units and inverter units
2. Flange mounting: applicable to 380V 160kW and lower rectifier units and inverter units

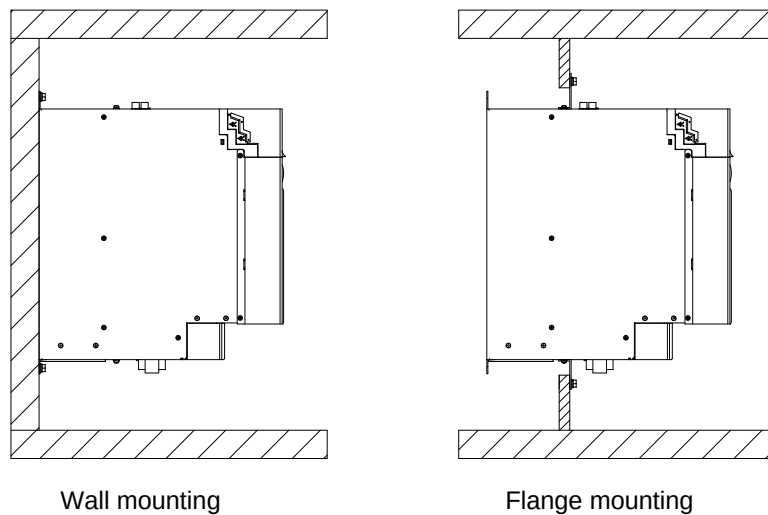


Figure 4-2 Unit installation method

1. Mark the installation hole positions. For details about the installation hole positions, see Appendix D Dimension drawings.
2. Secure the screws or bolts into the marked positions.
3. Lean the unit against the wall.
4. Tighten the fastening screws to the wall.

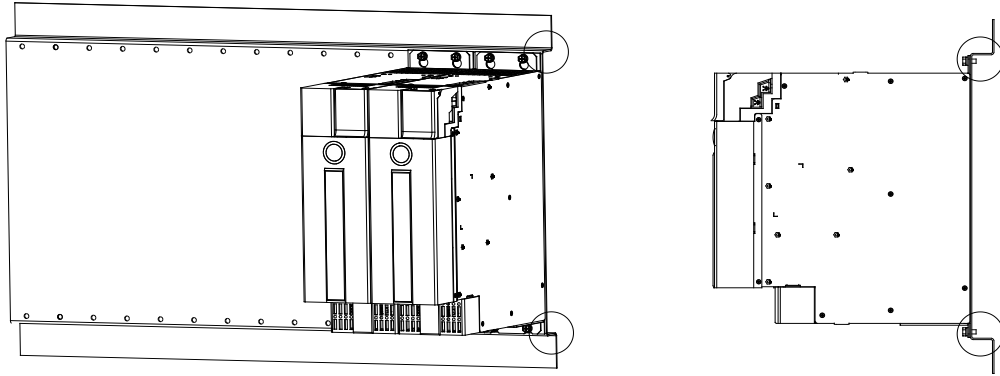
Note: The flange mounting plate must be used for flange mounting.

4.3.4 Installation backplate design requirements

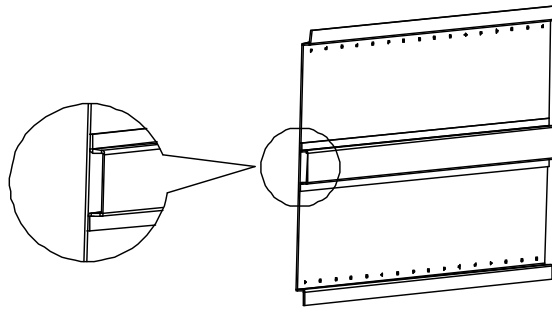
1. Installation backplate thickness and rigidity reinforcement principles

To prevent the power unit from being damaged during transportation and to ensure the normal running of the power unit, the power unit installation backplate needs to have sufficient rigidity and strength, and the thickness is not less than 2mm. Reinforce the backplate at the top and bottom mounting feet. The reinforcement methods include:

Solution 1: Horizontally bend the backplate.



Solution 2: Weld a transverse reinforcement beam on the back of the backplate.



2. Rules of making installation holes

The book-size units feature equal height and equal clearance (50mm) for installation holes. The installation holes are prefabricated when the backplate is processed, and the combined installation can also be flexibly configured. For details about the hole positions, see Appendix D Dimension drawings.

To prevent damage to the power unit during transportation, the mounting screws must not be fastened solely into the tapped holes of the mounting backplate. They must be further secured by installing self-clinching nuts or independent nuts on the rear side of the backplate.

To ensure a reliable connection of the built-in DC bus of the power unit, the relative positions of the rectifier unit mounting holes must be accurate. It is recommended to machine the mounting holes in the backplate in advance and avoid drilling holes on site.

4.3.5 Installation space and heat dissipation

To ensure that the units are installed reliably and in good heat dissipation, pay attention to the following:

1. 50mm-wide units must not be installed individually. At least three units should be installed in parallel to ensure mechanical stability.
2. For applications requiring up and down installation, reserve sufficient clearance around the units to ensure effective heat dissipation. For details, see Figure 4-3.
3. A minimum ventilation clearance must be maintained above and below each unit to ensure proper heat dissipation. See Figure 4-4.

Note: The dimensions specified in Figure 4-3 and Figure 4-4 represent the minimum clearance requirements.

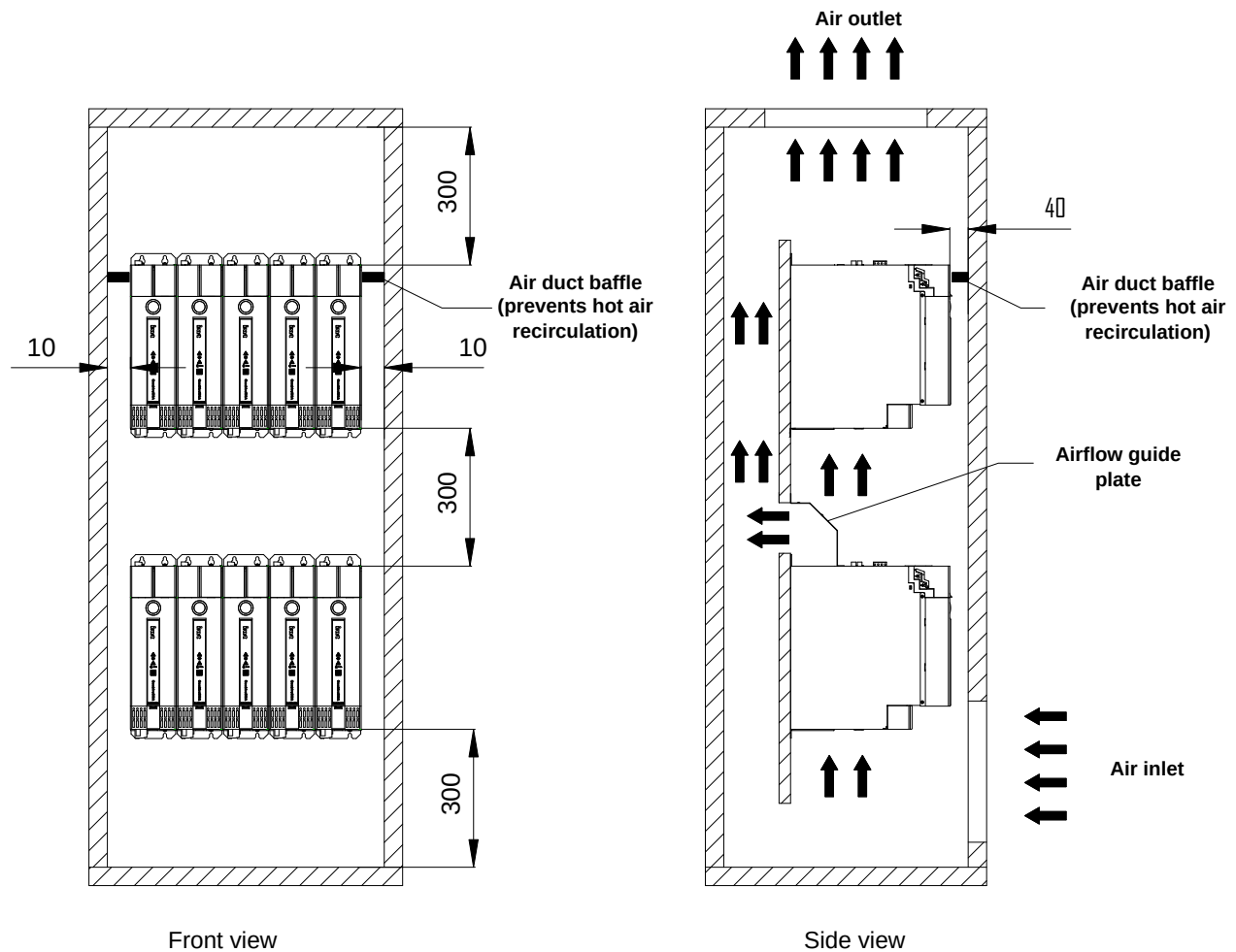


Figure 4-3 Clearance for side-by-side installation of multiple units (unit: mm)

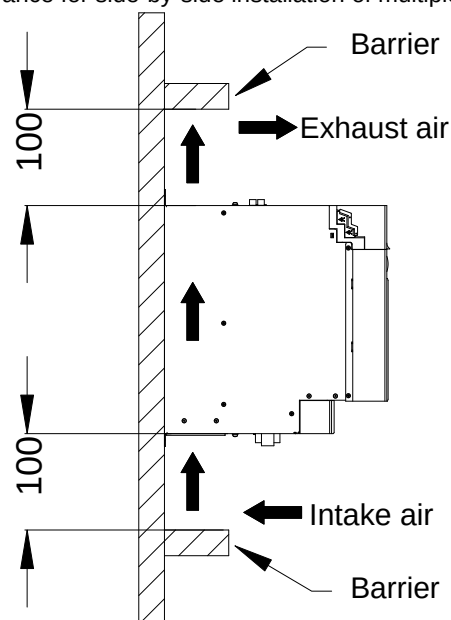


Figure 4-4 Installation clearance with obstructions above and below (unit: mm)

To ensure good heat dissipation of the units, design the air inlet and outlet as follows:

1. Air inlet area formula: $S = (1.5 \text{ to } 2.0) \times (S_{\text{unit1}} + S_{\text{unit2}} + S_{\text{unit3}} + \dots + S_{\text{unitn}})$
In which, S indicates the system ventilation area while S_{unit} indicates the ventilation area of each unit. For details about the ventilation area of a unit, see Table 4-1.

2. Air outlet area formula:

$$S = (1.2 \text{ to } 1.5) \times \text{Air inlet area}$$
3. In the case that the system exhaust fan is installed at the air outlet, the actual total air volume of the fan must not be less than the sum of the air volume required by all units. For details about the air volumes required by the units, see Table 4-1.

Table 4-1 Ventilation areas and actual air volumes of units

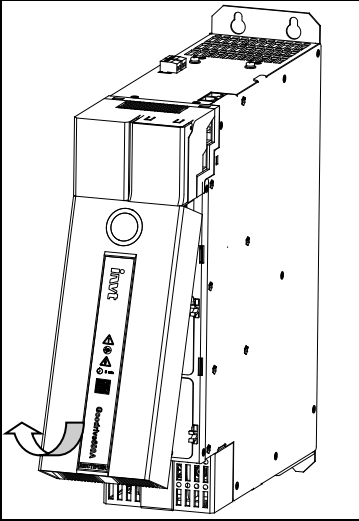
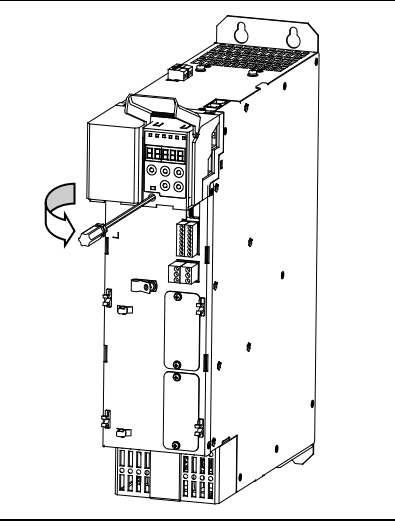
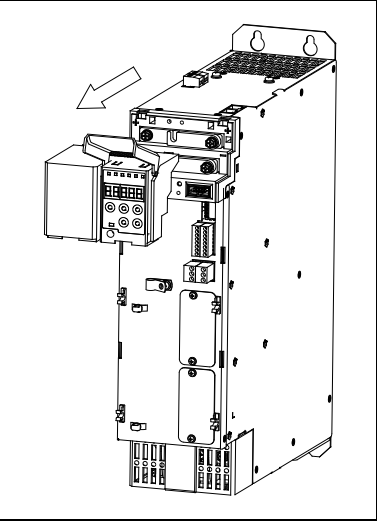
No.	Product model	Ventilation area (cm ²)	Actual air volume (CFM)
1	GD600A-51-1R5-4	15	8
2	GD600A-51-2R2-4	15	8
3	GD600A-51-004-4	15	20
4	GD600A-51-5R5-4	15	20
5	GD600A-51-7R5-4	15	20
6	GD600A-51-011-4	45	70
7	GD600A-51-015-4	45	70
8	GD600A-51-018-4	45	70
9	GD600A-51-022-4	45	70
10	GD600A-51-030-4	45	70
11	GD600A-51-037-4	45	100
12	GD600A-51-045-4	90	150
13	GD600A-51-055-4	90	150
14	GD600A-51-075-4	90	150
15	GD600A-51-090-4	160	230
16	GD600A-51-110-4	160	230
17	GD600A-51-132-4	160	270
18	GD600A-51-160-4	160	270
19	GD600A-61-022-4-B(-S)	15	18
20	GD600A-71-045-4-B	50	40
21	GD600A-61-110-4-B(-S)	90	125
22	GD600A-71-160-4	150	180
23	GD600A-71-355-4	130	352
Note: Ventilation area refers to the actual through-hole area in the cut-out area: Ventilation area = Cut-out area x Cut-out rate Unit conversion: 1CFM=0.0283185 m ³ /min			

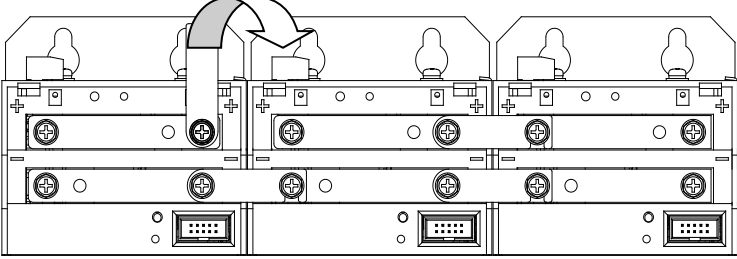
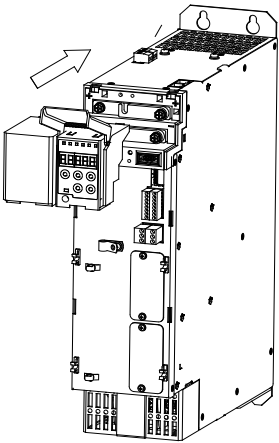
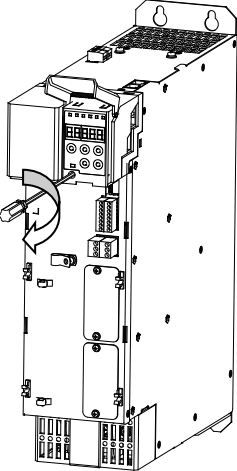
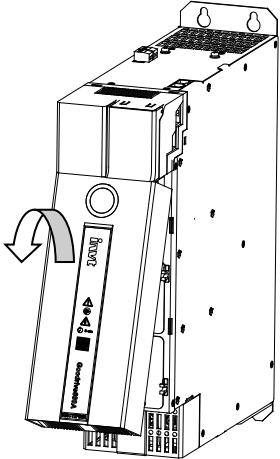
Note:

- Not only the dissipation space for units but also the dissipation conditions for other devices in the cabinet must be fully considered.
- In applications requiring vertical (stacked) installation, air deflectors must be installed. For details, see Figure 4-3.
- In cases of passive ventilation (no system exhaust fan installed at the air outlet), air duct baffles must be installed to prevent hot air recirculation. For details, see Figure 4-3.

4.3.6 Busbar connection

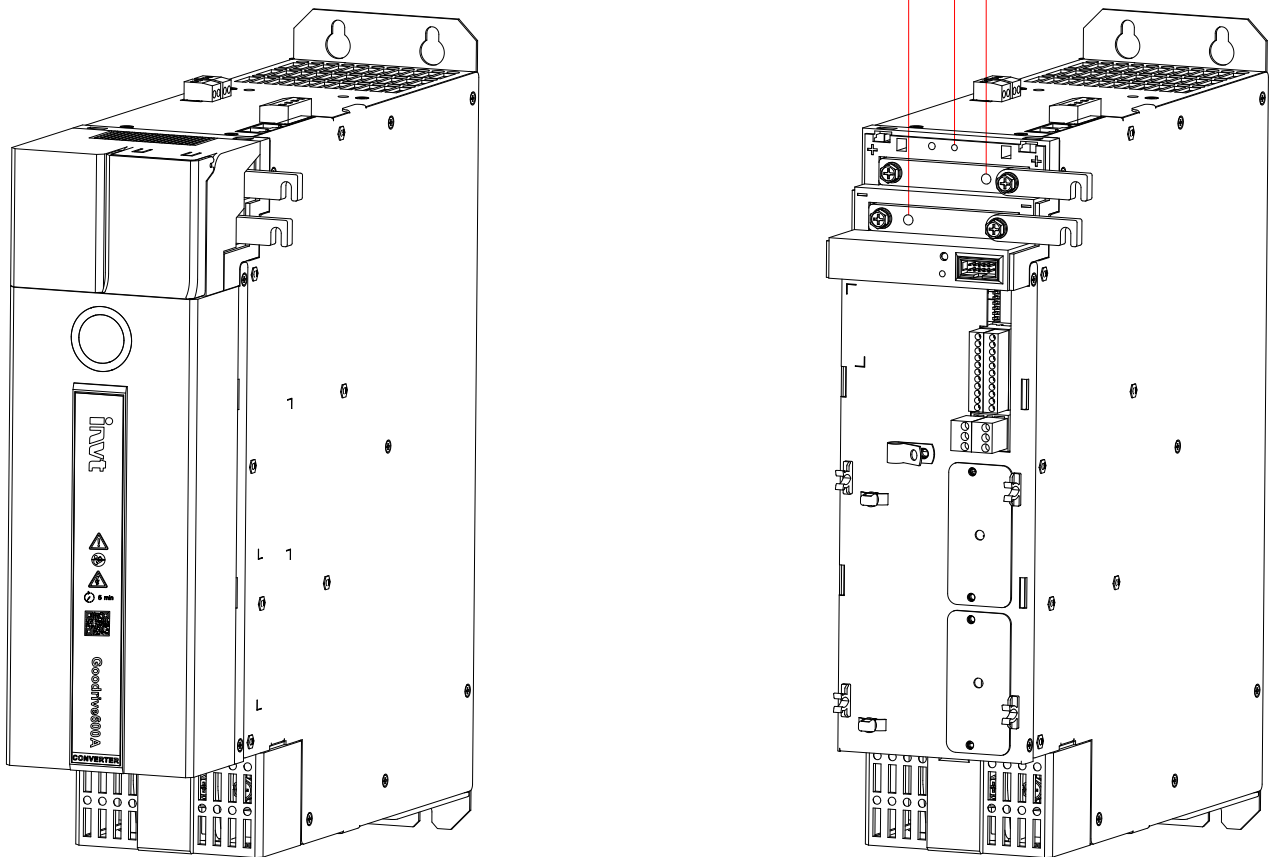
The DC busbars of the units require the removal of the top cover for connection.

 ● Before removing the keypad cover, ensure the unit has been powered off for more than 5 minutes. ● Avoid dropping the cover during disassembly, as it may cause damage to the equipment or personal injury.		
1. Remove the upper cover.		
Step 1 Rotate the middle cover upwards and remove it.	Step 2 Rotate the translucent keypad cover upward, and then use a flat-head screwdriver to loosen the fixing screws of the upper cover.	Step 3 Pull out the top cover vertically.
		

2. Connect the busbars.		
Step 1 Loosen the DC busbar screws (without removing them completely).		
Step 2 Rotate and connect the parallel copper busbars, then tighten the corresponding screws.		
		
3. Install the upper cover.		
Step 1 Insert the upper cover into the bus block.	Step 2 Fasten the screws fixed on the upper cover with a flat-head screwdriver, and close the translucent keypad cover.	Step 3 Insert the two snap-fits of the middle cover into the upper cover, and rotate and secure it onto the chassis.
		

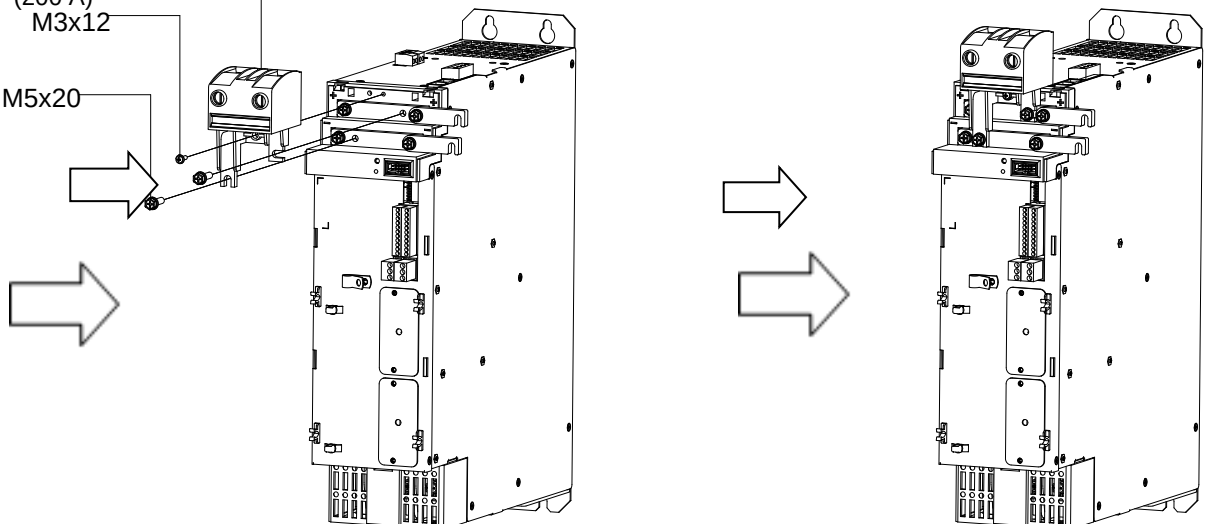
4.3.7 External busbar connection terminal installation

Reserved mounting holes in the busbar base for external busbar connection terminal



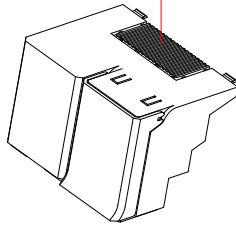
External busbar
connection terminal
(200 A)
M3x12

M5x20

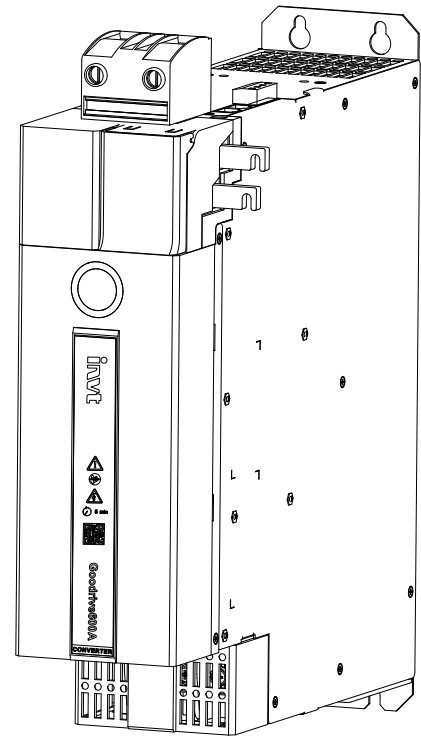
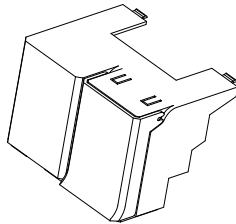


Use diagonal cutters or a similar tool to cut out the knockout along its edge, and remove any burrs.

Before
removal



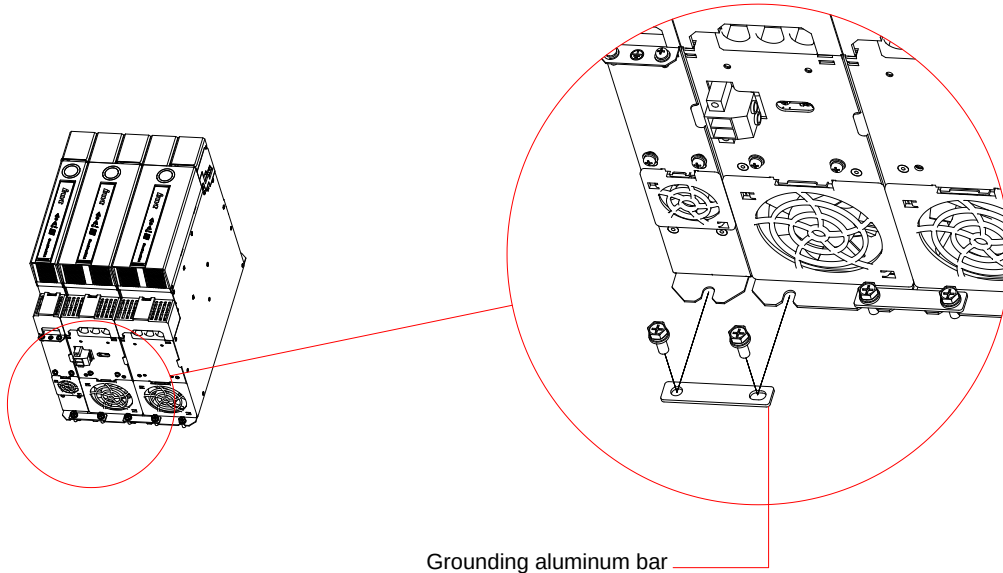
After
removal



Note: Please tighten screws with proper torque: For M3: 5–6 kgf·cm; For M5: 25–28 kgf·cm

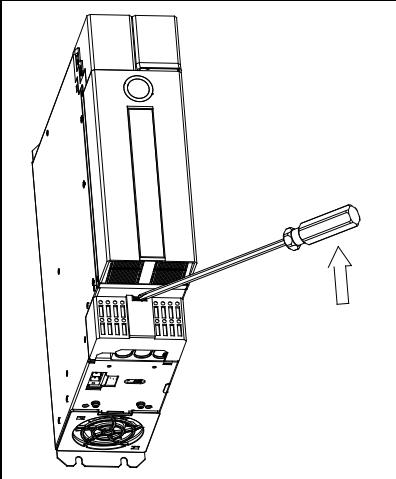
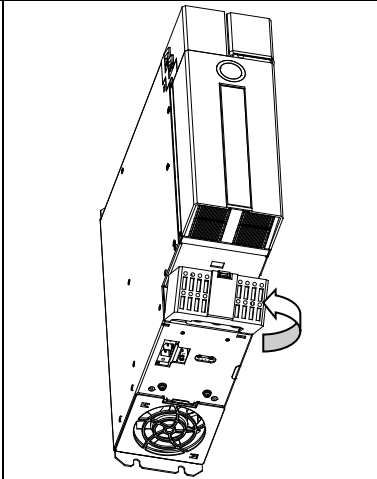
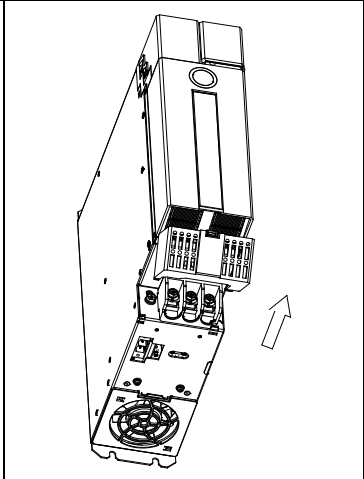
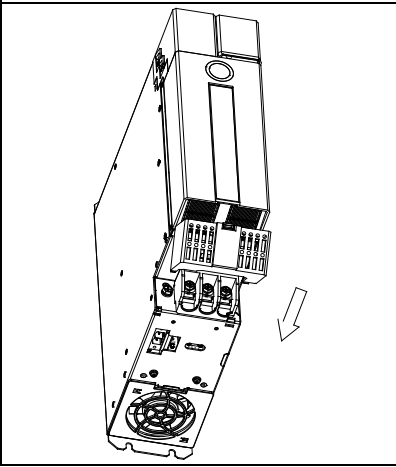
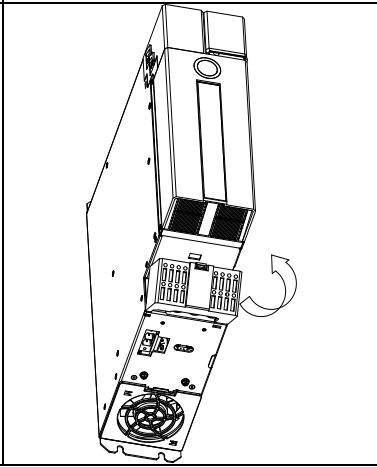
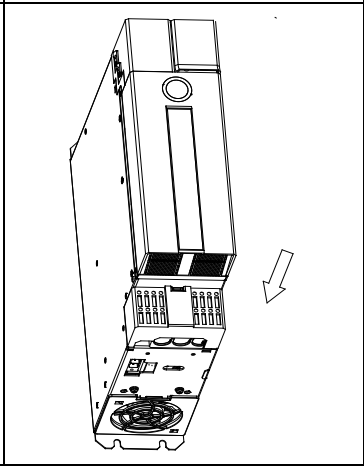
4.3.8 Grounding aluminum bar installation

To ensure proper grounding of the entire system and establish an equipotential bonding path, install grounding aluminum bars at the mounting holes between adjacent units and secure the bars to the mounting plate so that the units are interconnected through the grounding bars.



Grounding aluminum bar

4.3.9 AC terminal cover removal and installation

1. Remove the AC terminal cover.		
Step 1 Insert a screwdriver into the slot at the center of the AC terminal cover, and push it up to open the snap-fit.	Step 2 Rotate the AC terminal cover up.	Step 3 Pull the AC terminal cover out vertically.
		
2. Install the AC terminal cover		
Step 1 Insert the snap-fit at the bottom of the AC terminal cover into the chassis slot.	Step 2 Rotate the AC terminal cover downward.	Step 3 Press the middle of the AC terminal cover until the snap-fit clicks into the chassis slot.
		

4.4 Standard wiring of the main circuit

4.4.1 Main circuit wiring

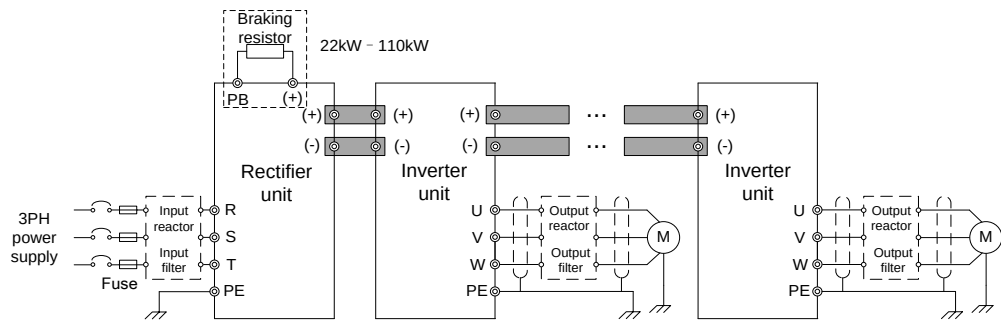


Figure 4-5 Main circuit wiring

Note: The fuse, braking resistor, input reactor, input filter, output reactor, and output filter are all optional parts. For details, see Appendix E Peripheral options.

4.4.2 Main circuit terminals

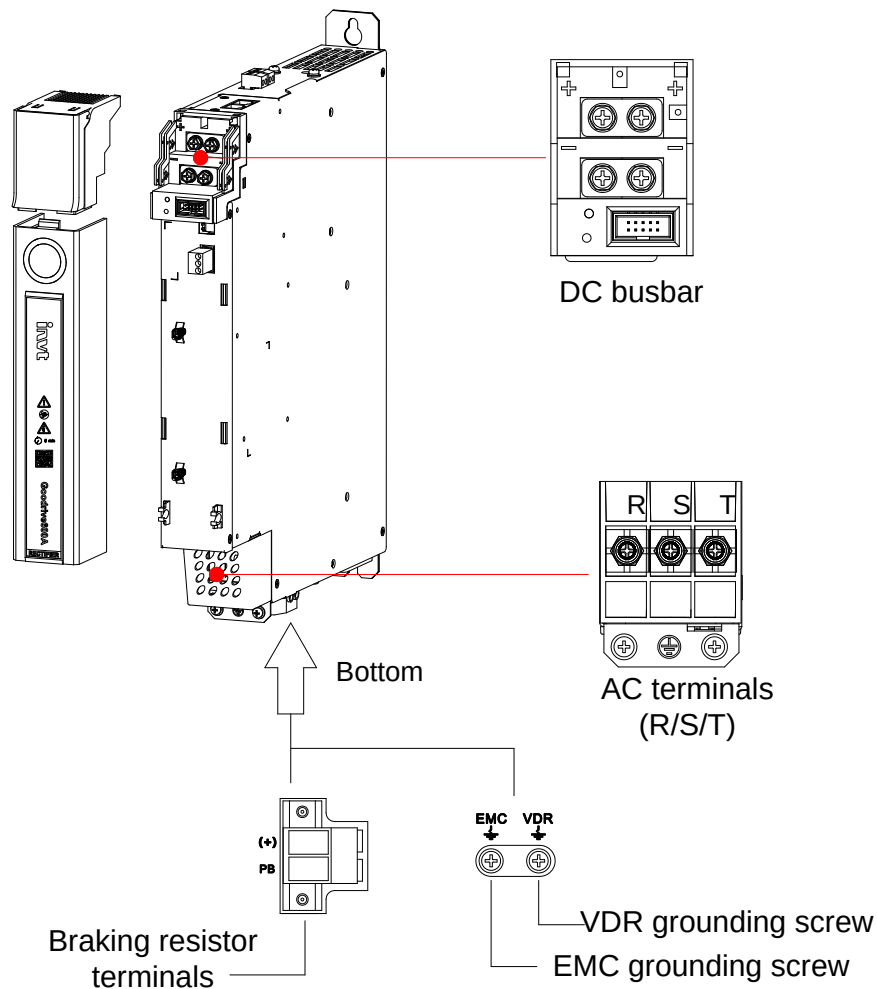


Figure 4-6 22kW rectifier unit main circuit terminals

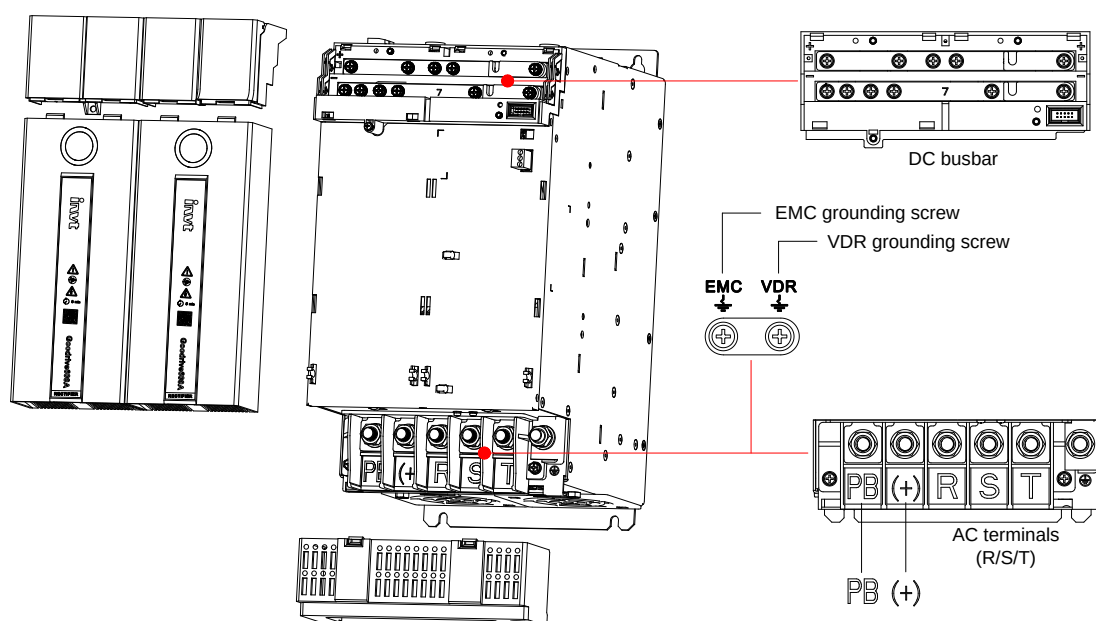


Figure 4-7 110kW rectifier unit main circuit terminals

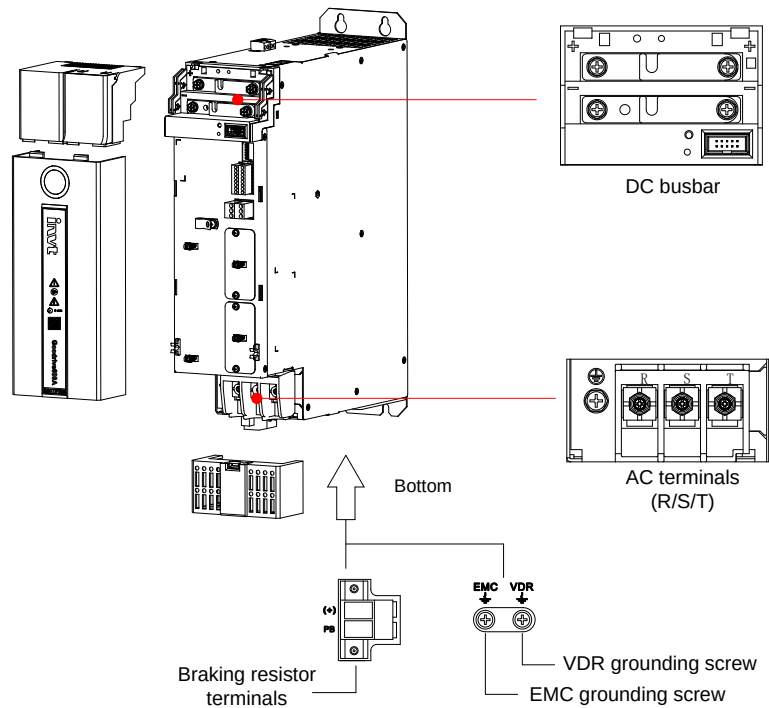


Figure 4-8 45kW and 160kW rectifier unit main circuit terminals

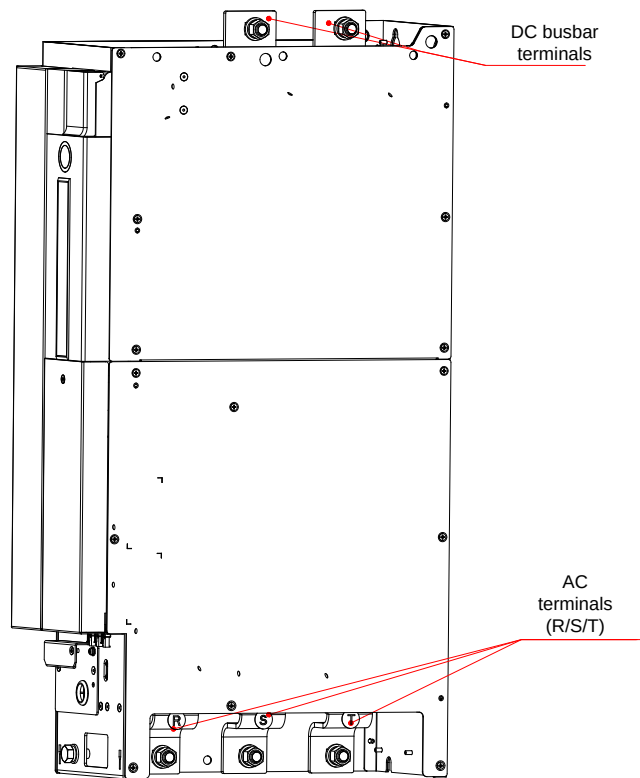


Figure 4-9 355kW rectifier unit main circuit terminals

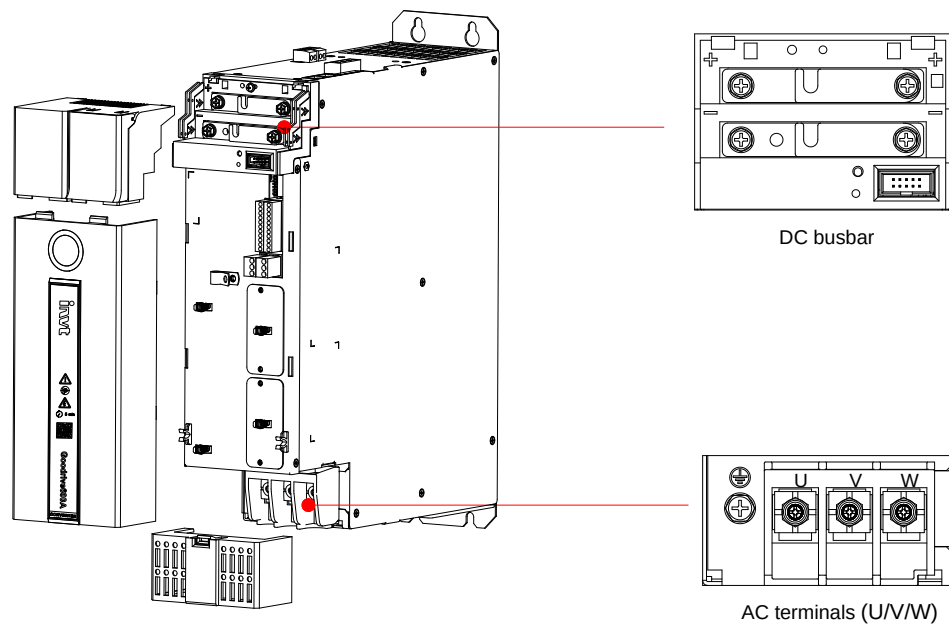


Figure 4-10 Inverter unit main circuit terminals

Table 4-2 Main circuit terminal description

Terminal symbol	Name	Function
R, S, T	Main circuit power inputs	3PH AC input terminals, connected to the grid
U, V, W	VFD outputs	3PH AC output terminals, usually connected to the motor
(+)	Positive bus terminal/Braking resistor terminal 1	(+), (-): connected to the braking unit (+), PB: connected to the braking resistor
(-)	Negative bus terminal	
PB	Braking resistor terminal 2	
PE	Grounding terminal	Grounding terminal for safe protection; each unit carries one PE terminal and proper grounding is required. The grounding resistance is less than 10Ω.

Note:

- It is not recommended to use asymmetrical motor cables. If there is a symmetrical grounding conductor in the motor cable besides the conductive shielded layer, ground the grounding conductor on the VFD end and motor end.
- Braking resistors and braking units are optional parts.
- Route the motor cable, input power cable and control cable separately.

4.4.3 Wiring procedure for main circuit terminals

1. Connect the grounding conductor of the input power cable to the grounding terminal (PE) of the rectifier unit, connect the phase conductors to the R, S and T terminals, and tighten securely.
2. Strip the motor cable, and connect the shield layer to the grounding terminal of the inverter unit using the 360° loop connection method. Connect the phase conductors to the U, V and W terminals, and tighten securely.
3. Connect the braking resistor supplied with a shielded cable to the designated position using the method introduced in the previous step.
4. Secure all cables mechanically outside the VFD.

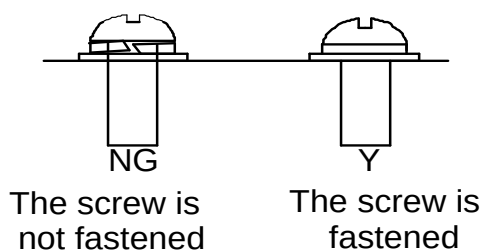


Figure 4-11 Screw installation diagram

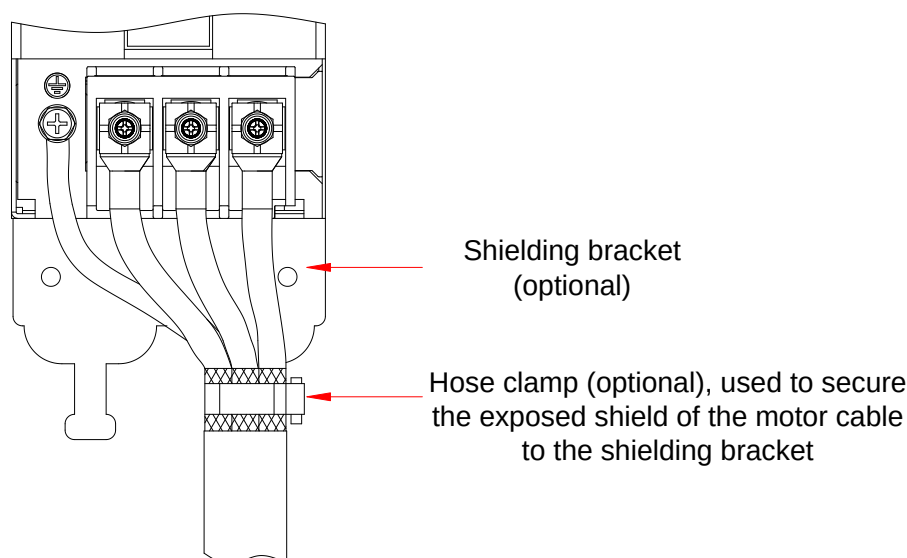
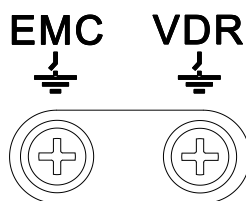


Figure 4-12 360° connection

4.4.4 Safety capacitor jumper

In applications equipped with a residual-current device (RCD), if the RCD trips during startup, disconnect the safety capacitor-to-ground jumper of the rectifier unit by removing the screw labeled EMC in the following figure.



Note: Please tighten screws with proper torque: For M3: 5–6 kgf·cm

4.4.5 Grounding system compatibility check

This product is equipped with a built-in EMC filter as standard and can be used in both symmetrically and asymmetrically grounded systems. When the VFD is used on an asymmetrically grounded system, the EMC screws, including the EMC screw, EMC AC screw, and EMC DC screw, as well as the EMC clip, must be removed to prevent the internal EMC filter capacitors from being connected to ground potential, which may cause the VFD to trip or become damaged. The VFD is designed for TN-S, TT, and IT grounding systems.

4.4.5.1 EMC filter

The VFD with an internal EMC filter can be installed on a symmetrically grounded TN-S system. If the VFD is installed in another grounding system, it may be necessary to disconnect the EMC filter and the VDR. See sections 4.4.5.3 When to disconnect the EMC filter or VDR: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems and 4.4.5.4 Guidelines for installing the VFD in TT systems.

Warning	
	Do not install a VFD with an EMC filter on a system that is not suitable for the filter, as this may result in hazards or damage to the VFD.

Note: When the internal EMC filter is disconnected, the EMC compatibility of the VFD will be significantly reduced and will not meet the EMC compatibility motor cable length requirements in appendix C.5.2 EMC compliance declaration.

4.4.5.2 Phase-to-ground VDR

Most VFDs are designed to operate on three-phase power supply systems with symmetrical line voltages. To meet surge immunity requirements, these VFDs are equipped with VDRs, which provide voltage surge protection as well as phase-to-phase and phase-to-ground protection. The VDR circuit is designed only for surge suppression (transient line protection) and is not intended for continuous operation.

Note: For ungrounded supply systems, the phase-to-ground VDR can provide a continuous current path to ground. Exceeding the published phase-to-phase, phase-to-ground voltage or energy ratings may damage the VDR.

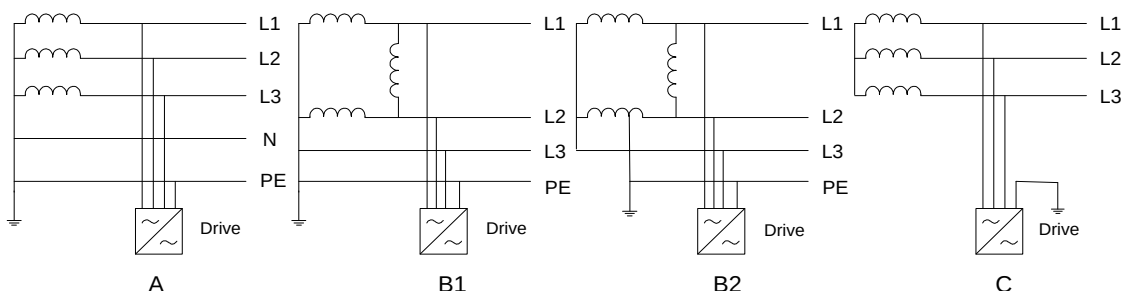
Standard VFDs with VDRs can be installed in symmetrically grounded TN-S systems. If the VFD is installed to another grounding system, it may be necessary to disconnect the VDR. See sections 4.4.5.3 When to disconnect the EMC filter or VDR: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems, 4.4.5.4 Guidelines for installing the VFD in TT systems, and 4.4.5.6 Disconnecting the internal EMC filter or VDR.

Warning	
	Do not connect the phase-to-ground VDR to a system that is not suitable for the VDR when installing the VFD. Otherwise, the VDR circuit may be damaged.

4.4.5.3 When to disconnect the EMC filter or VDR: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems

The requirements for disconnecting EMC filters and VDRs, as well as additional requirements for different power systems are shown in the following.

Grounding system Rectifier unit	Symmetrical grounding TN-S system, also known as grounding Y system (A)	Corner-grounded delta (B1) and midpoint-grounded delta (B2) systems $\leq 600V$	IT system (floating ground or high resistance grounding [$>30\Omega$]) (C)
22kW	Do not disconnect the EMC AC screw, EMC DC screw, and VDR screw.	Disconnect the EMC AC screw and EMC DC screw. Disconnect the VDR screw.	Disconnect the EMC AC screw, EMC DC screw, and VDR screw.
45kW and higher	Do not disconnect the EMC or VDR screw.	Disconnect the EMC screw and VDR screw.	Disconnect the EMC screw and VDR screw.



Note: These are the EMC filter and VDR screws in the VFDs in different frame sizes.

Rectifier unit	EMC filter screw	VDR screw
22kW	EMC AC screw and EMC DC screw	VDR
45kW and higher	EMC screw	VDR

4.4.5.4 Guidelines for installing the VFD in TT systems

The VFD can be installed on the TT system under the following conditions:

- A residual current protection device has been installed in the power supply system.
- Verify that the screws have been disconnected. Otherwise, the leakage current from the EMC filter, VDR, and capacitor can cause the residual current protection device to trip.

Rectifier unit	EMC filter screw	VDR grounding screw
22kW	EMC AC screw and EMC DC screw	VDR screw
45kW and higher	EMC screw	VDR screw

Note: The VFD will not be compliant with the EMC classification if the EMC filter screw is disconnected. The VFD does not guarantee the proper operation of the drive internal ground leakage detector. In large systems, the leakage protection device may trip unexpectedly.

4.4.5.5 Identifying grid grounding systems

Warning	
	Only qualified electrical personnel shall perform the work described in this section. Depending on the installation location, this work can even be classified as live work. Only qualified electrical professionals certified for this type of work are permitted to proceed. Comply with all applicable local regulations. Failure to do so may result in injury or death.

To determine the grounding system, check the power transformer connections. Refer to the applicable electrical drawings of the actual installation building. Otherwise, measure these voltages at the switchboard and see the table to identify the grounding system type.

- Input line phase-to-phase voltage (U_{L-L})
- Input line L1 to-ground voltage (U_{L1-G})
- Input line L2 to-ground voltage (U_{L2-G})
- Input line L3 to-ground voltage (U_{L3-G})

The following table shows the relationship between line-to-ground voltage and line-to-line voltage for each grounding system.

U_{L-L}	U_{L1-G}	U_{L2-G}	U_{L3-G}	Power system type
X	0.58 X	0.58 X	0.58 X	Symmetric grounding system (TN-S system)
X	1.0 X	1.0 X	0	Corner-grounded delta system (asymmetric)
X	0.866 X	0.5 X	0.5 X	Neutral-grounded delta system (asymmetrical)
X	Voltage level changes over time	Voltage level changes over time	Voltage level changes over time	IT system (floating or high resistance grounding [$>30\Omega$]) asymmetric
X	Voltage level changes over time	Voltage level changes over time	Voltage level changes over time	TT system (protective earth connection of electrical equipment is provided by local connection. A separate protective earth connection is installed at the generator)

4.4.5.6 Disconnecting the internal EMC filter or VDR

To disconnect the internal EMC filter or VDR, proceed as follows:

Step 1 Turn off the power supply to the VFD.

Step 2 Disconnect the internal EMC filter, remove the EMC screw (see the EMC filter and VDR screw descriptions for VFDs of different power classes in section 4.4.5.3 When to disconnect the EMC filter or VDR: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems for details).

Step 3 To disconnect the VDR, remove the VDR screw.

Step 4 For the models with the built-in EMC filter, the common-mode capacitor circuit is grounded to the heat sink through the EMC screw, forming a loop path for high-frequency noise and releasing high-frequency interference; if leakage protection is applied during startup when a leakage circuit breaker has been configured, disconnect the EMC screw (see EMC filter and VDR screw descriptions for VFDs of different power classes in section 4.4.5.3 When to disconnect the EMC filter or VDR: TN-S, IT, corner-grounded delta and midpoint-grounded delta systems for details).

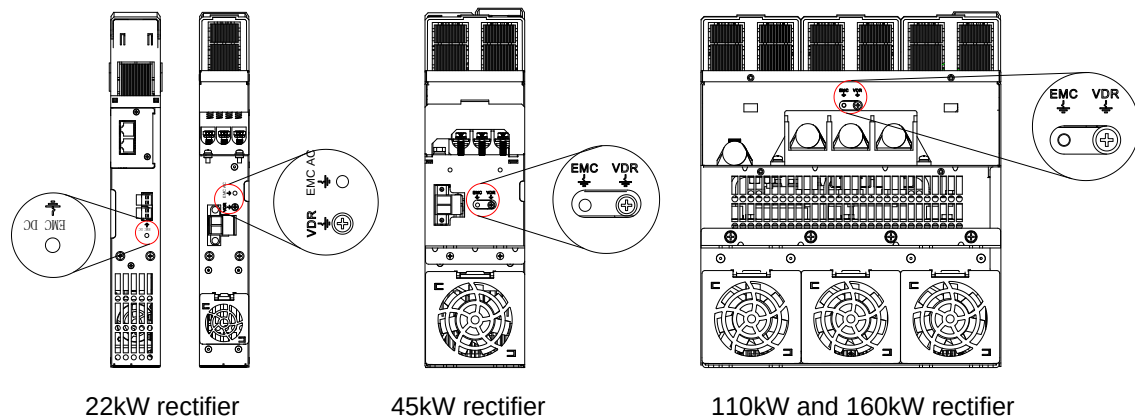


Figure 4-13 EMC screw

Note:

- Do not remove the EMC screw when the VFD is powered on.
- Disconnecting the EMC filter will reduce the VFD electromagnetic compatibility, which may cause the failure to meet the EMC specification requirements.
- For the models with embedded EMC filter, the common-mode capacitor circuit is grounded to the heat sink through the EMC screw, forming a loop path for high-frequency noise and releasing high-frequency interference; if leakage protection is applied during startup when a leakage circuit breaker has been configured, disconnect the EMC screw.

4.5 Standard wiring of the control circuit

4.5.1 Rectifier unit control circuit wiring

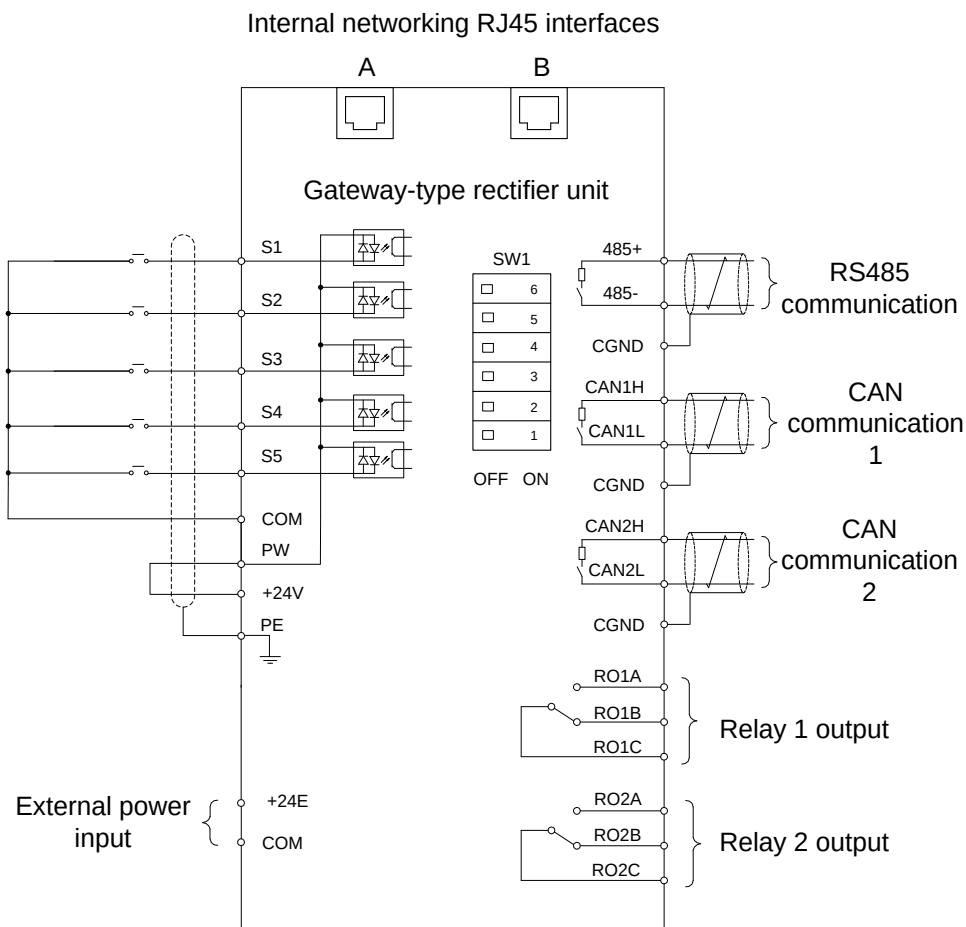


Figure 4-14 Gateway-type rectifier unit wiring

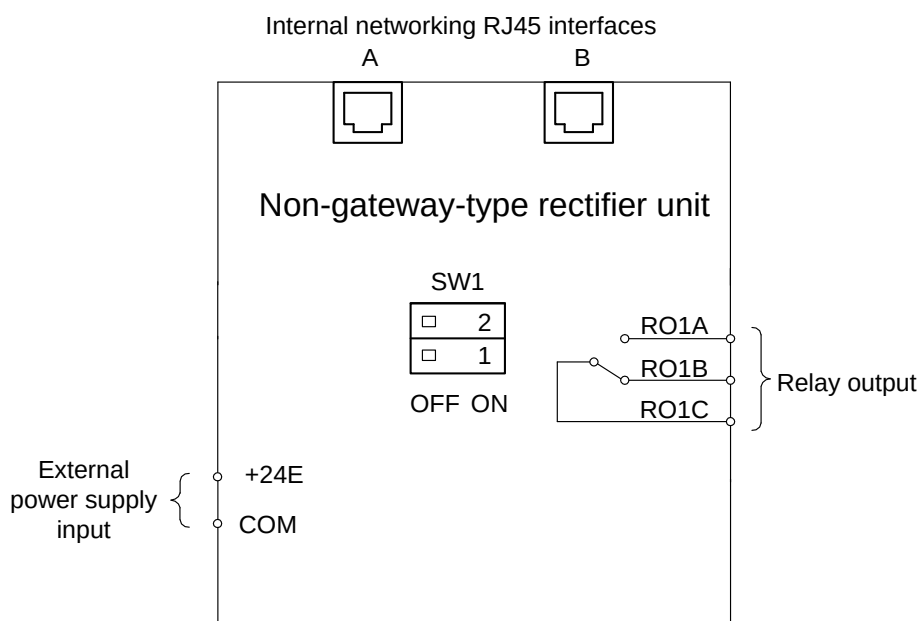


Figure 4-15 Non-gateway-type uncontrolled rectifier unit wiring

Note: The network cable between the uncontrolled rectifier unit and the inverter unit must be connected.

4.5.2 Rectifier unit control circuit terminals

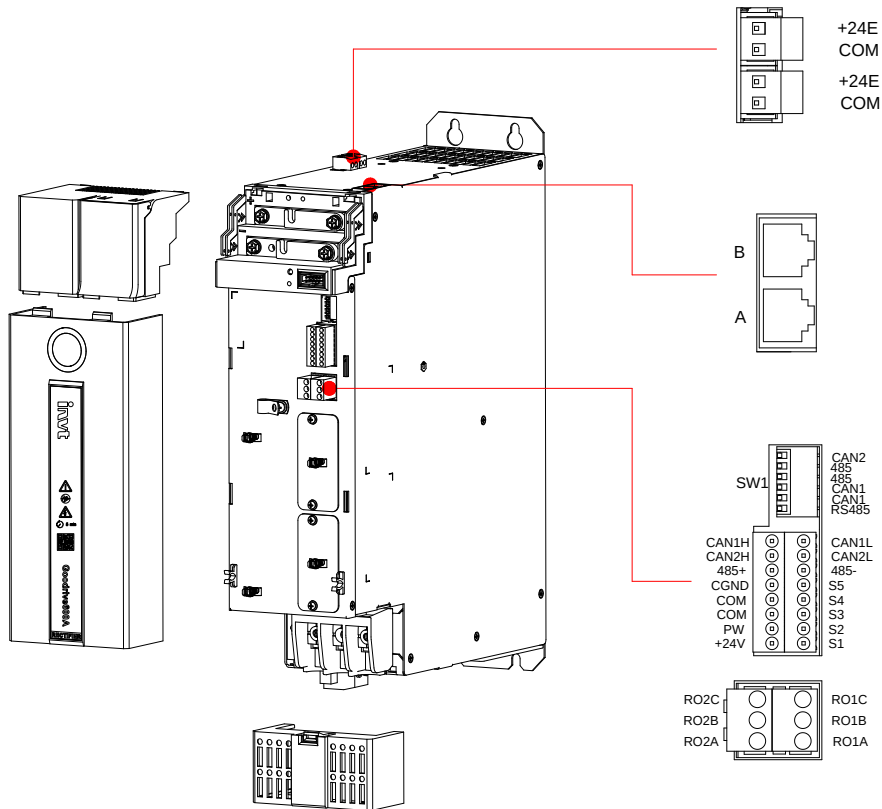


Figure 4-16 Gateway-type rectifier unit control circuit terminals

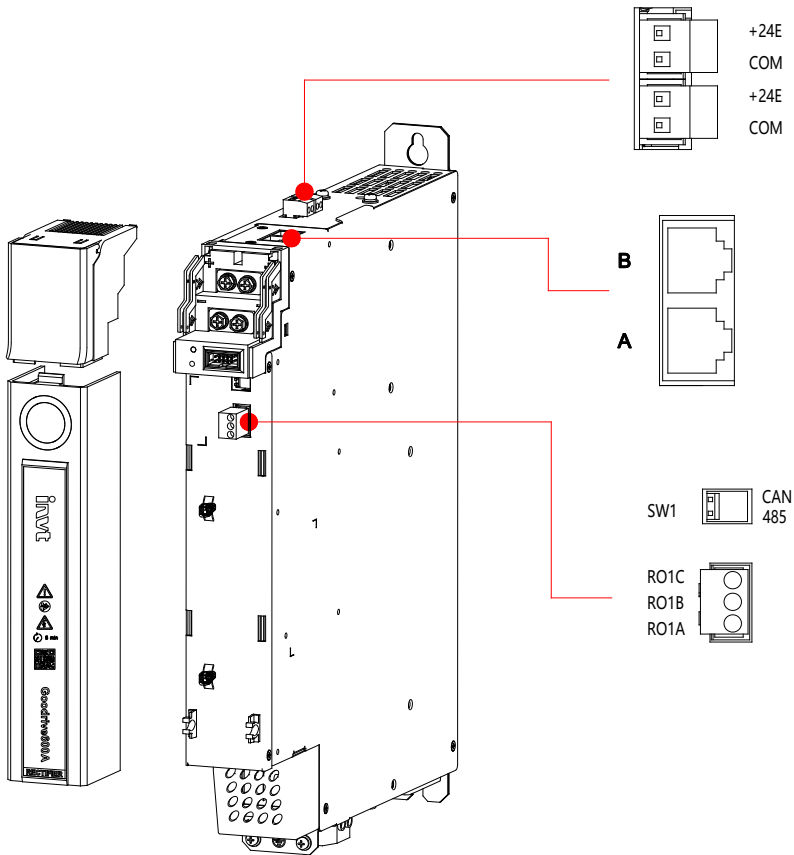


Figure 4-17 Non-gateway-type rectifier unit control circuit terminals

4.5.3 Rectifier unit control circuit terminal definition

Terminal type	Name	Description
Gateway-type rectifier unit control circuit terminals		
Digital input	PW	External power supply terminal for digital inputs Voltage range: 12–24V
	+24V	User power supply provided by the VFD. Max. output current: 200mA
	COM	Common terminal of +24V
	S1	Digital input 1
	S2	Digital input 2
	S3	Digital input 3
	S4	Digital input 4
	S5	Digital input 5
Relay output	RO1A	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO1B	
	RO1C	
	RO2A	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO2B	
	RO2C	
Communication	485+	For RS485 communication ports, it is recommended to use shielded twisted pair. The termination resistor is connected through switching positions 4 and 5 of DIP switch SW1 to ON.
	485-	
	CAN1H	CAN communication port 1. It can be configured as a CANopen master or slave. The CAN1H and CAN1L terminals are directly connected to the CAN1H and CAN1L pins of the RJ45 interface inside the rectifier unit. Use shielded twisted pair cables. The termination resistor is enabled via SW1 positions 2 and 3.
	CAN1L	
	CAN2H	CAN communication port 2. Use shielded twisted pair cables. The termination resistor is enabled via SW1 position 6. It supports the CAN master/slave control.
	CAN2L	
	CGND	Terminal for connecting the communication-wire shield layer
Power supply	+24E	External power supply input. The input voltage range is 24V±15%, and the supply current is greater than 1A.
	COM	This supply can be disconnected, which does not affect the normal operation of the unit. Parameter query and setting, and communication debugging can be performed via the external power supply when the main power is disconnected.
RJ45 interface	CAN1H	CAN communication port 1
	CAN1L	The termination resistor is enabled via SW1 positions 2 and 3.
	RS485+	RS485 internal bus, used to connect to the external keypad or for PC commissioning. The termination resistor is enabled via SW1 position 1.
	RS485-	
	+8V	External keypad power supply
	CGND	
/	PE	Grounding terminal (RJ45 metal housing)
Non-gateway-type rectifier unit control circuit terminals		

Terminal type	Name	Description
Relay output	RO1A	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO1B	
	RO1C	
RJ45 interface	CANH	CAN communication port. Use shielded twisted pair cables. It supports internal
	CANL	CAN communication between the rectifier unit and inverter unit. The termination resistor is enabled via SW1 position 2.
	RS485+	RS485 internal bus, used for connecting to an external keypad or PC for debugging. The termination resistor is enabled via SW1 position 1.
	RS485-	
	+8V	External keypad power supply
	CGND	
/	PE	Grounding terminal (RJ45 metal housing)

The rectifier unit and inverter unit are connected to the CANopen bus through RJ45. Figure 4-18 shows the RJ45 terminal interface description.

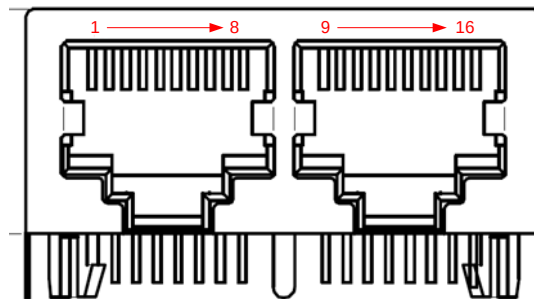


Figure 4-18 CANopen RJ45 terminals

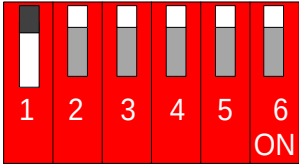
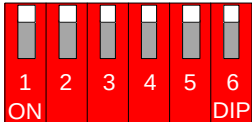
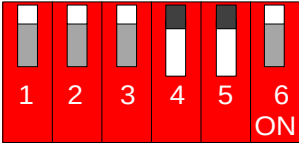
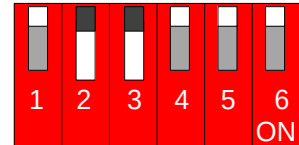
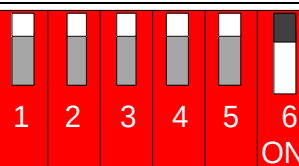
Table 4-3 RJ45 interface definition

Pin	Network signal	Description
8, 16	CAN_H	CAN bus high level
7, 15	CAN_L	CAN bus low level
3, 6, 10, 11, 14	NC	Not connected
5, 13	RS485+	Internal RS485 communication terminal, used to connect to an external keypad or PC.
4, 12	RS485-	
1, 9	CGND	It can be used as a common ground for the external keypad power supply negative and signal cable.
2	+8V	External keypad power supply +

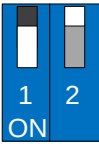
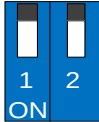
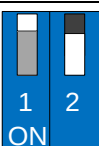
Note: When connecting to our TS series PLC, verify the RJ45 signal definition first.

4.5.4 Rectifier unit DIP switch function description

4.5.4.1 Half-controlled rectifier and inverter control boards

Function	Description	Position	Factory default position of DIP switch
Internal 485 termination resistor selection	Switching position 1 to ON indicates the termination resistor is connected.		 All DIP switches are OFF by default.
Communication 485 termination resistor selection	Switching positions 4 and 5 to ON indicates the termination resistor is connected.		
CAN1 termination resistor selection (CANopen)	Switching positions 2 and 3 to ON indicates the termination resistor is connected.		
CAN2 termination resistor selection (Master/slave CAN)	Switching position 6 to ON indicates the termination resistor is connected.		

4.5.4.2 Uncontrolled rectifier control board (22kW and 110kW)

Function	Description	Position	Factory default position of DIP switch
Internal 485 termination resistor selection	Switching position 1 to ON indicates the termination resistor is connected.		 485 termination resistor: ON CAN termination resistor: ON
CAN termination resistor selection	Switching position 2 to ON indicates the termination resistor is connected.		

4.5.5 Inverter unit control circuit wiring

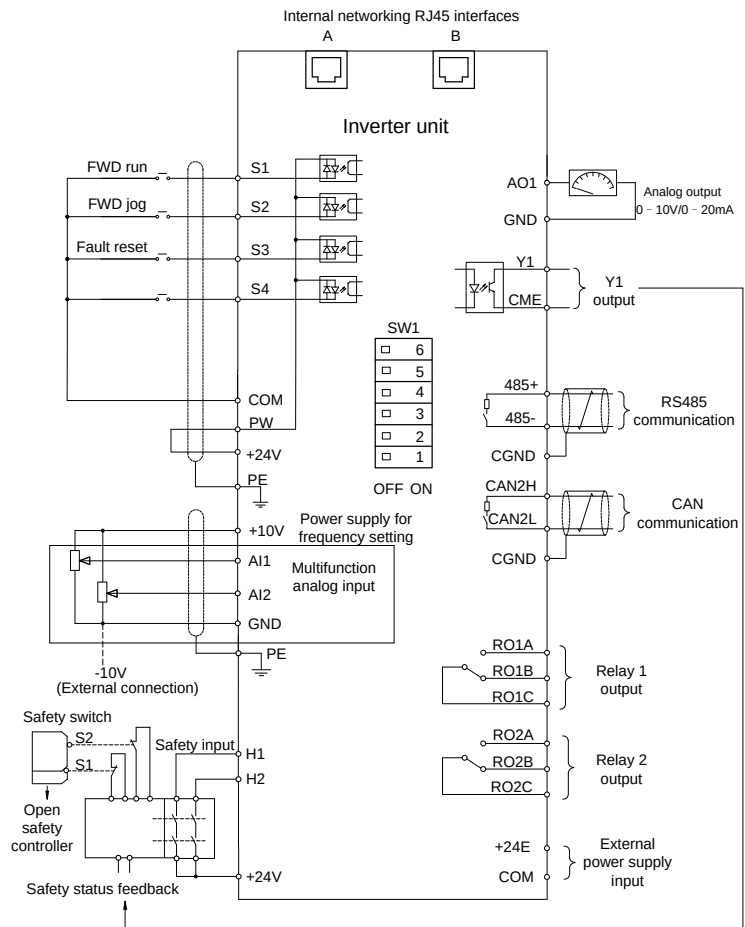


Figure 4-19 Inverter unit control circuit wiring

4.5.6 Inverter unit control circuit terminals

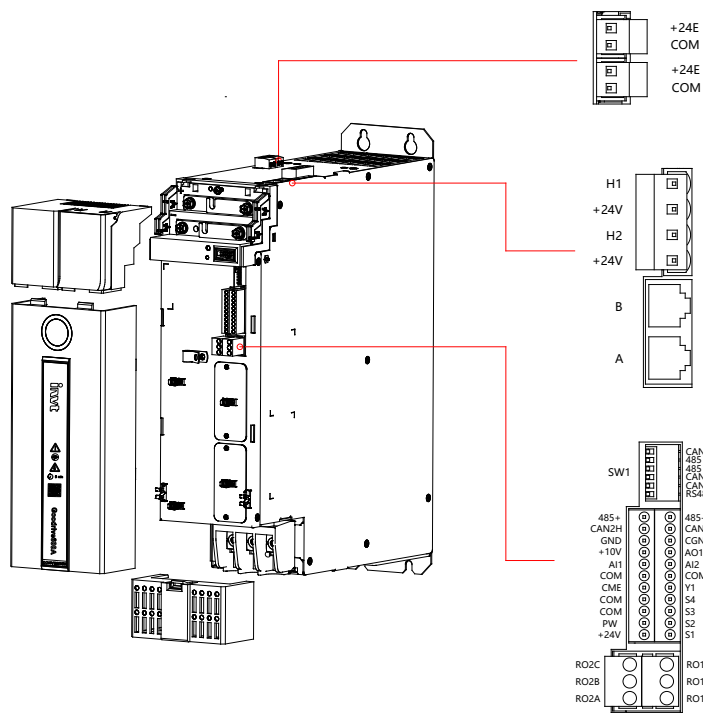


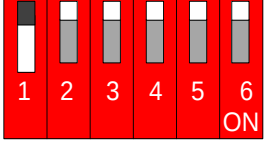
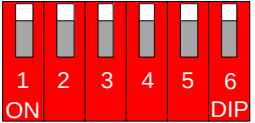
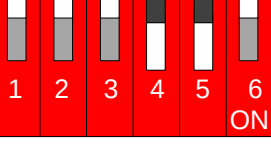
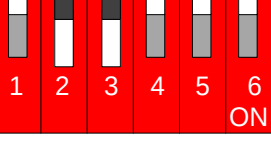
Figure 4-20 Inverter unit control circuit terminals

4.5.7 Inverter unit control circuit terminal definition

Terminal type	Name	Description
Analog input/output	+10V	Internal +10.5V power supply, max. output current: 50mA
	AI1	Input range: AI1: 0–10V/0–20mA; AI2: -10V–+10V
	AI2	Input impedance: 20kΩ for voltage input; 250Ω for current input Whether voltage or current is used for input of AI1 is set through P05.50. Resolution: 5mV when 10V corresponds to 50Hz Deviation: ±0.5% at 25°C, when input is above 5V/10mA
	GND	+10.5V reference ground
	AO1	Output range: 0–10V or 0–20mA Whether voltage or current is used for output is set through P06.32. Deviation: ±0.5% when output exceeds 5V or 10mA at 25°C
Digital input and output	PW	External power input terminal for digital input circuits Voltage range: 12–24V
	+24V	User power supply provided by the VFD. Max. output current: 200mA
	COM	+24V reference ground
	S1	Digital input 1
	S2	Digital input 2
	S3	Digital input 3
	S4	Digital input 4
	H1	STO input 1
	H2	STO input 2
	Y1	Switch capacity: 200mA/30V Output frequency range: 0–1kHz
	CME	Common terminal of open collector output; shorted to COM by default
Relay output	RO1A	RO1 output; RO1A: NO; RO1B: NC; RO1C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO1B	
	RO1C	
	RO2A	RO2 output; RO2A: NO; RO2B: NC; RO2C: common Contact capacity: 3A/AC250V, 1A/DC30V
	RO2B	
	RO2C	
Communication	485+	For RS485 communication ports, it is recommended to use shielded twisted pair.
	485-	The termination resistor is connected through switching positions 4 and 5 of DIP switch SW1 to ON.
	CAN2H	Supports the CAN master/slave control
	CAN2L	
	CGND	Terminal for connecting the communication-wire shield layer
Power supply	+24E	External power supply input. The input voltage range is 24V±15%, and the supply current is greater than 1A.
	COM	The power supply can be disconnected, which does not affect the normal operation

Terminal type	Name	Description
		of the unit. Parameter query and setting, and communication debugging can be performed via the external power supply when the main power is disconnected.
RJ45 interface	CAN1H	CAN communication port 1. It supports the CANopen slave protocol (by default).
	CAN1L	The termination resistor is connected through switching positions 2 and 3 of DIP switch SW1 to ON.
	RS485+	RS485 internal bus, used to connect to the external keypad or for PC commissioning.
	RS485-	The termination resistor is connected through switching position 1 of DIP switch SW1 to ON.
	+8V	External keypad power supply
	CGND	
/	PE	Grounding terminal (RJ45 metal housing)

4.5.8 Inverter unit DIP switch function description

Function	Description	Position	Factory default position of DIP switch
Internal 485 termination resistor selection	Switching position 1 to ON indicates the termination resistor is connected.		 1 2 3 4 5 6 ON DIP All DIP switches are OFF by default.
Communication 485 termination resistor selection	Switching positions 4 and 5 to ON indicates the termination resistor is connected.		
CAN1 termination resistor selection (CANopen)	Switching positions 2 and 3 to ON indicates the termination resistor is connected.		
CAN2 termination resistor selection (Master/slave CAN)	Switching position 6 to ON indicates the termination resistor is connected.		

4.5.9 Control circuit wiring

4.5.9.1 Digital input

Digital input supports two wiring modes: NPN and PNP, and internal or external power supply can be selected. PW and +24V are shorted before delivery. The default is NPN wiring mode, using the internal power supply.

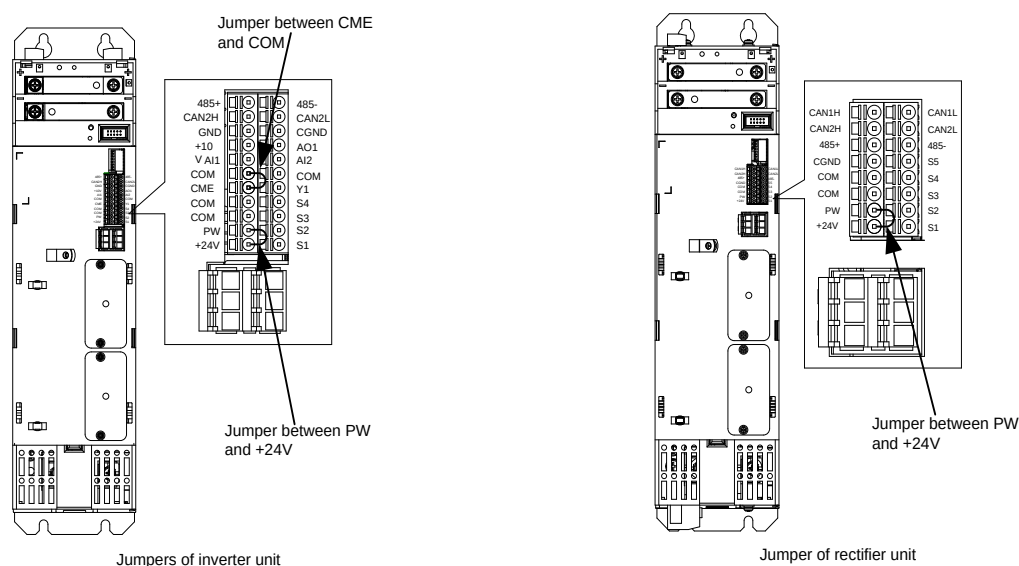


Figure 4-21 Shorting-wire position

NPN wiring mode:

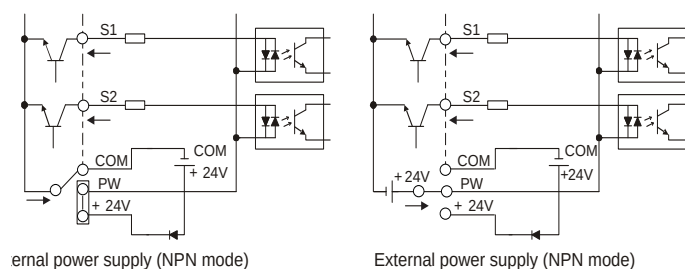


Figure 4-22 NPN wiring mode

Short PW to +24V, and connect the COM terminal of the VFD to the common terminal of the external controller when the internal 24V power supply of the VFD is used.

Remove the short-circuit wires between the PW and +24V terminals, connect the positive terminal of the external 24V power supply to the PW terminal, and connect the negative terminal of the external 24V power supply to the S terminal through the switch of the external controller when an external 24V power supply is used.

PNP wiring mode:

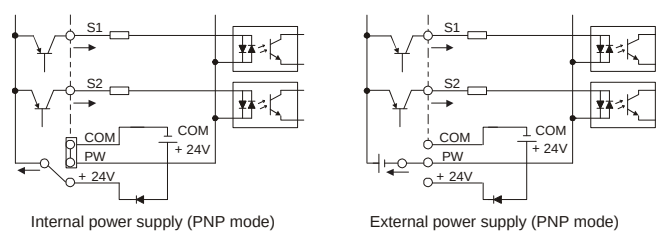


Figure 4-23 PNP wiring mode

Remove the short-circuit wires between the PW and +24V terminals, short PW to COM, and connect the +24V terminal of the VFD to the common terminal of the external controller when the internal 24V power supply of the VFD is used.

Remove the short-circuit wires between the PW and +24V terminals, connect the negative terminal of the external 24V power supply to the PW terminal, and connect the positive terminal of the external 24V power supply to the S terminal through the switch of the external controller when an external 24V power supply is used.

4.5.9.2 Digital output

Digital output is an open-collector output. A pull-up resistor must be configured with a resistance of at least 500Ω. The

internal power supply or external power supply can be used. CME and COM are shorted before the delivery. The internal power supply is used by default.

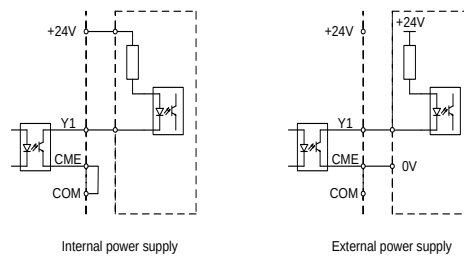


Figure 4-24 Digital output wiring

Short CME to COM, and connect the +24 V terminal of the VFD to the power input end of the external controller when the internal 24V power supply of the VFD is used.

Remove the short-circuit wires between the CME and COM terminals, and connect the CME terminal of the VFD to 0V of the external power supply when an external 24V power supply is used.

4.5.9.3 Relay output

When the relay cuts off the inductive load (such as relay, contactor, and so on) current, a voltage spike occurs and the relay contacts must be protected. When the relay or contactor coil voltage is 220V AC, a varistor needs to be connected in parallel at each end of the relay or contactor coil; when the relay or contactor coil voltage is 24V DC, a flyback diode needs to be connected in parallel at each end of the relay or contactor coil.

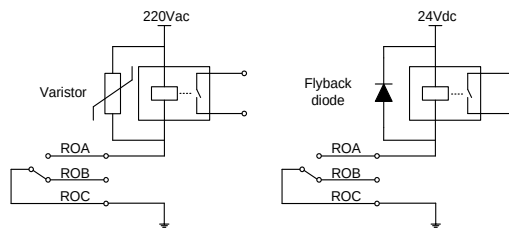


Figure 4-25 Relay output wiring

4.5.9.4 Analog input/output

The analog voltage signal is susceptible to external interference. It is recommended that you use shielded cables for analog input/output cables, and the connection distance should be as short as possible, and 20 meters at most. The cable shield layer is connected to the PE terminal of the VFD by using the 360° connection method. In the scenario with severe interference, analog input/output cables need to be configured with magnetic rings.

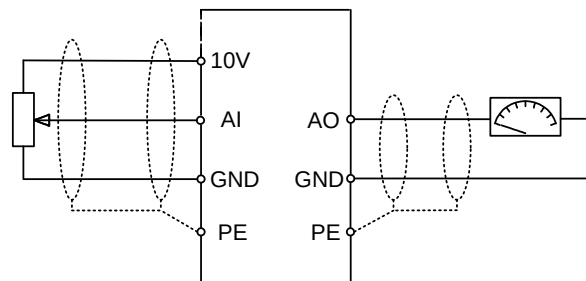


Figure 4-26 Analog input/output wiring

4.5.9.5 24V external power supply

Each unit is configured with two 24V external power interfaces, which can realize the serial connection of the external power supplies between the units. After the 24V power supply is connected, the control section of the entire system can function without the main circuit power supply, allowing users to configure parameters and query information.

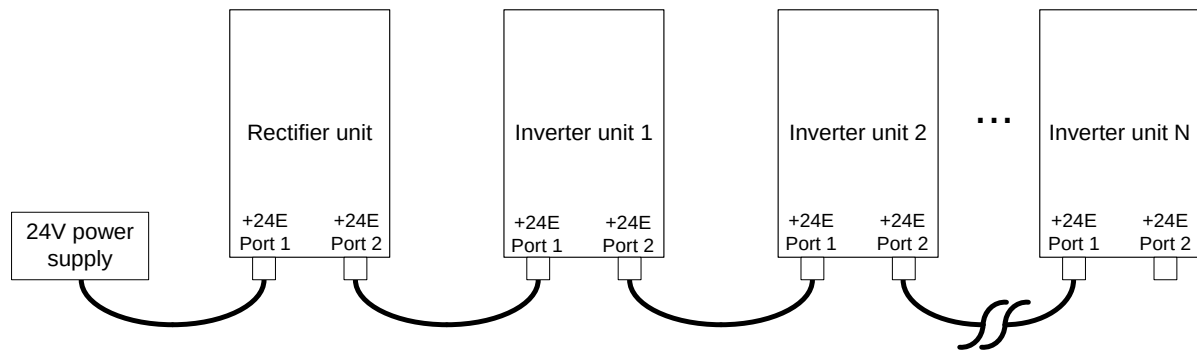


Figure 4-27 External power supply wiring

4.6 Power distribution protection

4.6.1 VFD and power cable protection

In case of short circuit, the fuse protects input power cables to avoid damage to the VFD; if internal short-circuit occurs in the VFD, it can protect neighboring equipment from being damaged.

Goodrive600A series VFD

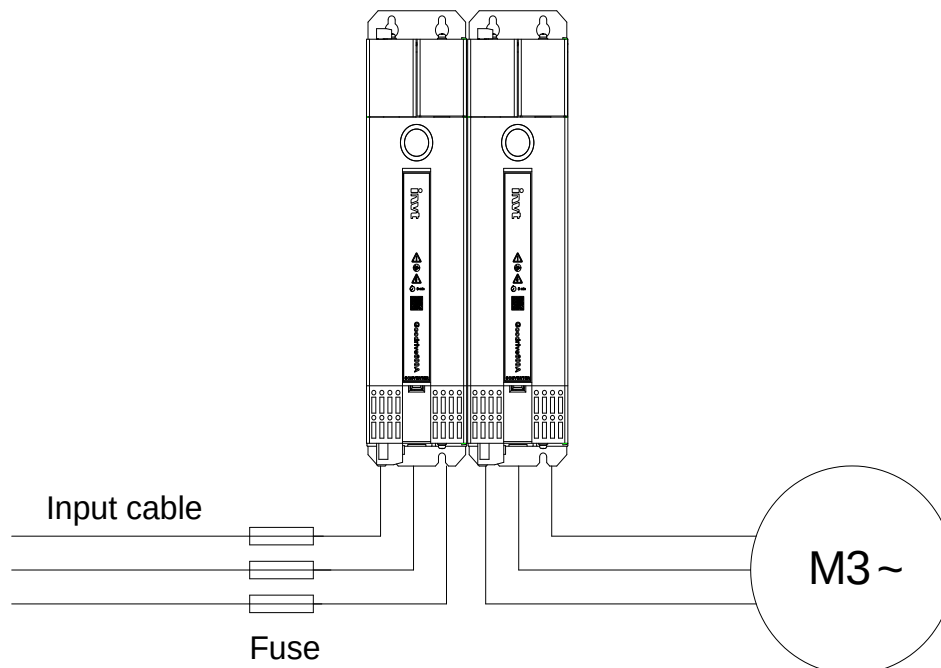


Figure 4-28 Fuse configuration

Note: Select the fuse according to E.5 Breaker and electromagnetic contactor.

4.6.2 Motor and motor cable protection

If the motor cable is selected based on VFD rated current, the VFD is able to protect the motor cable and motor during short circuit without other protective devices.

	If the VFD is connected to multiple motors, use a separate thermal overload switch or breaker to protect the cable and motor, which may require the fuse to cut off the short circuit current.
--	---

4.6.3 Motor thermal overload protection

The motor must be protected against thermal overload. Once overload is detected, current must be cut off. The VFD is

equipped with the motor thermal overload protection function, which can block output and cut off the current (if necessary) to protect the motor.

4.6.4 Bypass connection protection

In some critical scenarios, the power/variable frequency conversion circuit needs to be configured to ensure proper operation of the system when a fault occurs in the VFD.

In some special scenarios, such as in soft startup, power-frequency running is directly performed after startup, which requires bypass connection.



Do not connect any power source to the VFD output terminals U, V, and W. The voltage applied to the motor cable may cause permanent damage to the VFD.

If frequent switchover is needed, you can use the switch which carries mechanical interlock or a contactor to ensure motor terminals are not connected to input power cables and VFD output terminals simultaneously.

5 Basic operation guidelines and function descriptions

5.1 What this chapter contains

This chapter instructs you on how to use the VFD keypad and commission the VFD common functions.

5.2 Keypad introduction

The VFD comes standard with a basic LED keypad, which can be used to operate both the rectifier unit and the inverter unit. You can set the VFD parameters, read state data and perform fault reset through the keypad.



Figure 5-1 Keypad

No.	Name	Description							
1	Status indicator	RUN/TUNE	Off: Stopped state On: Running state						
		FWD/REV	It is unused in the rectifier state.						
		TRIP	Fault indicator Off: Normal state Flashing: Alarm state On: Fault state						
2	Unit indicator	Hz	Frequency unit						
		RPM	Rotation speed unit						
		A	Current unit						
		%	Percentage						
		V	Voltage unit						
3	LED display	The five-digit LED display shows various monitoring data and alarm codes such as the frequency setting and output frequency.							
		Display	Means	Display	Means	Display	Means	Display	Means
			0		1		2		3
			4		5		6		7
			8		9		A		b
			C		d		E		F
			H		I		L		N
			n		O		P		r
			S		t		U		v
			.		-				

No.	Name	Description		
4	Key description		Programming key	Press to enter or exit the level-1 menu, or to cancel a parameter change.
			Confirmation key	Press to enter the next menu level or confirm a parameter setting. In the fault interface, press to implement fault reset. In autotuning state, press it to start autotuning.
			UP	Press to increase a value or move upward.
			DOWN	Press to decrease a value or move downward.
			Right-shifting key	In stop and run display interfaces, press the shift key to cyclically select the display parameters; during parameter modification, press the shift key to cyclically select the digit to be modified.

5.3 Keypad display

The VFD keypad displays information such as the stopped-state parameters, running-state parameters, and fault status, and allows you to modify function codes.

5.3.1 Status display

In stopped state, the keypad displays stopped-state parameters, as shown in Figure 5-2. In stopped state, the half-controlled rectifier unit displays the following parameters: grid frequency, braking current, bus voltage, and grid voltage (while the uncontrolled rectifier unit displays only the bus voltage and braking current). You can press the **SHIFT** key to cyclically switch between the selected parameters. The parameters that the inverter unit can display in the stopped state are specified by P07.07.

After receiving a valid running command, the rectifier/inverter unit enters the running state, and the keypad displays running-state parameters, with the **RUN/TUNE** indicator on. See Figure 5-2.

In running state, the half-controlled rectifier unit displays the following parameters: grid frequency, braking current, bus voltage, and grid voltage (while the uncontrolled rectifier unit displays only the bus voltage and braking current). You can press the **SHIFT** key to cyclically switch between the selected parameters. The parameters that the inverter unit can display in the running state are specified by P07.05 and P07.06.

After detecting a fault signal, the rectifier/inverter unit enters the fault alarm state immediately, the fault code flashes on the keypad, and the **TRIP** indicator is on. Perform fault reset by using the **DATA/ENT** key, control terminals, or communication commands. If the fault persists, the fault code is continuously displayed.

You can press the **PRG/ESC** key to enter the editing mode in stopped, running, or fault alarm state (if a user password is used, see the description of P07.00). The editing mode contains two levels of menus in the following sequence: Function code group or function code number → Function code setting. You can press the **DATA/ENT** key to enter the function parameter display interface. In the function parameter display interface, you can press the **DATA/ENT** key to save parameter settings or press the **PRG/ESC** key to exit the parameter display interface.

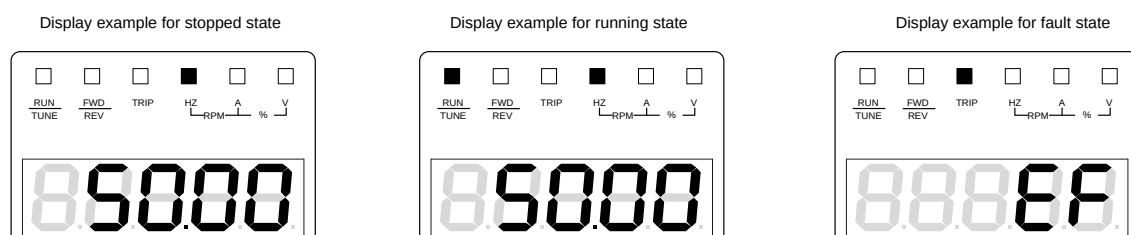


Figure 5-2 Status display

5.4 Operation procedure

Various operations can be performed on the rectifier/inverter unit through the keypad, including entering/exiting menus, selecting parameters, and setting parameters.

5.4.1 Modifying function codes

The rectifier unit provides three levels of menus, including:

1. Function code group number (level-1 menu)
2. Function code number (level-2 menu)
3. Function code setting (level-3 menu)

Note: In the level-3 menu, press the **PRG/ESC** or **DATA/ENT** key to return to the level-2 menu. If you press the **DATA/ENT** key, the set value of the parameter is saved to the control board first, and then the keypad returns to the level-2 menu, displaying the next function code. If you press the **PRG/ESC** key, the keypad returns to the level-2 menu directly, without saving the set value of the parameter, and the current function code is displayed.

If you enter the level-3 menu but no digit is flashing, the parameter cannot be modified due to either of the following reasons:

- It is read-only. Read-only parameters include actual detection parameters and running record parameters.
- It cannot be modified in running state and can be modified only in stopped state.

Example: Change the value of P00.01 from 0 to 1.

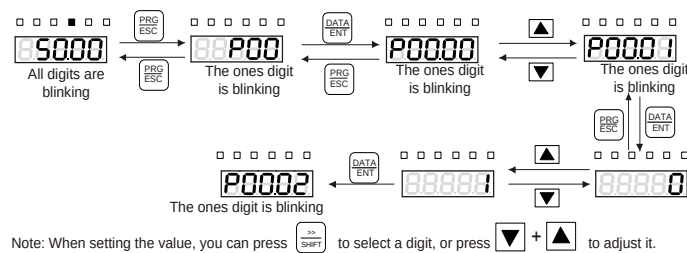


Figure 5-3 Modifying a parameter

5.4.2 Setting a password

The rectifier/inverter unit provides the user password protection function. When you set P07.00 to a non-zero value, the value is the user password. If password protection is enabled, "0.0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface. To disable the password protection function, you need only to set P07.00 to 0.

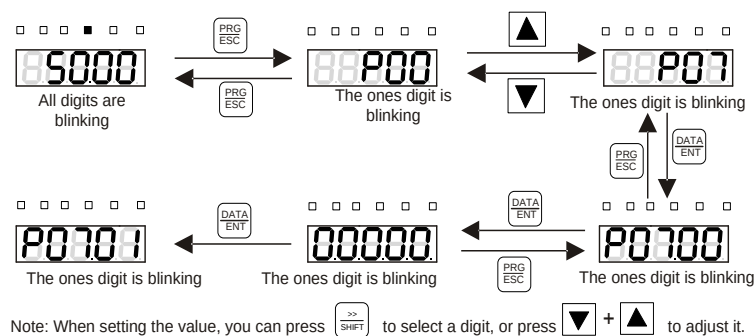


Figure 5-4 Setting a password

5.4.3 Status viewing

The function code group P17 of the rectifier unit is the status viewing group while the function code groups P17, P18, and P19 of the inverter unit are the status viewing groups. You can enter the related function code group directly to view the status.

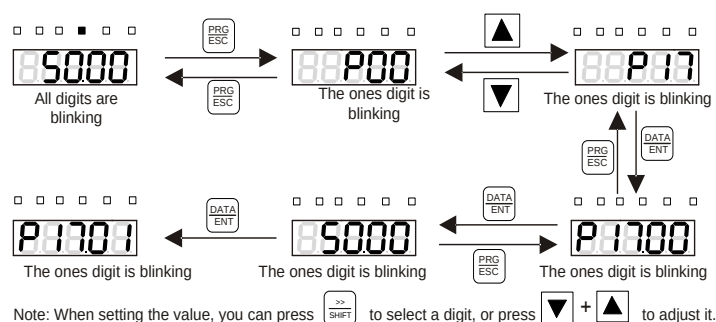


Figure 5-5 Viewing a parameter

5.5 Rectifier unit basic functions

5.5.1 Basic information

Rectifier function code	Name	Description	Default	Modify
P00.00	Control board software version number	Actual control board software version Setting range: 1.00–655.35	Depends on version	●

The rectifier unit version number is factory-set and cannot be changed.

5.5.2 Basic function parameter setting

Rectifier function code	Name	Description	Default	Modify
P00.03	Undervoltage point for bus voltage	Undervoltage point for bus voltage for protection purpose. When the bus voltage is lower than the value of this function parameter during running, the VFD stops and reports the bus undervoltage fault. Setting range: 0.0–500.0V	350.0V	◎

When the bus voltage is lower than the value of this function parameter during running, the system considers it is in the undervoltage state, which is not good for the inverter unit to run. Set the value according to the actual application situation.

Rectifier function code	Name	Description	Default	Modify
P00.05	Overvoltage point for bus voltage	Overvoltage point for bus voltage for protection purpose. When the bus voltage is higher than the value of this function parameter during running, the VFD stops and reports the bus overvoltage fault. Setting range: 500.0–850.0V	800.0V	◎

When the bus voltage is higher than the value of this function parameter during running, the system considers it is in the overvoltage state. In the overvoltage state, the rectifier unit keypad flashes. In addition, if the motor is running in the power generation state, the bus voltage may continuously increase. Set the value according to the actual application situation.

Rectifier function code	Name	Description	Default	Modify
P00.04	Braking unit braking start voltage	Specifies the voltage at which the braking unit starts braking. When the bus voltage reaches the value of this function parameter during running, the braking transistor starts braking. This function is valid only for the models configured with built-in braking units, invalid for the models connected to external braking units. Setting range: 400.0–800.0V	700.0V	○
P00.10	Braking transistor shoot-through protection enable	Setting range: 0x000–0x111 P00.10 specifies the fault protection mode for the braking transistor. 0: Disable 1: Enable Ones place: Braking transistor shoot-through enable selection. Tens place: Braking transistor overcurrent enable selection. Hundreds place: Braking transistor overload enable selection. Note: Valid only for the rectifier unit with the built-in braking unit.	0x111	◎

When bus voltage is higher than P00.04, the braking unit acts to reduce the bus voltage. You need to configure the external braking resistor according to the actual application. P00.10 specifies the fault protection enable selection for the braking transistor in case of shoot-through, overcurrent and overload, and it is active by default. Set the protection mode according to the actual application.

Rectifier function code	Name	Description	Default	Modify
P00.14	Function parameter restore	0: No operation 1: Restore default values 2: Clear fault records Note: After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may clear the user password. Exercise caution before using this function.	0	◎

When using function parameter restoring, note that: After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may clear the user password. Exercise caution before using this function.

5.5.3 Half-controlled rectifier unit start/stop control

In the half-controlled rectifier unit, after setting P01.14 (Enabling auto run) to 1, the rectifier unit will run automatically upon power-up (three-phase 380V). Use the keypad to check whether the grid voltage, grid frequency, and bus voltage are

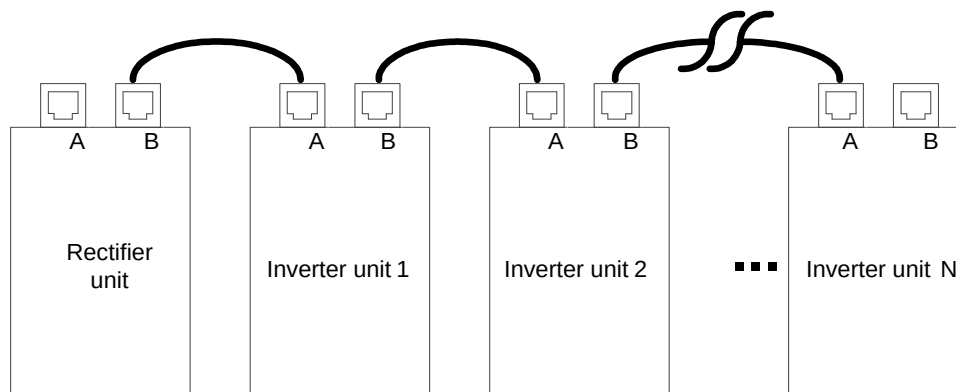
normal in sequence. Under normal conditions, the grid voltage is approximately 380V, the grid frequency is approximately 50.0Hz, and the bus voltage is approximately 560V.

To switch to other start/stop control methods, set P01.14 (Enabling auto run) to 0. After performing a power cycle, use P00.01 (Channel of run commands) to select the desired start/stop method. Available options include keypad, control terminal, and communication. If you select the terminal control mode, you need to configure related digital terminal functions; if you select the communication control mode, you need to set P00.02 to select a communication mode.

Rectifier function code	Name	Description	Default	Modify
P00.01	Channel of run commands	Used to select the channel of rectifier unit control commands. including the start, stop, and fault reset commands. 0: Keypad (external LCD keypad) (LED off) The running commands are controlled through external keypad keys, such as RUN and STOP/RST. 1: Terminal (the indicator flashing) The running commands such as run, stop, and fault reset are controlled through multi-function input terminals. 2: Communication (LED on) The run commands are controlled by the host controller through communication.	1	☐
P00.02	Communication mode of run commands	Used to select the rectifier unit communication command mode. 0: Modbus 1: CANopen 2: PLC card 3: PROFIBUS-DP 4: PROFINET/EtherCAT 5: Ethernet card	0	☐
P01.14	Auto run enable	0: Disable 1: Enable When the rectifier side detects that run conditions are met at initial power-up, it starts running automatically. Note: If the grid voltage is not established within 10s, the auto run will be canceled. A restart is required for the change to take effect.	0	☐

5.5.4 Rectifier unit fault protection

The upper RJ45 port on the rectifier unit is directly connected to the upper RJ45 port on the inverter unit via a network cable to establish internal CAN broadcast communication, as shown in the following figure.



The rectifier unit transmits the fault code to the inverter unit, and the inverter unit determines whether it stops or how it stops through the settings of P11. The faults that the rectifier unit reports to the inverter unit include E013 (Rectifier phase loss), E015 (Rectifier module overheating), and E023 (Rectifier braking transistor fault). The inverter action for rectifier faults can be configured through P11.31–P11.55, as listed in the following table (using P11.31–P11.35 as examples).

Inverter function code	Name	Description	Default	Modify
P11.31	Fault selection 1	Setting range: 11–9000	11	☐
P11.32	Fault selection 2	Setting range: 11–9000	12	☐
P11.33	Fault selection 3	Setting range: 11–9000	13	☐
P11.34	Fault selection 4	Setting range: 11–9000	14	☐
P11.35	Fault level processing group 1	Setting range: 0x0000–0x4444 Ones place (P11.31 Fault selection 1): Tens place (P11.32 Fault selection 2): Hundreds place (P11.33 Fault selection 3): Thousands place (P11.34 Fault selection 4): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved	0x0000	☐

For its internal CAN broadcast interaction, the following function codes must be configured on the rectifier unit. The CAN node addresses of the rectifier and inverter units must be unique (different from each other), while the CAN baud rate must be identical.

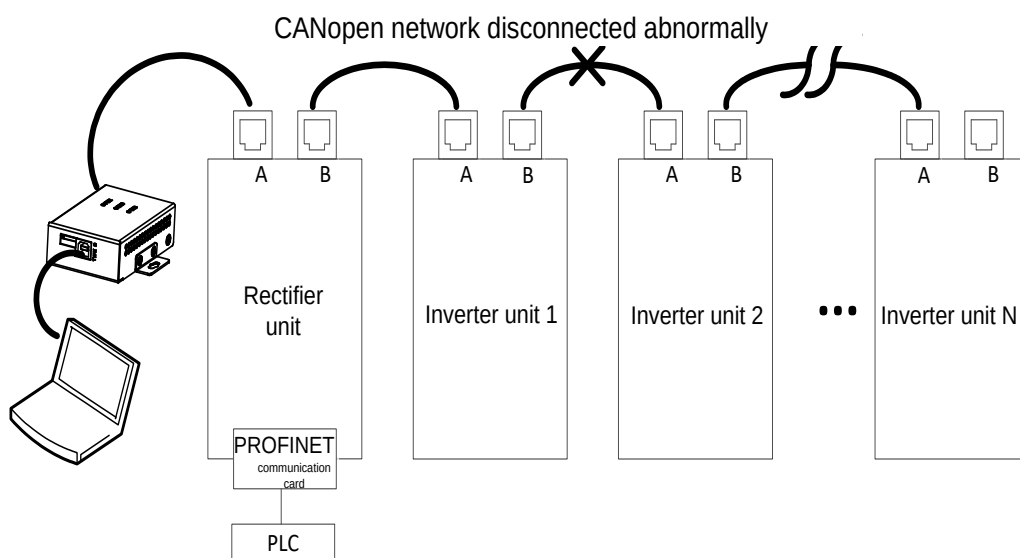
Rectifier function code	Name	Description	Default	Modify
P21.01 (Non-gateway type)	CAN module address	Setting range: 100–103	100	☐

Rectifier function code	Name	Description	Default	Modify
P21.01 (Gateway type)	CANopen module address	Setting range: 1–127	1	○
P21.29	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500Kbps 5: 800kbps 6: 1Mbps	4	○

Inverter function code	Name	Description	Default	Modify
P14.08	CANopen module address	Setting range: 1–127	2	○
P14.09	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500Kbps 5: 800kbps 6: 1Mbps	4	○

5.5.5 Communication fault protection

In the rectifier and inverter communication network topology, different protective actions for the inverter units are required in communication failure in different application cases, preventing further damage to machinery or process materials. The following takes the PROFINET-to-CANopen communication networking as an example.



When a CANopen communication fault occurs, some inverter units may remain online while others go offline. The inverter

action for an E030 (Rectifier communication fault) is configured through inverter unit function codes P11.31–P11.55. In this scenario, the rectifier unit triggers an OFFL fault (Partial slave unit offline fault). Offline inverter units will trigger E031 (Local CANopen communication fault) and stop according to their individual settings. Other inverter units will perform a stop based on the E030 (Rectifier CAN broadcast fault or Rectifier CANopen communication fault) configuration in group P11.

5.5.6 Digital input function

The gateway-type rectifier unit is equipped with five programmable digital input terminals as standard. The functions of all the digital input terminals can be set through function codes.

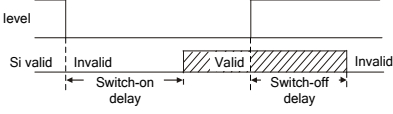
Rectifier function code	Description	Description	Default	Modify
P05.01	S1 function	Setting range: 0–15 See the following table for details.	1	⊙
P05.02	S2 function		2	⊙
P05.03	S3 function		0	⊙
P05.04	S4 function		0	⊙
P05.05	S5 function		0	⊙

These parameters are used to set the corresponding functions of digital input terminals. The selectable functions are as follows.

Setting	Function	Description
0	No function	You can set the unused terminals to "no function" to avoid maloperation.
1	Run (Rising edge active)	The rectifier unit runs.
2	Fault reset (rising edge active)	The terminal is used for fault reset. The function can also be achieved by using the DATA/ENT key on the keypad.
3	External fault (rising edge active)	An external fault occurs, displaying the external fault information.
4	Incoming circuit breaker feedback (level active)	The rectifier unit sends a runnable command to the inverter unit according to this feedback signal.
5–6	Reserved	/
7	Inverter unit run inhibit (level active)	The rectifier unit sends a run prohibition command to the inverter unit according to this feedback signal.
8	Inverter unit coast to stop (level active)	The rectifier unit sends a coast to stop command to the inverter unit.
9	Inverter unit stop according to the set mode (level active)	The rectifier unit sends a command of stopping according to the set mode to the inverter unit.
10–15	Reserved	/

Related function codes are as follows.

Rectifier function code	Name	Description	Default	Modify										
P05.06	Input terminal polarity selection	Used to set the polarity of input terminals. When a bit is 0, the input terminal is positive. When a bit is 1, the input terminal is negative. <table border="1"> <tr> <td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr> <tr> <td>S5</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr> </table> Setting range: 0x00–0x1F	Bit4	Bit3	Bit2	Bit1	Bit0	S5	S4	S3	S2	S1	0x00	○
Bit4	Bit3	Bit2	Bit1	Bit0										
S5	S4	S3	S2	S1										

Rectifier function code	Name	Description	Default	Modify
P05.07	Digital input filter time	Used to set the filter time of sampling for terminals S1–S5. In strong interference cases, increase the value to avoid maloperation. Setting range: 0.000–1.000s	0.000s	○
P05.13	S1 switch-on delay	These function codes specify delay time corresponding to the level changes of programmable input terminals during switch-on or switch-off. 	0.000s	○
P05.14	S1 switch-off delay		0.000s	○
P05.15	S2 switch-on delay		0.000s	○
P05.16	S2 switch-off delay		0.000s	○
P05.17	S3 switch-on delay		0.000s	○
P05.18	S3 switch-off delay		0.000s	○
P05.19	S4 switch-on delay		0.000s	○
P05.20	S4 switch-off delay		0.000s	○
P05.21	S5 switch-on delay		0.000s	○
P05.22	S5 switch-off delay	Setting range: 0.000–50.000s	0.000s	○

Note: Non-gateway-type rectifier units do not have input terminal functions.

5.5.7 Relay output

Gateway-type rectifier units are equipped with two groups of multifunction relay output terminals.

Rectifier function code	Description	Description	Default	Modify				
P06.03	RO1 output selection	Setting range: 0–31	1	○				
P06.04	RO2 output selection	See the following table for details.	2					
P06.07	Output terminal polarity selection	Setting range: 0x0–0x3 When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. <table border="1"><tr><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td></tr></table>	Bit1	Bit0	RO2	RO1	0x0	○
Bit1	Bit0							
RO2	RO1							

Note: Non-gateway-type rectifier units do not support RO2.

Relay output function selection:

Setting	Function	Description
0	No output	The output terminal does not have any function.
1	Ready to run	When the rectifier unit works properly and sends the runnable command to the inverter unit, it outputs the ON signal.
2	Running (Not supported by non-gateway-type rectifier unit)	When the rectifier unit detects that the bus voltage is in normal state, it outputs the ON signal.
3	Fault output	When the rectifier unit encounters a fault, it outputs the ON signal.
4	Bus overvoltage (Not supported by)	When the rectifier unit detects bus overvoltage, it outputs the ON signal.

Setting	Function	Description
	non-gateway-type rectifier unit)	
5	Bus undervoltage (Not supported by non-gateway-type rectifier unit)	When the rectifier unit detects bus undervoltage, it outputs the ON signal.
6	Three-phase input overvoltage (Not supported by non-gateway-type rectifier unit)	When the rectifier unit detects three-phase input overvoltage, it outputs the ON signal.
7	Three-phase input undervoltage	When the rectifier unit detects three-phase input undervoltage, it outputs the ON signal.
8	Output of rectifier unit overheating	When the rectifier unit detects rectifier module overheating, it outputs the ON signal.
9	Output of braking unit overheating	When the rectifier unit detects braking unit overheating, it outputs the ON signal. (It is valid only for the 45kW rectifier model.)
10	Breaker acting (Not supported by non-gateway-type rectifier unit)	When three-phase input overvoltage occurs or the braking transistor is short-circuited, it outputs the ON signal to trip the breaker.
11	Grid fault output (Not supported by non-gateway-type rectifier unit)	When the rectifier unit detects three-phase input voltage failure, distortion, or phase loss, it outputs the ON signal.
12	Specific bus voltage output	When the bus voltage is greater than P07.13, it outputs the ON signal.
13–31	Reserved	/

5.5.8 Communication function

For details, see chapter 6 Communication networking.

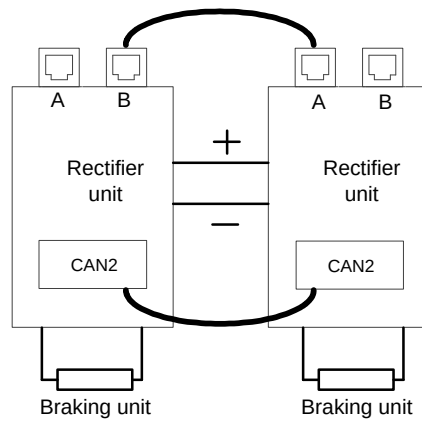
5.5.9 Rectifier unit parallel connection

5.5.9.1 Gateway-type rectifier unit parallel connection

When the capacity of a single rectifier unit is insufficient, gateway-type rectifier units can be connected in parallel. For parallel operation, configure the units as follows. Gateway-type rectifier units support parallel operation of up to four rectifier units. Use the CAN2H and CAN2L terminals on the front cover for communication between the rectifier units.

Use P21.56 to set the master and slave addresses. The addresses must be unique; it is recommended to set the master to 1 and the slave to 2. Use P21.59 to define the master or slave. Set the parallel-machine synchronous braking adjustment voltage through P21.62, which reduces the braking transistor turn-off voltage of the two units. Thus, the hysteresis voltage is added during braking, and the braking synchronization is effectively improved, enabling master/slave braking.

Rectifier faults are transmitted to the inverter via CAN1 of the RJ45 port. The wiring method is shown in the following figure.



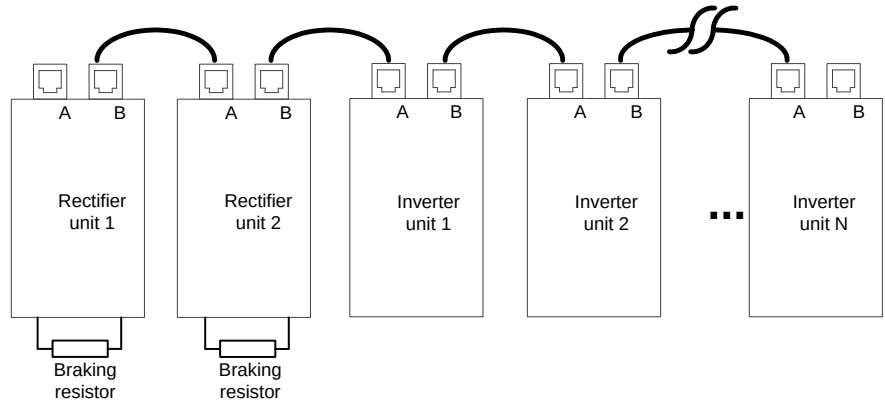
Involved function codes are listed in the following.

Function code	Description	Description	Recommended value (Master)	Recommended value (Slave)
P21.56	CAN master/slave communication address	Setting range: 0–4 Rectifier CAN master/slave address setting	1	2
P21.57	CAN master/slave communication rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1M bps	4	4
P21.58	CAN master/slave communication timeout time	Setting range: 0.0–30.0s	5.0	5.0s
P21.59	Master/slave mode	0: Invalid 1: Master 2: Slave	1	2
P21.60	Master/slave control mode	Setting range: 0x000–0x110 Ones place: Reserved Tens place: Whether slave receives control commands from master 0: Slave receives control commands from master 1: Slave does not receive control commands from master Hundreds place: Enable master/slave to transmit/receive data 0: Enable 1: Disable	0x000	0x000
P21.61	Slave count	Setting range: 0–3	Depends on slave quantity	/
P21.62	Parallel-operation synchronized braking adjustment voltage	Setting range: 0.0–100.0V	23.0	23.0V

5.5.9.2 Non-gateway-type rectifier unit parallel connection

When the capacity of a single rectifier unit is insufficient, multiple non-gateway-type rectifier units can be connected in parallel. Up to four non-gateway-type rectifier units can be paralleled, which are connected via network cables through the RJ45 ports.

Use function code P21.01 to set the rectifier addresses. The master and slave addresses must be unique. It is recommended to set one unit as the master with the address 100, and the slave units to addresses greater than 100 (excluding 100). The rectifier units perform communication and control via the internal CAN protocol. The connection method is shown in the following figure.



Related function codes are as follows.

Function code	Description	Description	Recommended value (Master)	Recommended value (Slave)
P21.01	CAN module address	Setting range: 100–103 It must be set to 100 for the master, and 101 or higher for slaves.	100	101

5.6 Inverter unit basic functions

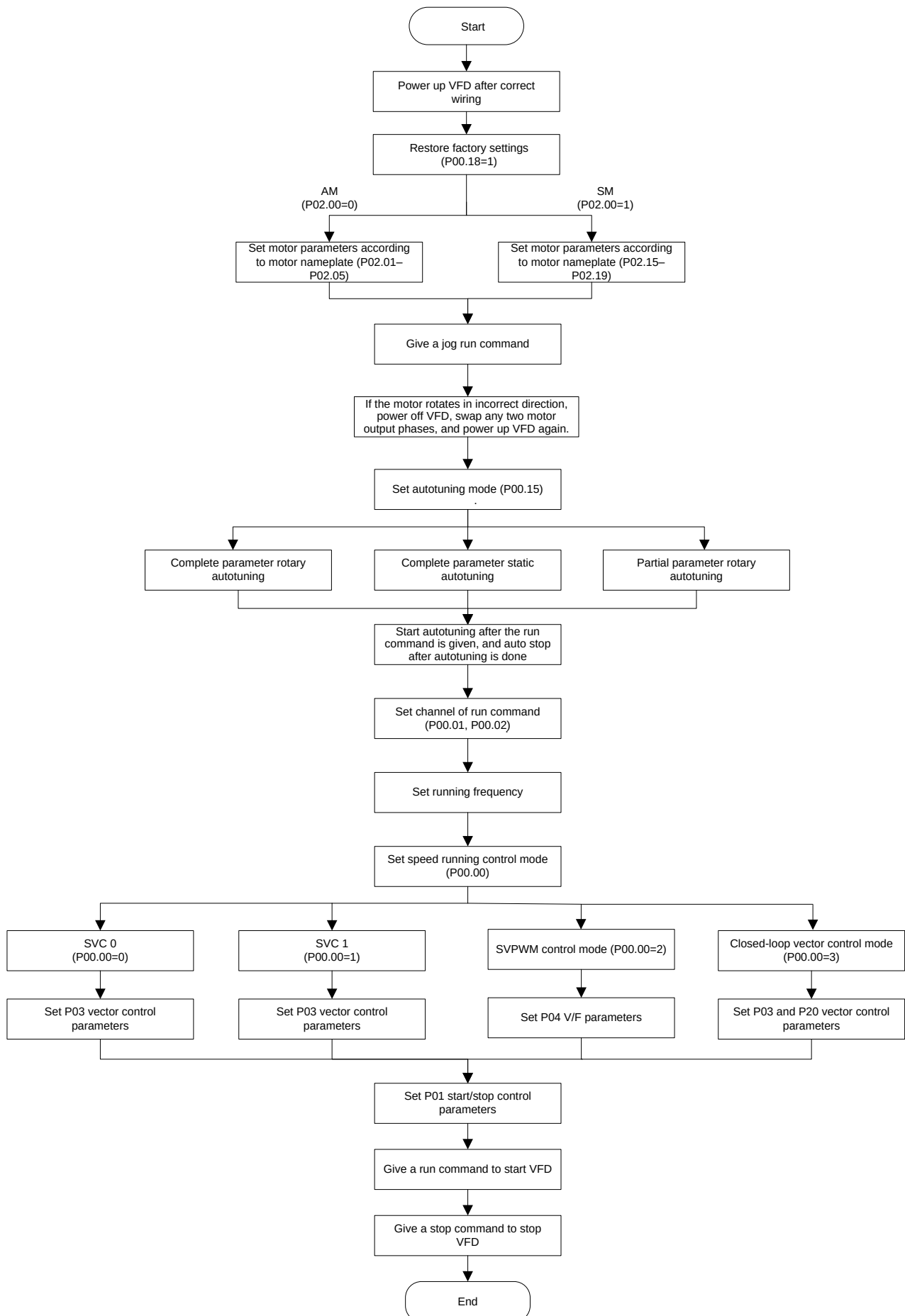
5.6.1 What this section describes

This section describes the internal function modules of the inverter unit.

	- Ensure that all terminals have been securely connected. - Ensure that the motor power matches the inverter unit.
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5.6.2 Common commissioning procedure of the inverter unit

The common commissioning procedure is as follows (taking motor 1 as an example).



Note: If a fault occurs, check the cause according to "Troubleshooting".

The channel of run commands can be set through terminal commands in addition to P00.01 and P00.02.

Channel of run commands P00.01	Multifunction terminal function 36 Switch the command channel to keypad	Multifunction terminal function 37 Switch the command channel to terminal	Multifunction terminal function 38 Switch the command channel to communication
Keypad	/	Terminal	Communication
Terminal	Keypad	/	Communication
Communication	Keypad	Terminal	/

Note: "/" indicates that the multifunction terminal function is not available for the selected reference channel.

Inverter function code	Name	Description	Default
P00.00	Speed control mode	0: Sensorless vector control (SVC) mode 0 1: Sensorless vector control (SVC) mode 1 2: Space voltage vector PWM control mode (SVPWM) 3: Closed-loop vector control mode Note: When vector control mode 0, 1, or 3 is selected, the inverter unit must perform motor parameter autotuning first.	2
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication Note: The keypad indicates the external LCD keypad, since the built-in LED keypad is not equipped with the Run key.	0
P00.02	Communication mode of run commands	0: Modbus 1: CANopen 2: Ethernet 3: EtherCAT/PROFINET 4: PLC card 5: Reserved 6: PROFIBUS-DP Note: The options 2, 3, 4, and 6 are add-on functions and are available only when corresponding expansion cards are configured.	0
P00.15	Motor parameter autotuning	Setting range: 0x000–0x234 Ones place: Motor basic parameter autotuning 0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: VFD parameter autotuning Tens place: Initial magnetic pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 3: Rotary autotuning 2 Hundreds place: System inertia autotuning	0x000

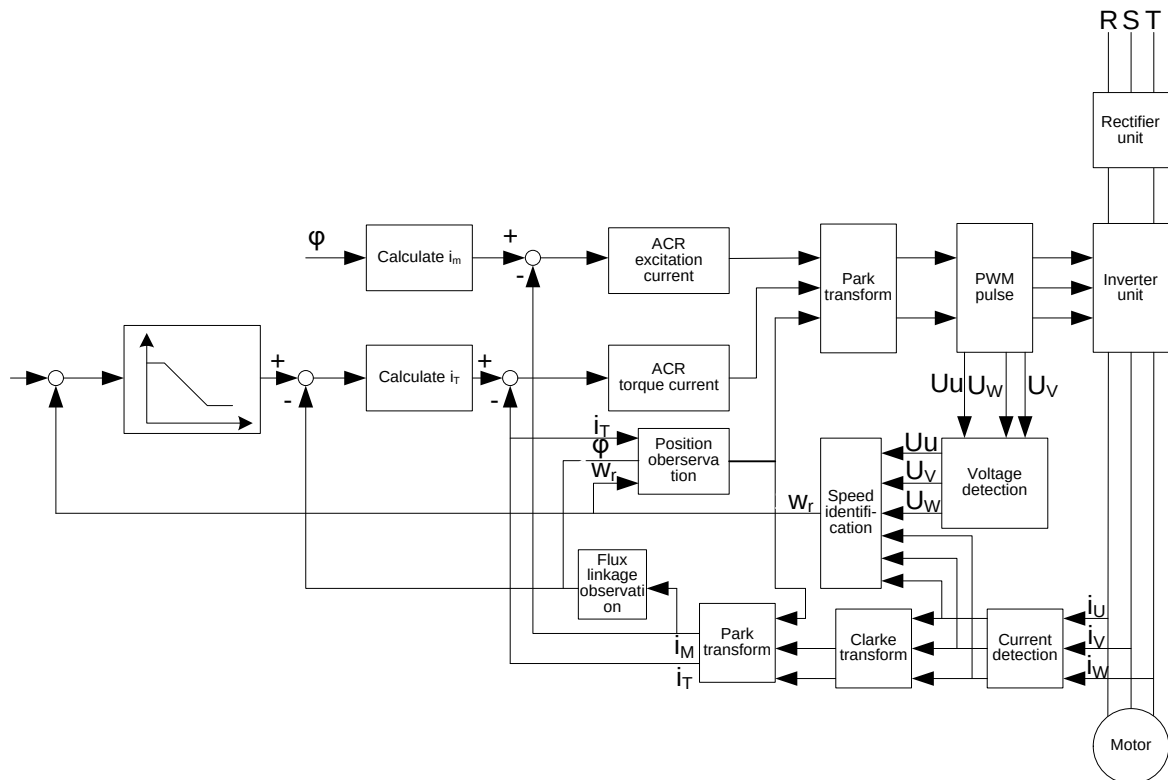
Inverter function code	Name	Description	Default
		0: No operation 1: Mode 1 2: Mode 2	
P00.18	Function parameter restore	0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Lock keypad parameters 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) Note: After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function.	0
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.01	AM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model
P02.02	AM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	AM 1 rated speed	Setting range: 1–60000rpm	Depends on model
P02.04	AM 1 rated voltage	Setting range: 0–1200V	Depends on model
P02.05	AM 1 rated current	Setting range: 0.8–6000.0A	Depends on model
P02.15	SM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model
P02.16	SM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	SM 1 pole pair count	Setting range: 1–50	2
P02.18	SM 1 rated voltage	Setting range: 0–1200V	Depends on model
P02.19	SM 1 rated current	Setting range: 0.8–6000.0A	Depends on model
P05.01–P05.04	Function selection of multifunction digital input terminals (S1–S4)	36: Switch the run command channel to keypad 37: Switch the run command channel to terminal 38: Switch the run command channel to communication	/
P07.01	Function parameter copy	0: No operation 1: Upload parameters to keypad 2: Download all parameters (including motor parameters) 3: Download non-motor-group parameters 4: Download motor-group parameters Note: Valid only for the externally connected LCD keypad.	0

5.6.3 Vector control

Asynchronous motors constitute a complex and challenging system characterized by high-order, non-linear, strongly coupled, and multi-variable properties. Vector control serves as a sophisticated solution designed to overcome the control difficulties associated with asynchronous motors. The core principle of this theory is to accurately measure and regulate the stator current vector of asynchronous motors. By following the laws of field orientation, the stator current vector is decomposed into two independent components: the exciting current (responsible for generating the magnetic field) and the torque current (responsible for generating torque). By precisely controlling the magnitude and phase of these two components (essentially regulating the stator current vector), decoupled control of excitation and torque current is achieved, ultimately fulfilling high-performance speed regulation on asynchronous motors.

The inverter units integrate advanced sensorless vector control (SVC) algorithms, supporting the drive of asynchronous or synchronous motors, which can be selected via P02.00. Since the core of the vector control algorithm relies heavily on an accurate motor parameter model, the accuracy of these parameter settings is critical to control performance. Therefore, before initiating vector operation, you are recommended to enter accurate motor parameters and perform motor parameter autotuning to ensure optimal control performance.

Due to the complexity of vector control algorithms, adjusting internal parameters often requires a high level of theoretical expertise. Consequently, exercise caution when adjusting specialized vector control parameters to avoid compromising system stability and performance.



Inverter function code	Name	Description	Default
P00.00	Speed control mode	0: Sensorless vector control (SVC) mode 0 1: Sensorless vector control (SVC) mode 1 2: Space voltage vector PWM control mode (SVPWM) 3: Closed-loop vector control mode Note: When vector control mode 0, 1, or 3 is selected, the inverter unit must perform motor parameter autotuning first.	2

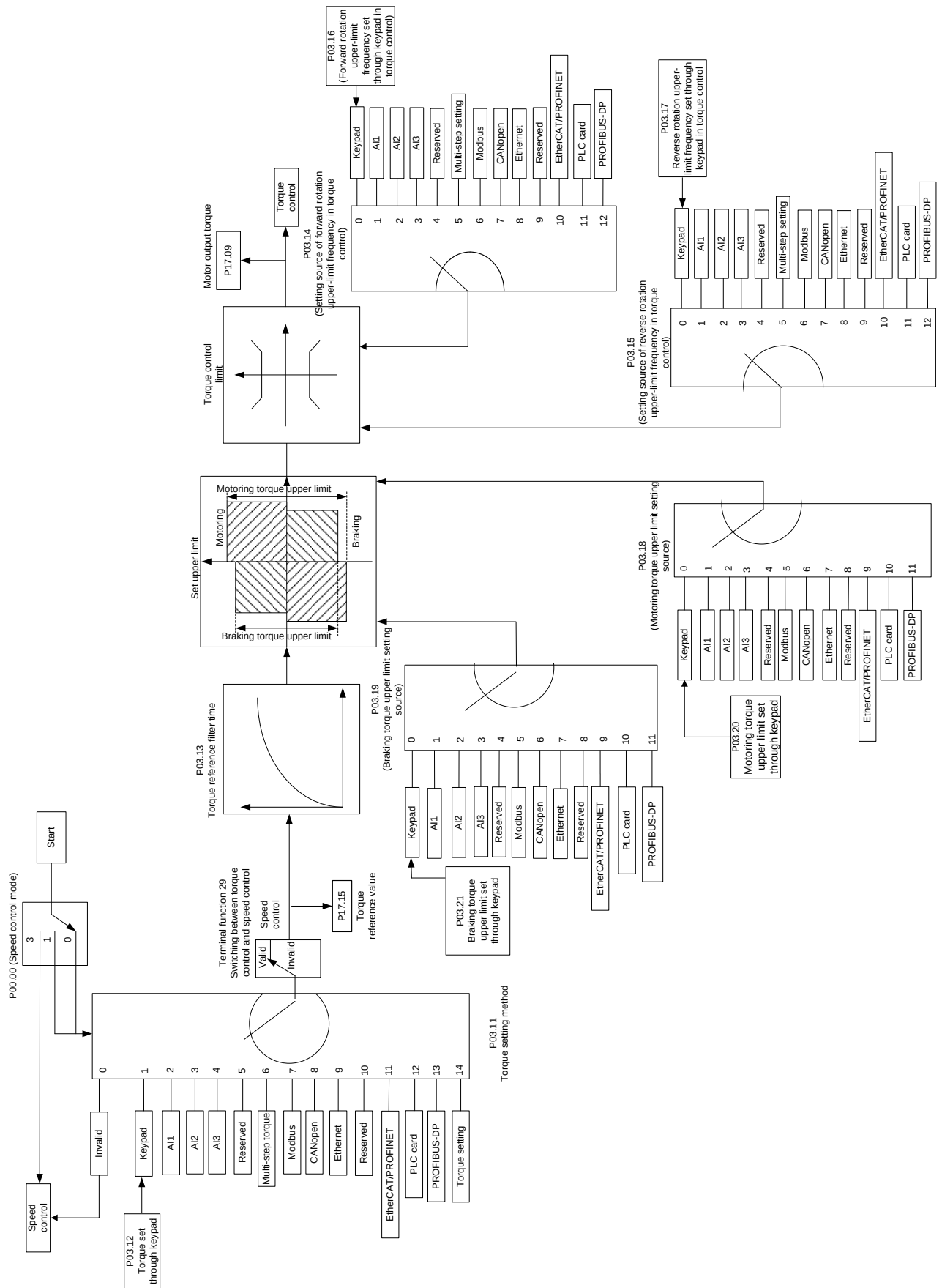
Inverter function code	Name	Description	Default
P00.15	Motor parameter autotuning	Setting range: 0x000–0x234 Ones place: Motor basic parameter autotuning 0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: VFD parameter autotuning Tens place: Initial magnetic pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 3: Rotary autotuning 2 Hundreds place: System inertia autotuning 0: No operation 1: Mode 1 2: Mode 2	0
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P03.00	Motor 1 speed-loop proportional gain 1	Setting range: 0–200.0	20.0
P03.01	Speed-loop integral time 1 of motor 1	Setting range: 0.000–10.000s	0.200s
P03.02	Motor 1 speed-loop switching low-point frequency	Setting range: 0.00Hz–P03.05	5.00Hz
P03.03	Motor 1 speed-loop proportional gain 2	Setting range: 0–200.0	20.0
P03.04	Speed-loop integral time 2 of motor 1	Setting range: 0.000–10.000s	0.200s
P03.05	Motor 1 speed-loop switching high-point frequency	Setting range: P03.02–P03.03 (Max. output frequency)	10.00Hz
P03.06	Motor 1 speed-loop output filter	Setting range: 0–8 (corresponding to 0–2 ⁸ /10ms)	0
P03.07	Motor 1 vector control slip compensation coefficient (Motoring)	Setting range: 50%–200%	100%
P03.08	Motor 1 vector control slip compensation coefficient (Generating)	Setting range: 50%–200%	100%
P03.11	Torque setting method	0: Keypad (P03.12) 1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Reserved 6: Multi-step torque 7: Modbus communication	0

Inverter function code	Name	Description	Default
		8: CANopen communication 9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET communication 12: PLC card 13: PROFIBUS-DP communication 14: Tension setting Note: For these settings, 100% corresponds to the motor rated current.	
P03.12	Torque set through keypad	Setting range: -300.0%~300.0% (of the motor rated current)	20.0%
P03.13	Torque reference filter time	Setting range: 0.000~10.000s	0.010s
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step setting 6: Modbus communication 7: CANopen communication 8: Ethernet communication 9: Reserved 10: EtherCAT/PROFINET communication 11: PLC card 12: PROFIBUS-DP communication 13: Tension setting Note: For these settings, 100% corresponds to the maximum frequency.	0
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1~13: Same as those for P03.14	0
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	Setting range: 0.00 Hz~P00.03 (Max. output frequency)	50.00Hz
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control		50.00Hz
P03.18	Setting source of motoring torque upper limit	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Modbus communication 6: CANopen communication 7: Ethernet communication 8: Reserved 9: EtherCAT/PROFINET communication 10: PLC card	0

Inverter function code	Name	Description	Default
		11: PROFIBUS-DP communication Note: For these settings, 100% corresponds to the motor rated current.	
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1–11: Same as those for P03.18	0
P03.20	Motoring torque upper limit set through keypad	Setting range: 0.0–300.0% (of the motor rated current)	180.0%
P03.21	Braking torque upper limit set through keypad		180.0%
P03.22	Flux weakening coefficient in constant power zone	Setting range: 0.1–2.0	1.0
P03.23	Min. flux weakening point in constant power zone	Setting range: 5%–100%	10%
P03.24	Max. voltage limit	Setting range: 0.0–120.0%	100.0%
P03.25	Pre-excitation time	Setting range: 0.000–10.000s	0.300s
P03.32	Torque control enable	0: Disable 1: Enable	0
P03.33	Flux weakening integral gain	Setting range: 0.0–300.0%	100.0%
P03.35	Control mode optimization selection	Setting range: 0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved Hundreds place: Speed-loop integral separation enable 0: Disable 1: Enable Thousands place: Reserved Note: Valid only in the closed-loop vector control mode (P00.00=3).	0x0000
P03.36	Motor 1 speed-loop differential gain	Setting range: 0.00–10.00s	0.00s
P03.54	Motor 1 current-loop band width	Setting range: 0–2000	400
P17.32	Motor flux linkage	Setting range: 0.0–200.0%	0.0%

5.6.4 Torque control

The inverter units support torque control and speed control. Speed control aims to stabilize the speed to keep the set speed consistent with the actual running speed, meanwhile, the max. load-carrying capacity is restricted by the torque limit. Torque control (which is enabled by setting P03.32, supported only when P00.00=0, 1, or 3) aims to stabilize the torque to keep the set torque consistent with the actual output torque, meanwhile, the output frequency is restricted by the upper and lower limits.



Inverter function code	Name	Description	Default
P00.00	Speed control mode	0: Sensorless vector control (SVC) mode 0 1: Sensorless vector control (SVC) mode 1 2: Space voltage vector PWM control mode (SVPWM) 3: Closed-loop vector control mode Note: When vector control mode 0, 1, or 3 is selected, the inverter unit must perform motor parameter autotuning first.	2
P03.11	Torque setting method	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Reserved 6: Multi-step torque 7: Modbus communication 8: CANopen communication 9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET communication 12: PLC card 13: PROFIBUS-DP communication 14: Tension setting Note: 100% corresponds to the motor rated current.	0
P03.12	Torque set through keypad	Setting range: -300.0%–300.0% (of the motor rated current)	20.0%
P03.13	Torque reference filter time	Setting range: 0.000–10.000s	0.010s
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad (P03.16) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step setting 6: Modbus communication 7: CANopen communication 8: Ethernet communication 9: Reserved 10: EtherCAT/PROFINET communication 11: PLC card 12: PROFIBUS-DP communication 13: Tension setting Note: 100% corresponds to the max. output frequency (P00.03).	0
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1–13: Same as those for P03.14	0
P03.16	Forward rotation	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz

Inverter function code	Name	Description	Default
	upper-limit frequency set through keypad in torque control		
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	50.00Hz
P03.18	Motoring torque upper limit setting source	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Modbus communication 6: CANopen communication 7: Ethernet communication 8: Reserved 9: EtherCAT/PROFINET communication 10: PLC card 11: PROFIBUS-DP communication Note: 100% corresponds to the motor rated current.	0
P03.19	Braking torque upper limit setting source	0: Keypad (P03.21) 1–11: Same as those for P03.18	0
P03.20	Motoring torque upper limit set through keypad	Setting range: 0.0–300.0% (of the motor rated current)	180.0%
P03.21	Braking torque upper limit set through keypad		180.0%
P03.32	Torque control enable	0: Disable 1: Enable	0
P17.09	Motor output torque	Setting range: -250.0%–250.0%	0.0%
P17.15	Torque reference value	Setting range: -300.0%–300.0% (of the motor rated current)	0.0%

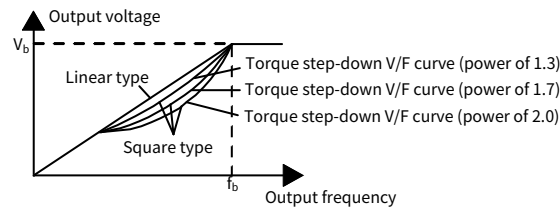
5.6.5 SVPWM

The inverter unit also features an SVPWM control mode. This mode is suitable for applications that do not require high control accuracy. It is also recommended for multi-motor applications where one unit drives multiple motors.

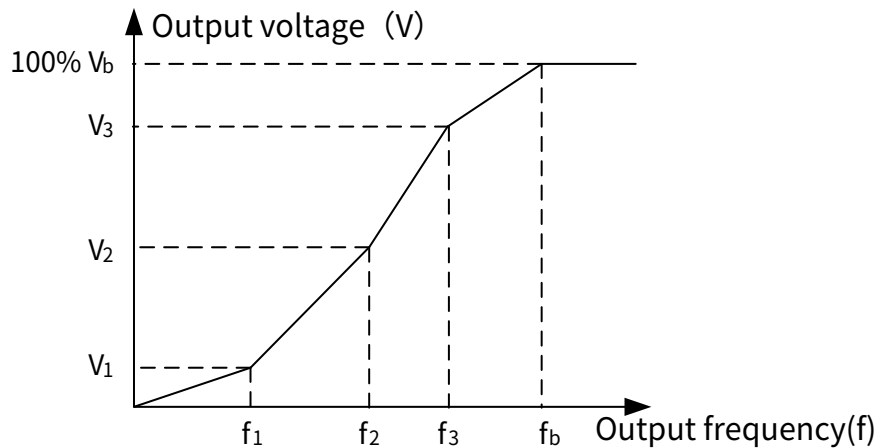
The inverter unit provides multiple V/F curve modes to meet different requirements. You can select V/F curves or set V/F curves as required.

Suggestions:

1. For the load featuring constant moment, such as conveyor belt which runs in straight line, as the whole running process requires constant moment, it is recommended to adopt the straight line V/F curve.
2. For the load featuring decreasing moment, such as fan and water pumps, as there is a power (square or cube) relation between its actual torque and speed, it is recommended to adopt the V/F curve corresponding to the power of 1.3, 1.7 or 2.0.



The inverter unit also provides multi-point V/F curves. You can change the V/F curves output by the inverter unit by setting the voltage and frequency of the three points in the middle. A whole curve consists of five points starting from (0Hz, 0V) and ending at (motor fundamental frequency, motor rated voltage). During setting, follow the rule: $0 \leq f_1 \leq f_2 \leq f_3 \leq$ Motor base frequency; and, $0 \leq V_1 \leq V_2 \leq V_3 \leq$ Motor rated voltage



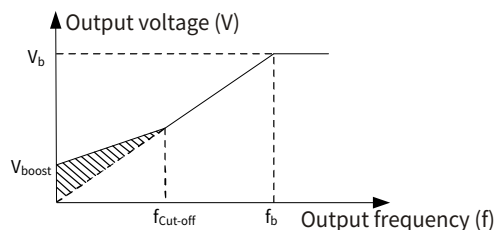
The inverter unit provides dedicated function codes for SVPWM control mode. Proper configuration of function codes can effectively improve SVPWM control performance.

1. Torque boost

The torque boost function can effectively compensate for the low-speed torque performance in space voltage control. Automatic torque boost has been set by default, which enables the inverter unit to adjust the torque boost value based on actual load conditions.

Note:

- Torque boost takes effect only at the torque boost cut-off frequency.
- If torque boost is too large, the motor may encounter low-frequency vibration or overcurrent. If such a situation occurs, reduce the torque boost value.



2. Energy-saving run

During actual running, the inverter unit can search for the max. efficiency point to keep the multi-drive system to run in the most efficient state to save energy.

Note:

- This function is generally used in light load or no-load cases.
- This function is not applicable to the cases where sudden load changes often occur.

3. V/F slip compensation gain

SVPWM control is an open-loop mode. Sudden changes in motor load may cause motor speed fluctuations. For applications that require high speed stability, the slip compensation gain can be set so that the inverter unit internally adjusts the output to compensate for speed variations caused by load fluctuations.

The setting range of slip compensation gain is 0–200%, in which 100% corresponds to the rated slip frequency.

Note: Rated slip frequency = (Rated synchronous rotation speed of motor – Rated rotation speed of motor) x (Motor pole pair count)/60

4. Oscillation suppression

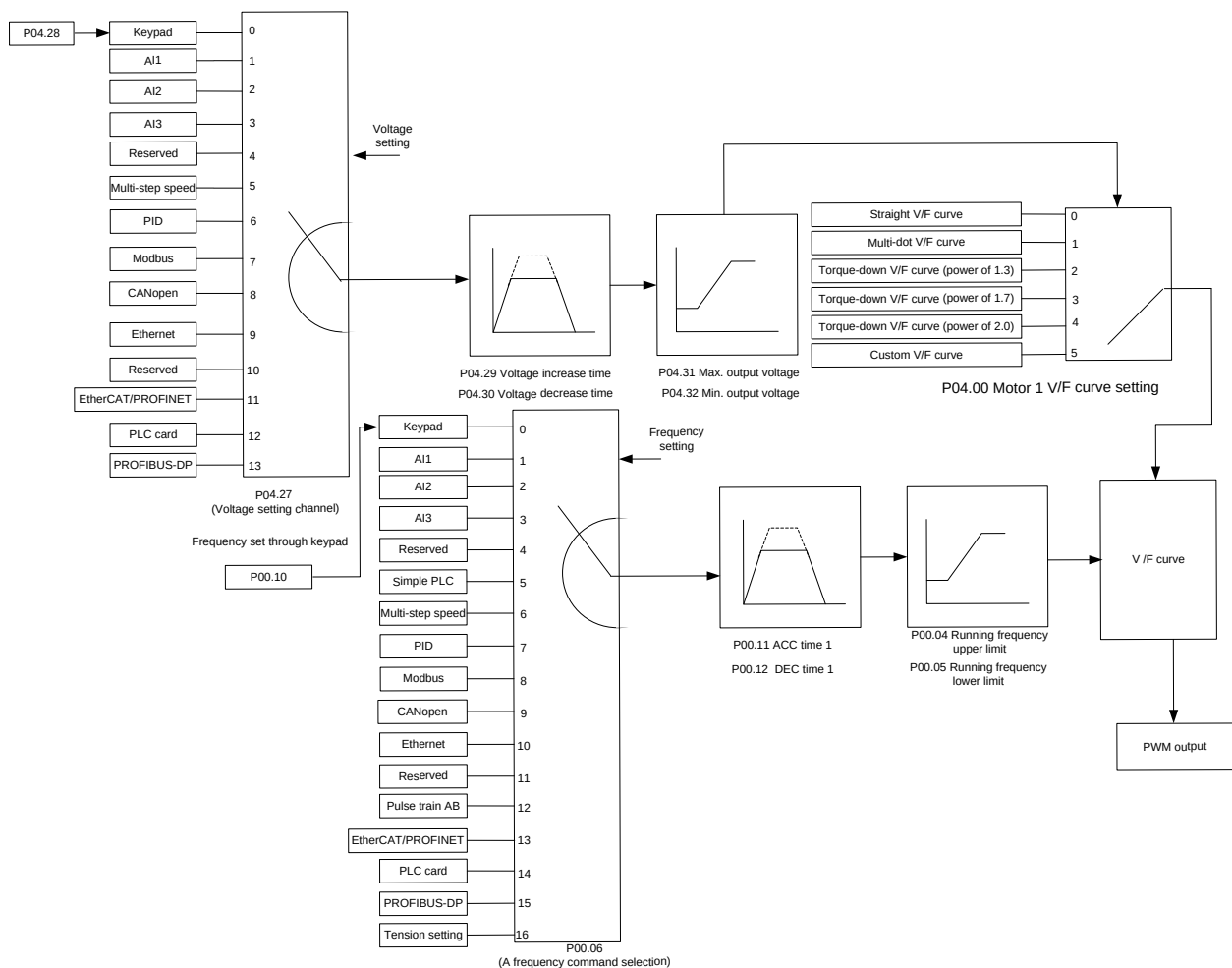
Motor oscillation is a common issue when SVPWM control mode is used in high-power drive applications. The inverter unit provides two function codes for setting oscillation suppression factors to suppress this oscillation. Set the corresponding function codes according to the oscillation frequency.

Note: A higher setting provides stronger oscillation suppression. However, an excessively high setting may cause issues such as excessive inverter output current.

5. Asynchronous motor IF control

Generally, the IF control mode is valid for AMs. It can be used for SMs only when the frequency is extremely low. Therefore, the IF control mode described in this manual is only involved with AMs. IF control is implemented by performing closed-loop control on the total output current of the inverter unit. The output voltage adapts to the current reference, and open-loop control is separately performed over the frequency of the voltage and current.

Customized V/F curve (V/F separation) function:



When selecting the customized V/F curve function, you can specify the setting channels and acceleration/deceleration

time of voltage and frequency respectively, which form a real-time V/F curve in combination manner.

Note: This type of V/F curve separation can be applied in various variable-frequency power sources. However, exercise caution when setting parameters as improper settings may cause equipment damage.

Inverter function code	Name	Description	Default
P00.00	Speed control mode	0: Sensorless vector control (SVC) mode 0 1: Sensorless vector control (SVC) mode 1 2: Space voltage vector PWM control mode (SVPWM) 3: Closed-loop vector control mode Note: When vector control mode 0, 1, or 3 is selected, the inverter unit must perform motor parameter autotuning first.	2
P00.03	Max. output frequency	Setting range: Max(P00.04,10.00)–590.00Hz	50.00Hz
P00.04	Running frequency upper limit	Setting range: P00.05–P00.03(Hz)	50.00Hz
P00.05	Running frequency lower limit	Setting range: 0.00Hz–P00.04	0.00Hz
P00.11	ACC time 1	Setting range: 0.0–3600.0s	Depends on model
P00.12	DEC time 1	Setting range: 0.0–3600.0s	Depends on model
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.02	AM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.04	AM 1 rated voltage	Setting range: 0–1200V	Depends on model
P04.00	Motor 1 V/F curve setting	0: Straight V/F curve 1: Multi-point V/F curve 2: 1.3-power reduced-torque V/F curve 3: 1.7-power reduced-torque V/F curve 4: 2.0-power reduced-torque V/F curve 5: Custom V/F (V/F separation)	0
P04.01	Motor 1 torque boost	Setting range: 0.0% (Automatic) – 10.0% (of motor 1 rated voltage)	0.0%
P04.02	Motor 1 torque boost cut-off	Setting range: 0.0%–50.0% (of motor 1 rated voltage)	20.0%
P04.03	Motor 1 V/F frequency point 1	Setting range: 0.00Hz–P04.05	0.00Hz
P04.04	Motor 1 V/F voltage point 1	Setting range: 0.0%–110.0%	0.0%
P04.05	Motor 1 V/F frequency point 2	Setting range: P04.03–P04.07	0.00Hz
P04.06	Motor 1 V/F voltage point 2	Setting range: 0.0%–110.0%	0.0%
P04.07	Motor 1 V/F frequency point 3	Setting range: P04.05–P02.02 or P04.05–P02.16	0.00Hz
P04.08	Motor 1 V/F voltage point 3	Setting range: 0.0%–110.0%	0.0%
P04.09	Motor 1 V/F slip compensation gain	Setting range: 0.0–200.0%	100.0%
P04.10	Motor 1 low-frequency	Setting range: 0–100	10

Inverter function code	Name	Description	Default
	oscillation suppression factor		
P04.11	Motor 1 high-frequency oscillation suppression factor	Setting range: 0–100	10
P04.12	Motor 1 oscillation suppression threshold frequency	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	30.00Hz
P04.13	Motor 2 V/F curve setting	0: Straight V/F curve 1: Multi-point V/F curve 2: 1.3-power reduced-torque V/F curve 3: 1.7-power reduced-torque V/F curve 4: 2.0-power reduced-torque V/F curve 5: Custom V/F (V/F separation)	0
P04.14	Motor 2 torque boost	Setting range: 0.0% (Automatic) – 10.0%	0.0%
P04.15	Motor 2 torque boost cut-off	Setting range: 0.0%–50.0% (of the rated frequency of motor 2)	20.0%
P04.16	Motor 2 V/F frequency point 1	Setting range: 0.00Hz–P04.18	0.00Hz
P04.17	Motor 2 V/F voltage point 1	Setting range: 0.0%–110.0%	0.0%
P04.18	Motor 2 V/F frequency point 2	Setting range: P04.16–P04.20	0.00Hz
P04.19	Motor 2 V/F voltage point 2	Setting range: 0.0%–110.0%	0.0%
P04.20	Motor 2 V/F frequency point 3	Setting range: P04.18–P02.02 or P04.18–P02.16	0.00Hz
P04.21	Motor 2 V/F voltage point 3	Setting range: 0.0%–110.0%	0.0%
P04.22	Motor 2 V/F slip compensation gain	Setting range: 0.0–200.0%	100.0%
P04.23	Motor 2 low-frequency oscillation suppression factor	Setting range: 0–100	10
P04.24	Motor 2 high-frequency oscillation suppression factor	Setting range: 0–100	10
P04.25	Motor 2 oscillation suppression threshold frequency	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	30.00Hz
P04.27	Voltage setting channel	0: Keypad (The value is set by P04.28.) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step speed running (The setting is determined by related parameters in group P10.) 6: PID 7: Modbus communication 8: CANopen communication	0

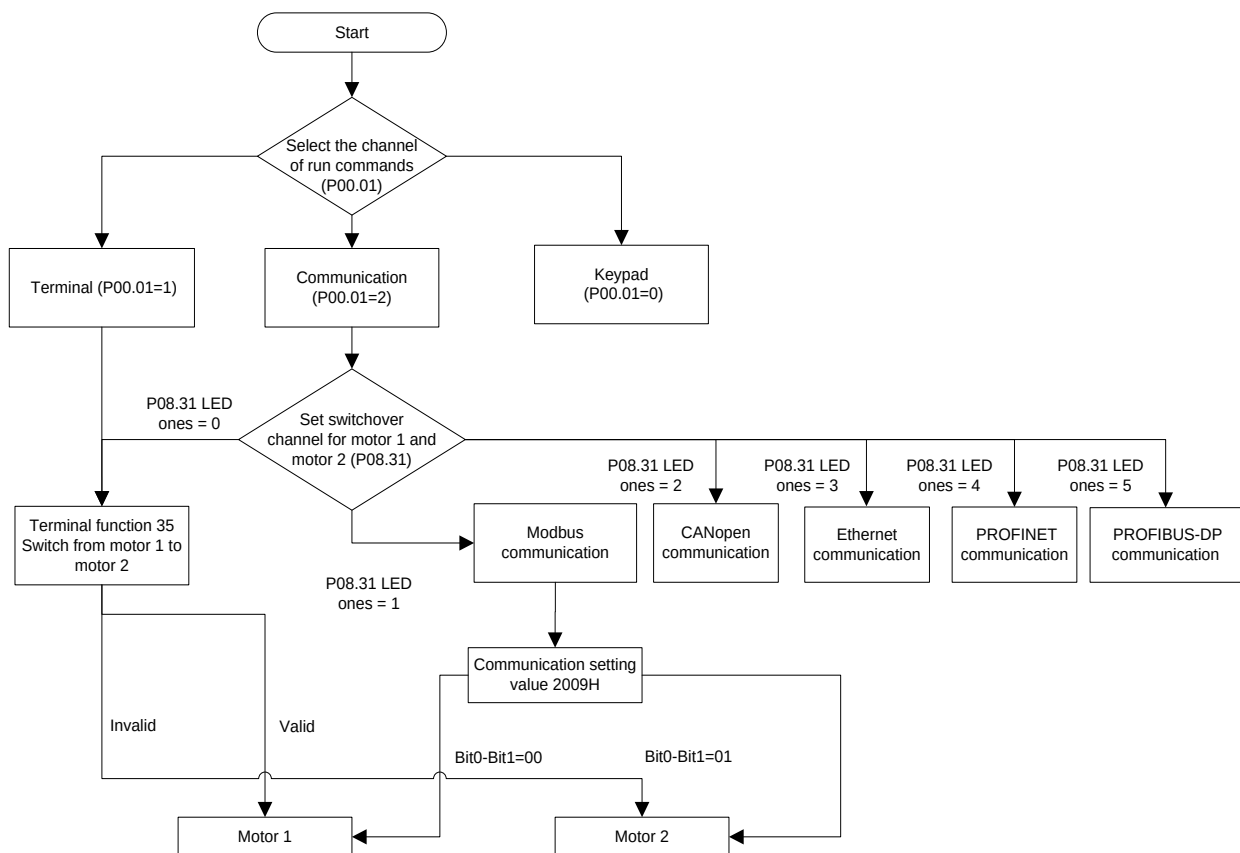
Inverter function code	Name	Description	Default
		9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET communication 12: PLC card 13: PROFIBUS-DP communication	
P04.28	Voltage set through keypad	Setting range: 0.0%–100.0% (of the motor rated voltage)	100.0%
P04.29	Voltage increase time	Setting range: 0.0–3600.0s	5.0s
P04.30	Voltage decrease time	Setting range: 0.0–3600.0s	5.0s
P04.31	Max. output voltage	Setting range: P04.32–100.0% (of the motor rated voltage)	100.0%
P04.32	Min. output voltage	Setting range: 0.0%–P04.31 (of the motor rated voltage)	0.0%
P04.34	SM V/F pull-in current 1	When the SM V/F control mode is enabled, the function code is used to set the reactive current of the motor when the output frequency is lower than the frequency specified by P04.36. Setting range: -100.0%–100.0% (of the motor rated current)	30.0%
P04.35	SM V/F pull-in current 2	When the SM V/F control mode is enabled, the function code is used to set the reactive current of the motor when the output frequency is greater than the frequency specified by P04.36. Setting range: -100.0%–100.0% (of the motor rated current)	10.0%
P04.36	SM V/F pull-in current switching frequency threshold	When the SM V/F control mode is enabled, the function code is used to set the frequency threshold for the switching between pull-in current 1 and pull-in current 2. Setting range: 0.0%–200.0% (of the motor rated frequency).	20.0%
P04.37	Reactive current closed-loop proportional coefficient in SM V/F control	When the SM V/F control mode is enabled, the function code is used to set the proportional coefficient of reactive current closed-loop control. Setting range: 0–3000	50
P04.38	Reactive current closed-loop integral time in SM V/F control	When the SM V/F control mode is enabled, the function code is used to set the integral coefficient of reactive current closed-loop control. Setting range: 0–3000	30
P04.39	Reactive current closed-loop output limit in SM V/F control	This parameter is valid in synchronous motor V/F control mode. It is used to set the output limit for reactive current closed-loop control. A higher value provides a higher reactive current closed-loop compensation voltage and greater motor output capability. In general, this parameter does not need to be adjusted. Setting range: 0–16000	8000

Inverter function code	Name	Description	Default
P04.40	AM 1 I/F mode enable	0: Disable 1: Enable	0
P04.41	AM1 I/F current setting	When I/F control is adopted for AM 1, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%
P04.42	AM 1 I/F mode proportional coefficient	When I/F control is adopted for AM 1, this parameter is used to set the proportional coefficient of the output current in closed-loop control. Setting range: 0–5000	350
P04.43	AM 1 I/F mode integral coefficient	When I/F control is adopted for AM 1, this parameter is used to set the proportional coefficient of the output current in closed-loop control. Setting range: 0–5000	150
P04.44	AM 1 I/F mode cut-in frequency	Setting range: 0.00Hz–P04.50	10.00Hz
P04.45	AM 2 I/F mode enable	0: Disable 1: Enable	0
P04.46	AM 2 I/F mode current setting	When I/F control is adopted for AM 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–200.0%	120.0%
P04.47	AM 2 I/F mode proportional coefficient	When I/F control is adopted for AM 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0–5000	350
P04.48	AM 2 I/F mode integral coefficient	When I/F control is adopted for AM 2, this parameter is used to set the output current. The value is a percentage in relative to the rated current of the motor. Setting range: 0–5000	150
P04.49	AM 2 I/F mode cut-in frequency	Setting range: 0.00Hz–P04.51	10.00Hz
P04.50	AM 1 I/F mode cut-out frequency	Setting range: P04.44–P00.03	25.00Hz
P04.51	AM 2 I/F mode cut-out frequency	Setting range: P04.49–P00.03	25.00Hz

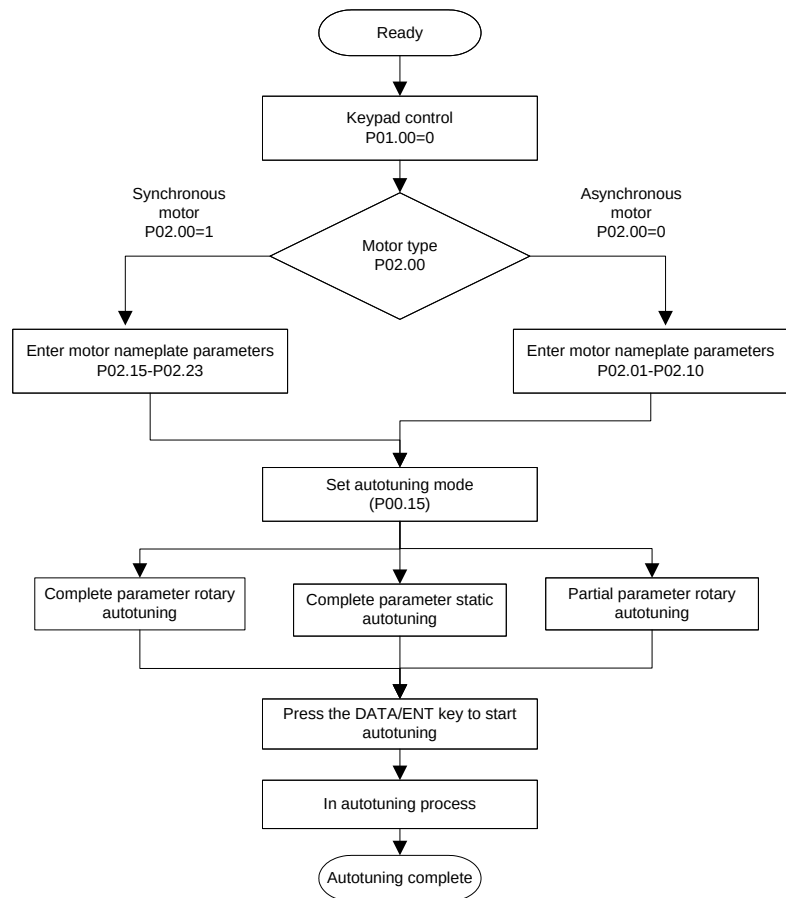
5.6.6 Motor parameter autotuning

	- Check the safety conditions surrounding the motor and load machineries before autotuning as physical injury may occur due to sudden start of motor during autotuning. - Although the motor does not run during static autotuning, the motor is still supplied with power. Do not touch the motor during autotuning; otherwise, electric shock may occur. Do not touch the motor before autotuning is completed.
	If the motor has been connected to a load, do not carry out rotary autotuning. Otherwise, the inverter unit may malfunction or mechanical device may be damaged. If rotary autotuning is carried out on a motor which has been connected to a load, incorrect motor parameter settings and motor action exceptions may occur. Disconnect from the load to carry out autotuning if necessary.

The inverter unit can drive both asynchronous motors and synchronous motors, and it supports two sets of motor parameters, which can be switched over by multifunction digital input terminals or communication modes.



The control performance of the inverter unit is based on accurate motor models. Therefore, you need to carry out motor parameter autotuning before running a motor for the first time (taking motor 1 as an example).



Note:

- Motor parameters must be set correctly according to the motor nameplate.
- After entering P00.15, you can press the **DATA/ENT** key to enter autotuning and press the **PRG/ESC** key to exit autotuning, since the local inverter unit keypad does not have the **RUN** and **STOP** keys.
- If rotary autotuning is selected during motor autotuning, disconnect the motor from the load to put the motor in static and no-load state. Otherwise, the motor parameter autotuning results may be incorrect. In this mode, autotune P02.06–P02.10 for AMs and autotune P02.20–P02.23 for SMs.
- If static autotuning is selected for motor autotuning, there is no need to disconnect the motor from the load, but the control performance may be impacted as only a part of the motor parameters have been autotuned. In this mode, parameters P02.06–P02.10 can be autotuned for an AM, and parameters P02.20–P02.22 can be autotuned for an SM. P02.23 (SM 1 back-EMF constant) can be calculated.
- Motor autotuning can be carried out on the present motor only. If you need to perform autotuning on the other motor, switch the motor through selecting the switchover channel of motor 1 and motor 2 by setting the ones place of P08.31.

Related parameter list:

Inverter function code	Name	Description	Default
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	0
P00.15	Motor parameter autotuning	Setting range: 0x000–0x234 Ones place: Motor basic parameter autotuning	0

Inverter function code	Name	Description	Default
		0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: VFD parameter autotuning Tens place: Initial magnetic pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 3: Rotary autotuning 2 Hundreds place: System inertia autotuning 0: No operation 1: Mode 1 2: Mode 2	
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P02.01	AM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model
P02.02	AM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.03	AM 1 rated speed	Setting range: 1–60000rpm	Depends on model
P02.04	AM 1 rated voltage	Setting range: 0–1200V	Depends on model
P02.05	AM 1 rated current	Setting range: 0.8–6000.0A	Depends on model
P02.06	AM 1 stator resistance	Setting range: 0.001–65.535Ω	Depends on model
P02.07	AM 1 rotor resistance	Setting range: 0.001–65.535Ω	Depends on model
P02.08	AM 1 leakage inductance	Setting range: 0.1–6553.5mH	Depends on model
P02.09	AM 1 mutual inductance	Setting range: 0.1–6553.5mH	Depends on model
P02.10	AM 1 no-load current	Setting range: 0.1–6553.5A	Depends on model
P02.15	SM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model
P02.16	SM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P02.17	SM 1 pole pair count	Setting range: 1–50	2
P02.18	SM 1 rated voltage	Setting range: 0–1200V	Depends on model
P02.19	SM 1 rated current	Setting range: 0.8–6000.0A	Depends on model
P02.20	SM 1 stator resistance	Setting range: 0.001–65.535Ω	Depends on model
P02.21	SM 1 direct-axis inductance	Setting range: 0.01–655.35mH	Depends on model

Inverter function code	Name	Description	Default
P02.22	SM 1 quadrature-axis inductance	Setting range: 0.01–655.35mH	Depends on model
P02.23	SM 1 back-EMF constant	Setting range: 0–10000	300
P05.01–P05.04	Function selection of multifunction digital input terminals (S1–S4)	35: Switch from motor 1 to motor 2	/
P08.31	Switching between motor 1 and motor 2	Setting range: 0x00–0x15 Ones place: Switching channel selection 0: Terminal 1: Modbus communication 2: CANopen communication 3: Ethernet communication 4: PROFINET communication 5: PROFIBUS-DP communication Tens place: Enable switching during running 0: Disable 1: Enable	0x00
P12.00	Motor 2 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0
P12.01	AM 2 rated power	Setting range: 0.1–3000.0kW	Depends on model
P12.02	AM 2 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.03	AM 2 rated speed	Setting range: 1–60000rpm	Depends on model
P12.04	AM 2 rated voltage	Setting range: 0–1200V	Depends on model
P12.05	AM 2 rated current	Setting range: 0.8–6000.0A	Depends on model
P12.06	AM 2 stator resistance	Setting range: 0.001–65.535Ω	Depends on model
P12.07	AM 2 rotor resistance	Setting range: 0.001–65.535Ω	Depends on model
P12.08	AM 2 leakage inductance	Setting range: 0.1–6553.5mH	Depends on model
P12.09	AM 2 mutual inductance	Setting range: 0.1–6553.5mH	Depends on model
P12.10	AM 2 no-load current	Setting range: 0.1–6553.5A	Depends on model
P12.15	SM 2 rated power	Setting range: 0.1–3000.0kW	Depends on model
P12.16	SM 2 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz
P12.17	SM 2 pole pair count	Setting range: 1–50	2
P12.18	SM 2 rated voltage	Setting range: 0–1200V	Depends on model
P12.19	SM 2 rated current	Setting range: 0.8–6000.0A	Depends on model
P12.20	SM 2 stator resistance	Setting range: 0.001–65.535Ω	Depends

Inverter function code	Name	Description	Default
			on model
P12.21	SM 2 direct-axis inductance	Setting range: 0.01–655.35mH	Depends on model
P12.22	SM 2 quadrature-axis inductance	Setting range: 0.01–655.35mH	Depends on model
P12.23	SM 2 back-EMF constant	Setting range: 0–10000	300

5.6.7 Start/stop control

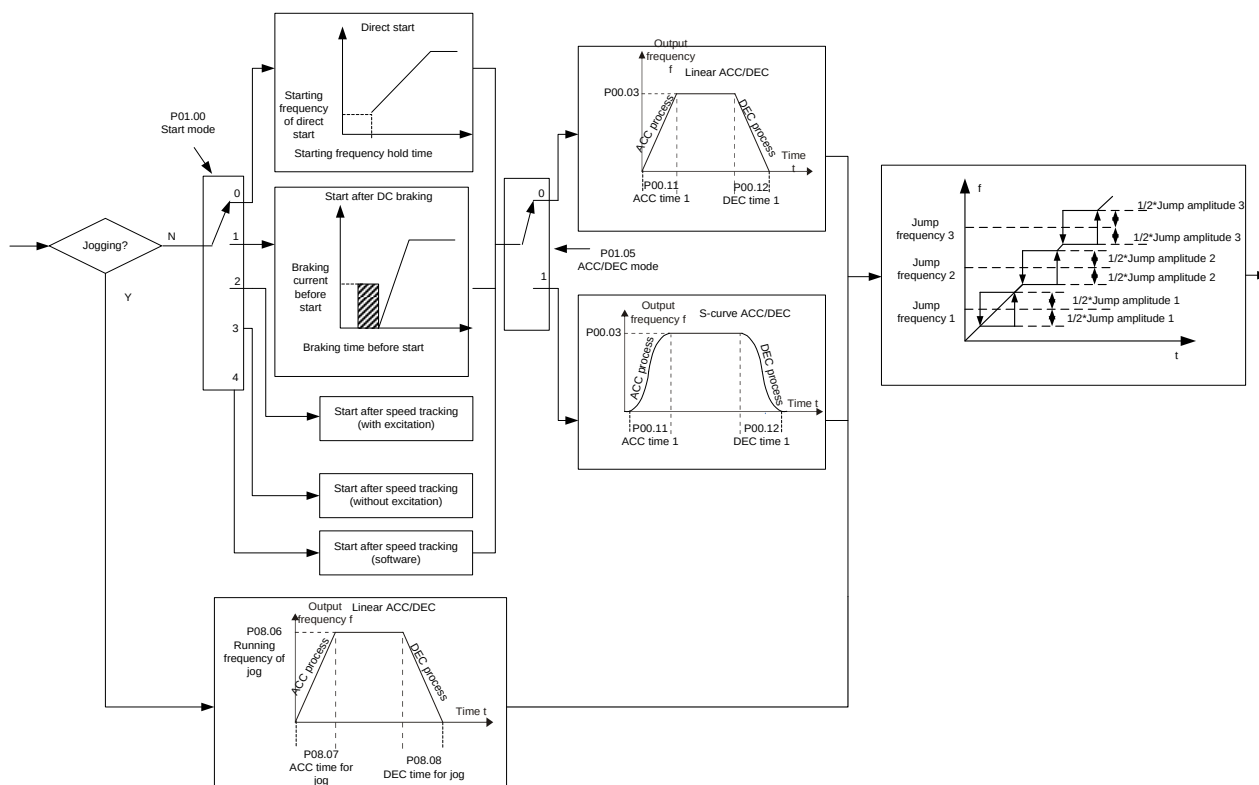
The start/stop control of the inverter unit involves three states: start after a run command is given at power-on; start after power-loss restart is effective; start after automatic fault reset. The three start/stop control states are described in the following.

There are three start modes for the inverter unit, which are start at starting frequency, start after DC braking, and start after speed tracking. You can select the proper start mode based on actual conditions.

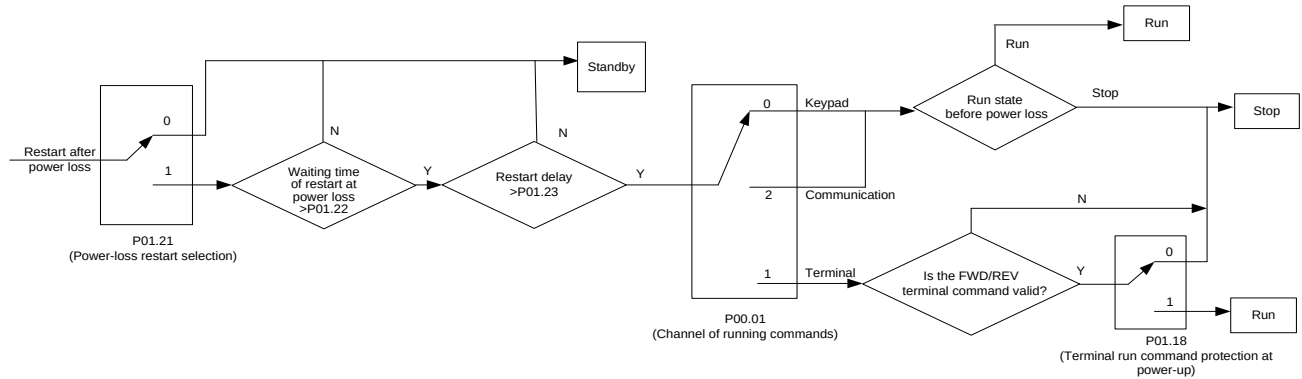
For large-inertia load, especially in cases where reversal may occur, you can choose to start after DC braking or start after speed tracking.

Note: It is recommended to drive SMs in direct start mode.

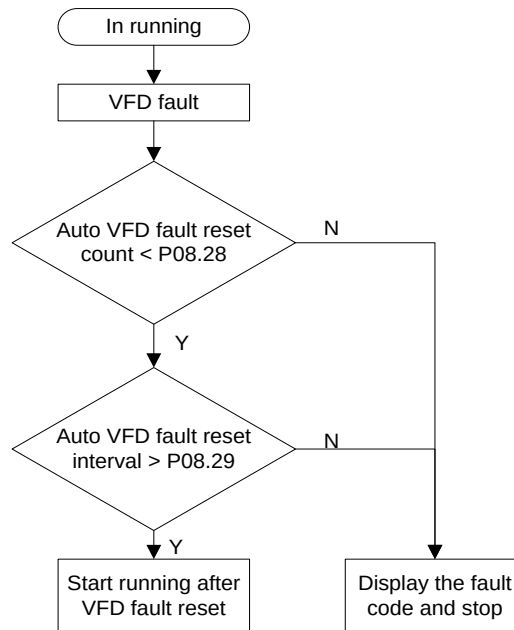
1. Logic diagram for start after a running command is given at power-on



2. Logic diagram for restart after inverter unit power loss



3. Logic diagram for restart after inverter unit automatic fault reset



Related parameter list:

Inverter function code	Name	Description	Default
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	0
P00.11	ACC time 1	Setting range: 0.0–3600.0s	Depends on model
P00.12	DEC time 1	Setting range: 0.0–3600.0s	Depends on model
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after speed tracking (with excitation) 3: Start after speed tracking (without excitation) 4: Start after speed tracking (software)	0
P01.01	Starting frequency of direct start	Setting range: 0.00–50.00Hz	0.50Hz
P01.02	Starting frequency hold time	Setting range: 0.0–50.0s	0.0s

Inverter function code	Name	Description	Default
P01.03	Braking current before start	Setting range: 0.0–100.0%	0.0%
P01.04	DC braking time before start	Setting range: 0.00–50.00s	0.00s
P01.05	ACC/DEC mode	0: Linear 1: S curve Note: If option 1 is selected, set P01.06, P01.07, P01.27 and P01.28 accordingly.	0
P01.08	Stop mode	0: Decelerate to stop 1: Coast to stop	0
P01.09	Starting frequency for braking at stop	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	0.00Hz
P01.10	Demagnetization time	Setting range: 0.00–30.00s	0.00s
P01.11	DC braking current at stop	Setting range: 0.0–100.0%	0.0%
P01.12	DC braking time at stop	Setting range: 0.00–50.00s	0.00s
P01.13	FWD/REV run deadzone time	Setting range: 0.0–3600.0s	0.0s
P01.14	FWD/REV run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1
P01.15	Stop speed	Setting range: 0.00–100.00Hz	0.50Hz
P01.16	Stop speed detection mode	0: Based on speed reference (only detection mode available in SVPWM control mode) 1: Based on speed feedback	0
P01.18	Terminal run command protection at power-up	0: Terminal run command invalid at power-up 1: Terminal run command valid at power-up	0
P01.19	Action when running frequency falls below the lower limit (valid when frequency lower limit > 0)	Setting range: 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place (valid only when ones place = 1 or 2): Stop method 0: Coast to stop 1: Decelerate to stop	0x00
P01.20	Wake-up-from-sleep delay	Setting range: 0.0–3600.0s Note: Valid only when the ones place of P01.19 is 2.	0.0s
P01.21	Power-loss restart selection	0: Disable restart 1: Enable restart	0
P01.22	Power-loss restart wait time	Setting range: 0.0–3600.0s Note: Valid only when the ones place of P01.21 is 1.	1.0s
P01.23	Start delay time	0.0–600.0s	0.0s
P01.24	Stop speed delay time	0.0–600.0s	0.0s
P01.25	Open-loop 0Hz output selection	0: Output without voltage 1: Output with voltage 2: Output according to the DC braking current at stop	0
P01.26	DEC time for emergency stop	Setting range: 0.0–60.0s	2.0s
P01.27	Time of starting segment of DEC S curve	Setting range: 0.0–50.0s	0.1s

Inverter function code	Name	Description	Default
P01.28	Time of ending segment of DEC S curve	Setting range: 0.0–50.0s	0.1s
P01.29	Short-circuit braking current	Setting range: 0.0–150.0% (of the VFD rated output current)	0.0%
P01.30	Short-circuit braking hold time at start	Setting range: 0.00–50.00s	0.00s
P01.31	Short-circuit braking hold time at stop	Setting range: 0.00–50.00s	0.00s
P01.32	Pre-excitation time for jogging	Setting range: 0–10.000s	0.300s
P01.33	Starting frequency of braking at jog stop	Setting range: 0.00Hz–P00.03	0.00Hz
P01.34	Sleep entry delay time	Setting range: 0–3600.0s	0.0s
P05.01–P05.04	Digital input function selection	1: Forward run 2: Reverse run 4: Forward jog 5: Reverse jog 6: Coast to stop 7: Fault reset 8: Run pause 21: ACC/DEC time selection 1 22: ACC/DEC time selection 2 30: ACC/DEC disable	/
P08.00	ACC time 2	Setting range: 0.0–3600.0s	Depends on model
P08.01	DEC time 2	Setting range: 0.0–3600.0s	Depends on model
P08.02	ACC time 3	Setting range: 0.0–3600.0s	Depends on model
P08.03	DEC time 3	Setting range: 0.0–3600.0s	Depends on model
P08.04	ACC time 4	Setting range: 0.0–3600.0s	Depends on model
P08.05	DEC time 4	Setting range: 0.0–3600.0s	Depends on model
P08.06	Running frequency of jog	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	5.00Hz
P08.07	ACC time for jog	Setting range: 0.0–3600.0s	Depends on model
P08.08	DEC time for jog	Setting range: 0.0–3600.0s	Depends on model
P08.19	Switching frequency of ACC/DEC time	Setting range: 0.00 Hz–P00.03 (Max. output frequency) 0.00Hz: No switchover If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0.00Hz
P08.21	Base frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz	0

Inverter function code	Name	Description	Default
		Note: Valid for straight ACC/DEC only.	
P08.28	Auto fault reset count	Setting range: 0–10	0
P08.29	Auto fault reset interval	Setting range: 0.1–3600.0s	1.0s

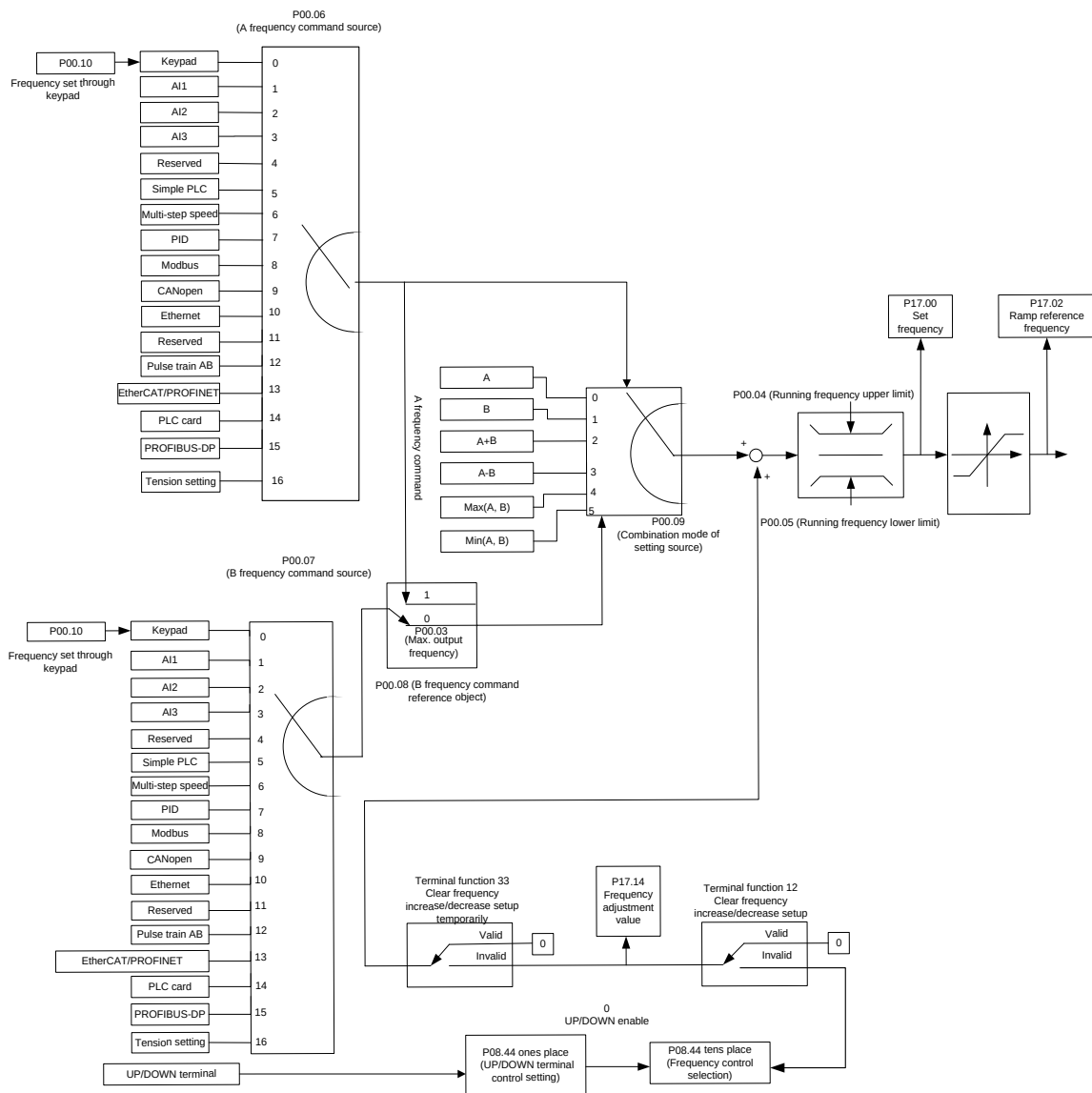
5.6.8 Frequency setting

The inverter unit supports multiple types of frequency reference modes, which can be categorized into: main reference channel and auxiliary reference channel.

There are two main reference channels, namely frequency reference channel A and frequency reference channel B. These two channels support simple arithmetical operation between each other, and they can be switched dynamically by setting multifunction terminals.

There is one input mode for auxiliary reference channel, namely terminal **UP/DOWN** digital input. By setting function codes, you can enable the corresponding reference mode and the impact made on the inverter frequency reference by this reference mode.

The actual reference of the inverter unit is comprised of the main reference channel and auxiliary reference channel.



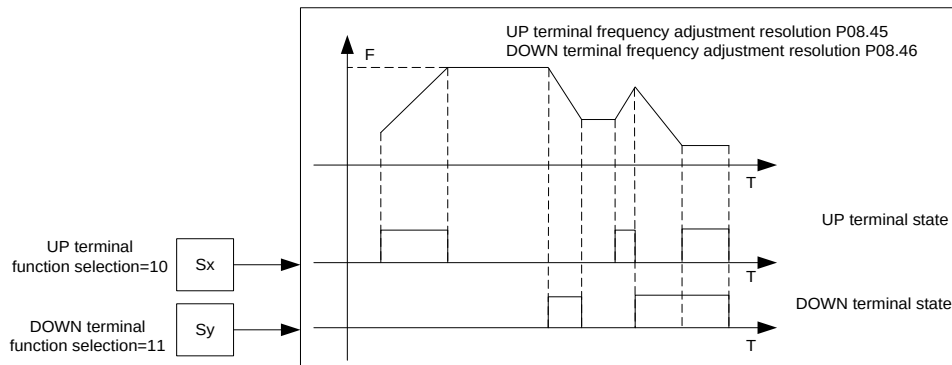
The inverter unit supports switchover between different reference channels, and the rules for channel switching are shown

in the following.

Present reference channel P00.09	Multifunction terminal function 13 (Switch from channel A to channel B)	Multifunction terminal function 14 (Switch from combined setting to channel A)	Multifunction terminal function 15 (Switch from combined setting to channel B)
A	B	/	/
B	A	/	/
A+B	/	A	B
A-B	/	A	B
Max(A, B)	/	A	B
Min(A, B)	/	A	B

Note: "/" indicates that the multifunction terminal function is not available for the selected reference channel.

When setting the internal auxiliary frequency of the inverter unit through multi-function terminal UP (10) and DOWN (11), you can increase/decrease the frequency quickly by setting P08.45 (UP terminal frequency adjustment resolution) and P08.46 (DOWN terminal frequency adjustment resolution).



Related parameter list:

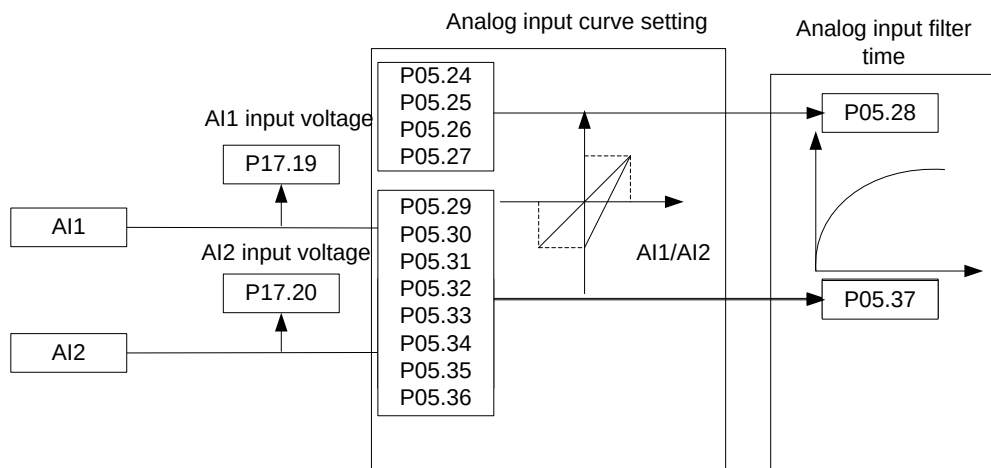
Inverter function code	Name	Description	Default
P00.03	Max. output frequency	Setting range: Max(P00.04,10.00)–590.00Hz	50.00Hz
P00.04	Running frequency upper limit	Setting range: P00.05–P00.03	50.00Hz
P00.05	Running frequency lower limit	Setting range: 0.00Hz–P00.04	0.00Hz
P00.06	A frequency command source	0: Keypad 1: AI1 2: AI2 3: AI3 4: Reserved 5: Simple PLC program 6: Multi-step speed running 7: PID control	0

Inverter function code	Name	Description	Default
P00.07	B frequency command source	8: Modbus communication 9: CANopen communication 10: Ethernet communication 11: Reserved 12: Pulse train AB 13: EtherCAT/PROFINET communication 14: PLC card 15: PROFIBUS-DP communication 16: Tension setting (valid only for A frequency command)	11
P00.08	B frequency command reference object	0: Max. output frequency 1: A frequency command	0
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min(A, B)	0
P05.01– P05.04	Function selection of multifunction digital input terminals (S1–S4)	10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting	/
P08.44	UP/DOWN terminal control setting	Setting range: 0x000–0x221 Ones place: Frequency enable selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000
P08.45	UP terminal frequency adjustment resolution	Setting range: 0.01–50.00Hz	0.50Hz
P08.46	DOWN terminal frequency adjustment resolution	Setting range: 0.01–50.00Hz	0.50Hz
P17.00	Set frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.02	Ramp reference frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz

Inverter function code	Name	Description	Default
P17.14	Frequency adjustment value	Range: 0.00Hz–P00.03	0.00Hz

5.6.9 Analog input

The inverter unit carries two analog input terminals, in which the AI1 setting range is 0–10V/0–20mA and whether AI1 uses voltage input or current input can be set through P05.50, and the AI2 setting range is -10–10V. Each input can be filtered separately, and the corresponding reference curve can be set by adjusting the reference corresponds to the max. value and min. value.



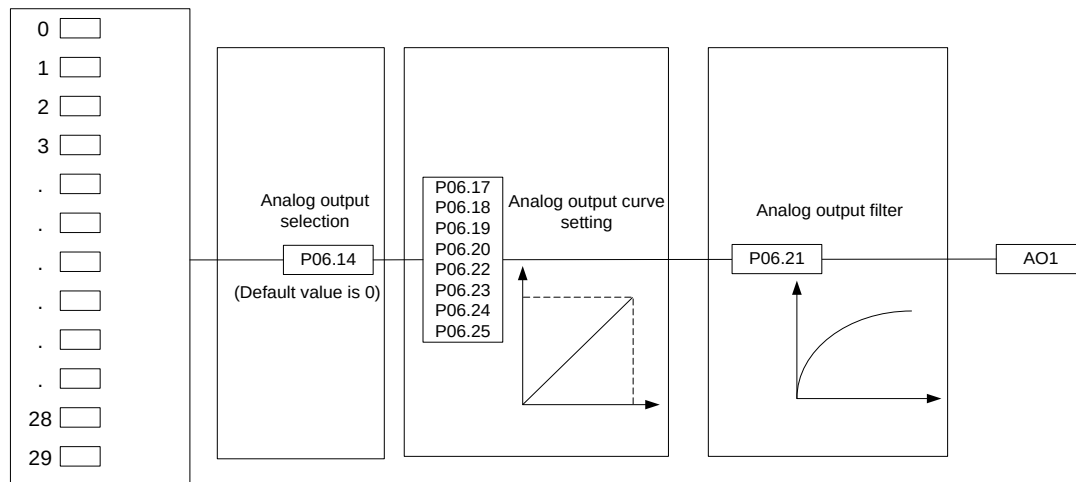
Related parameter list:

Inverter function code	Name	Description	Default
P05.24	AI1 lower limit	Setting range: 0.00V–P05.26	0.00V
P05.25	Corresponding setting of AI1 lower limit	Setting range: -300.0%–300.0%	0.0%
P05.26	AI1 upper limit	Setting range: P05.24–10.00V	10.00V
P05.27	Corresponding setting of AI1 upper limit	Setting range: -300.0%–300.0%	100.0%
P05.28	AI1 input filter time	Setting range: 0.000–10.000s	0.100s
P05.29	AI2 lower limit	Setting range: -10.00V–P05.31	-10.00V
P05.30	Corresponding setting of AI2 lower limit	Setting range: -300.0%–300.0%	-100.0%
P05.31	AI2 middle value 1	Setting range: P05.29–P05.33	0.00
P05.32	Corresponding setting of AI2 middle value 1	Setting range: -300.0%–300.0%	0.0%
P05.33	AI2 middle value 2	Setting range: P05.31–P05.35	0.00
P05.34	Corresponding setting of AI2 middle value 2	Setting range: -300.0%–300.0%	0.0%
P05.35	AI2 upper limit	Setting range: P05.33–10.00V	10.00V
P05.36	Corresponding setting of AI2 upper limit	Setting range: -300.0%–300.0%	100.0%
P05.37	AI2 input filter time	Setting range: 0.000–10.000s	0.030s

Inverter function code	Name	Description	Default
P05.50	AI1 input signal type	0: Voltage type 1: Current type	0

5.6.10 Analog output

The inverter unit carries one analog output terminal, of which the setting range is 0–10V/0–20mA. Analog output can be configured as voltage or current signals through setting P06.32. Analog output signals can be filtered separately, and the proportional relation can be adjusted by setting the max. value, min. value, and the percentage of their corresponding output. Analog output signal can output motor speed, output frequency, output current, motor torque and motor power at a certain proportion.



For AO output description, see the description for P06.14. (The min. value and max. value of the output correspond to 0.0% and 100.00% of the pulse or analog output. The actual output voltage or pulse frequency corresponds to the actual percentage, which can be set through function codes.)

Related parameter list:

Inverter function code	Name	Description	Default
P06.14	AO1 output	Setting range: 0–63	0
P06.15–P06.16	Reserved	For details, see Group P06—Output terminal functions in the inverter function parameter section.	0
P06.17	Voltage-type AO1 output lower limit	Setting range: -300.0%–P06.19	0.0%
P06.18	AO1 output corresponding to lower limit	Setting range: 0.00V–10.00V	0.00V
P06.19	Voltage-type AO1 output upper limit	Setting range: P06.17–300.0%	100.0%
P06.20	AO1 output corresponding to upper limit	Setting range: 0.00–10.00V	10.00V
P06.21	AO1 output filter time	Setting range: 0.000–10.000s	0.000s
P06.22	Current-type AO1	Setting range: -300.0%–P06.24	0.0%

Inverter function code	Name	Description	Default
	output lower limit		
P06.23	AO1 output corresponding to lower limit (current type)	Setting range: 0.00–20.00mA	0.00mA
P06.24	Current-type AO1 output upper limit	Setting range: P06.22–300.0%	100.0%
P06.25	AO1 output corresponding to upper limit (current type)	Setting range: 0.00–20.00mA	20.00mA
P06.32	AO1 output signal type	0: Voltage type 1: Current type	0

5.6.11 Motor temperature detection

5.6.11.1 Using an expansion card

Both the VFD IO expansion card (EC-IO702) and 24V simplified incremental PG card (EC-PG707-24) have the temperature sampling module. EC-IO702 supports the connection to temperature sensors of PT100, PT1000, KTY84, and NTC, while EC-PG707-24 supports the connection to temperature sensors of PT100, PT1000, and KTY84. Regardless of which temperature sensors are used, the wiring of the motor temperature detection sensors is the same. The following uses EC-IO702 as an example to describe the wiring method and setting.

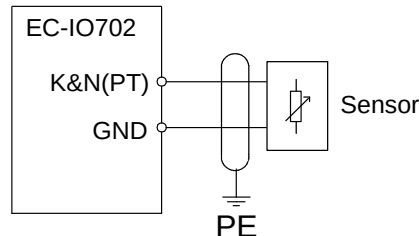


Figure 5-6 IO expansion card temperature sensor wiring

After installing the IO expansion card to the inverter unit, you can wire the temperature sensor according to the preceding figure. Then set P25.41 (Type of sensor for IO card to detect motor temperature), set P25.42–P25.44 (that is, set IO card detected motor OH protection threshold, Detection time of IO card detected motor OH protection, and Detection time of IO card detected motor OH protection). You can set P11 (Action to protect against motor OH during running). If you select a temperature sensor of the NTC type, you need to set B25/85 (P25.45).

Related function parameters:

Inverter function code	Name	Description	Default
P19.12	PG card detected motor temperature	Setting range: -20.0–200.0°C	0.0°C
P19.13	IO card detected motor temperature	Setting range: -20.0–200.0°C	0.0°C
P25.41	Type of sensor for IO card to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000	0

Inverter function code	Name	Description	Default
		3: KTY84 4: 5K NTC temperature sensor 5: 10K NTC temperature sensor	
P25.42	IO card detected motor OH protection threshold	Setting range: -20.0–200.0°C	110.0°C
P25.43	Detection time of IO card detected motor OH protection	Setting range: 0.0–3600.0s	5.0s
P25.44	IO card detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C
P25.45	IO card NTC sensor B25/85 value	Setting range: -20.0–50.0°C	10.0°C
P25.46	NTC temperature calibration coefficient	Setting range: 0–6000k	0
P25.47	Type of sensor for PG card to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84	0
P25.48	PG card detected motor OH protection threshold	Setting range: -20.0–200.0°C	110.0°C
P25.49	Detection time of PG card detected motor OH protection	Setting range: 0.0–3600.0s	5.0s
P25.50	PG card detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C

5.6.11.2 Using AI/AO

Motor temperature detection via AI/AO supports PT100, PT1000, and KTY84 sensors. The wiring can be selected from AI1/AO1 or AI2/AO1 combinations. The following uses the AI1/AO1 combination as an example.

First, you need to set the AI1 input type to voltage (that is, set P05.50 to 0) and set AO1 output type to current (that is, set P06.32 to 1).

During wiring, connect the temperature sensor (thermistor) in series between AO1 and GND, and then connect AO1 and AI1. In this way, the voltage at both ends of the thermistor can be automatically detected, and the detected value of AI1 is the voltage value of both ends of the thermistor. According to Ohm's law, the resistance value of the current thermistor can be calculated, and the temperature value of the motor can be obtained by querying the resistance-and-temperature table. The wiring diagram is as follows.

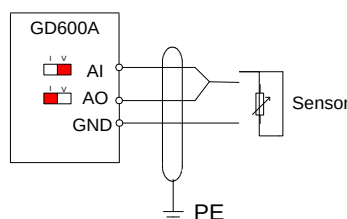


Figure 5-7 Wiring for AI/AO based motor temperature detection

AO1 outputs different fixed current values depending on the selected temperature sensor (set by P05.51). See the following table.

Temperature sensor type	PT100
AO1 output (recommended)	10.00mA

Note:

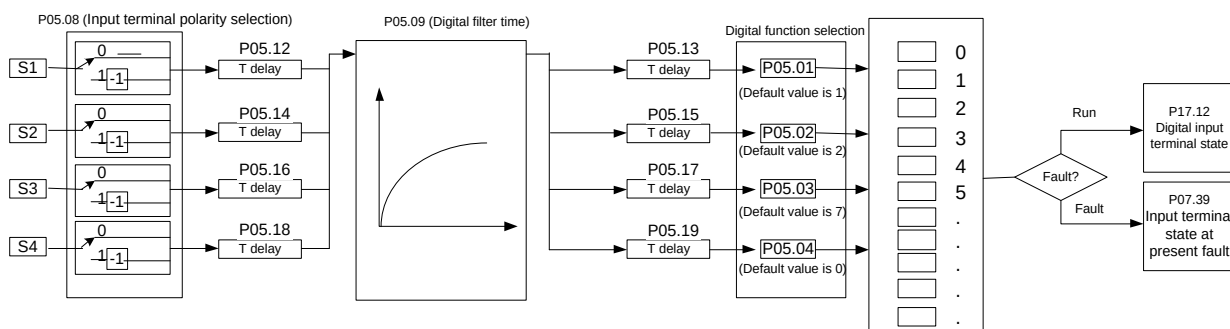
- When using the AI2/AO1 combination, you need to set P05.29 (AI2 lower limit) to 0.00V and P05.30 (Corresponding setting of AI2 lower limit) to 0.0%.
- To improve detection accuracy, you are recommended to perform an analog calibration before the detection.
- When AO1 is used for temperature detection, AO1 output selection (P06.14) is invalid.

Related function parameters of detecting motor temperature by using AI/AO:

Inverter function code	Name	Description	Default
P19.11	AI/AO detected motor temperature	Setting range: -20.0–200.0°C	0.0°C
P05.51	Type of sensor for AI/AO to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84	0
P05.52	AI/AO detected motor OH protection threshold	Setting range: -20.0–200.0°C	110.0°C
P05.53	AI/AO detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C
P05.54	KTY84 resistance offset (AI/AO temperature detection)	Setting range: -1000–1000	0
P05.55	PT100/PT1000 resistance offset (AI/AO temperature detection)	Setting range: -300.00–300.00	0.00
P05.56	Signal source for AI to detect motor temperature	0: Do not detect 1: AI1 2: AI2	0

5.6.12 Digital input

The inverter unit carries four programmable digital input terminals. The function of all the digital input terminals can be programmed through function codes.



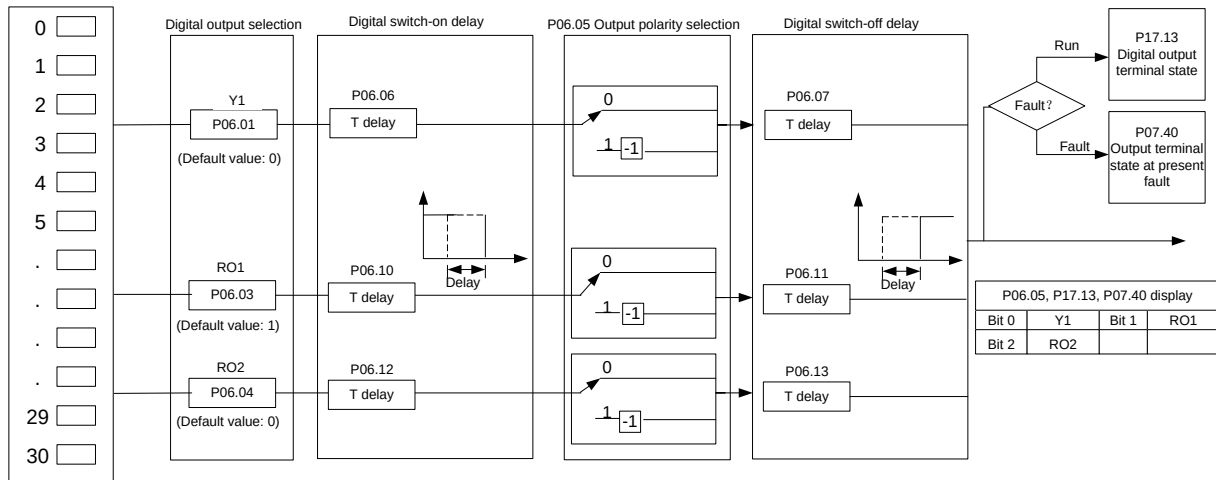
Note: Two different multifunction input terminals cannot be configured with a same function.

Related parameter list:

Inverter function code	Name	Description	Default								
P05.01	S1 function	Setting range: 0–111 For details, see Group P05—Input terminal functions in the inverter function parameter section.	1								
P05.02	S2 function		2								
P05.03	S3 function		7								
P05.04	S4 function		0								
P05.05–P05.07	Reserved		/								
P05.08	Input terminal polarity selection	Setting range: 0x0–0xF <table border="1"> <tr> <td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr> <tr> <td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr> </table>	Bit3	Bit2	Bit1	Bit0	S4	S3	S2	S1	0x0
Bit3	Bit2	Bit1	Bit0								
S4	S3	S2	S1								
P05.09	Digital input filter time	Setting range: 0.000–1.000s	0.010s								
P05.10	Virtual terminal setting	Setting range: 0x0–0xF (0: disable; 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal	0x0								
P05.11	Terminal control mode	0: Two-wire control mode 1 1: Two-wire control mode 2 2: Three-wire control mode 1 3: Three-wire control mode 2	0								
P05.12	S1 switch-on delay	Setting range: 0.000–50.000s	0.000s								
P05.13	S1 switch-off delay	Setting range: 0.000–50.000s	0.000s								
P05.14	S2 switch-on delay	Setting range: 0.000–50.000s	0.000s								
P05.15	S2 switch-off delay	Setting range: 0.000–50.000s	0.000s								
P05.16	S3 switch-on delay	Setting range: 0.000–50.000s	0.000s								
P05.17	S3 switch-off delay	Setting range: 0.000–50.000s	0.000s								
P05.18	S4 switch-on delay	Setting range: 0.000–50.000s	0.000s								
P05.19	S4 switch-off delay	Setting range: 0.000–50.000s	0.000s								
P07.39	Input terminal state at present fault	Setting range: 0x0000–0xFFFF	0x0000								
P17.12	Digital input terminal state	Setting range: 0x0–0xF <table border="1"> <tr> <td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr> <tr> <td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr> </table>	Bit3	Bit2	Bit1	Bit0	S4	S3	S2	S1	0x0
Bit3	Bit2	Bit1	Bit0								
S4	S3	S2	S1								

5.6.13 Digital output

The inverter unit carries two groups of relay output terminal, and one open collector Y output terminal. All digital output terminal functions can be programmed via function codes.



Note: The multi-function output terminals allow the same function to be assigned repeatedly.

Related parameter list:

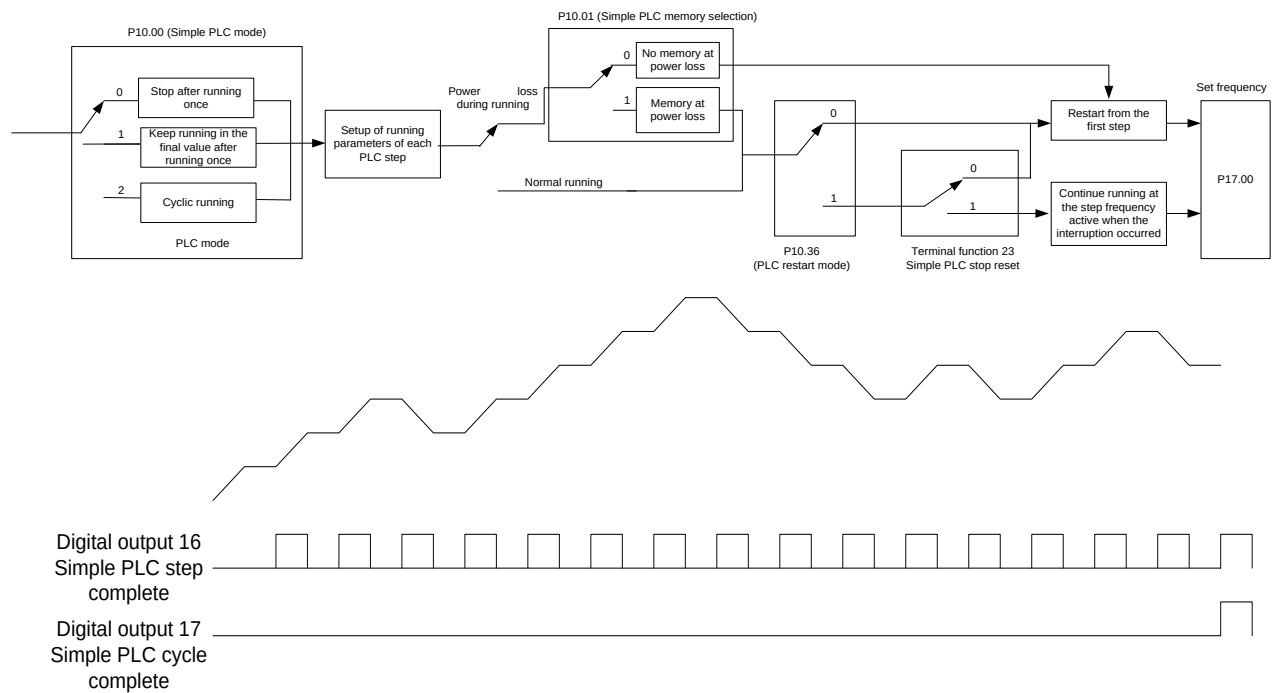
Inverter function code	Name	Description	Default						
P06.01	Y1 output	Setting range: 0–81	0						
P06.02	Reserved	For details, see Group P06—Output terminal functions in the inverter function parameter section.	/						
P06.03	RO1 output selection		1						
P06.04	RO2 output selection		0						
P06.05	Output terminal polarity selection	Setting range: 0x0–0x7 When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. <table><tr><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>Y1</td></tr></table>	Bit2	Bit1	Bit0	RO2	RO1	Y1	0x0
Bit2	Bit1	Bit0							
RO2	RO1	Y1							
P06.06	Y1 switch-on delay	Setting range: 0.000–50.000s	0.000s						
P06.07	Y1 switch-off delay	Setting range: 0.000–50.000s	0.000s						
P06.10	RO1 switch-on delay	Setting range: 0.000–50.000s	0.000s						
P06.11	RO1 switch-off delay	Setting range: 0.000–50.000s	0.000s						
P06.12	RO2 switch-on delay	Setting range: 0.000–50.000s	0.000s						
P06.13	RO2 switch-off delay	Setting range: 0.000–50.000s	0.000s						
P07.40	Output terminal state at present fault		0x0000						
P17.13	Digital output terminal state	Setting range: 0x0–0xF <table><tr><td>Bit3</td><td>Bit2</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>Y1</td></tr></table>	Bit3	Bit2	Bit0	RO2	RO1	Y1	0x0
Bit3	Bit2	Bit0							
RO2	RO1	Y1							

5.6.14 Simple PLC

A simple PLC is a multi-step speed generator, and the inverter unit can change the running frequency and direction automatically based on the run time to fulfill process requirements. Previously, such function was realized with external PLC, while now, the inverter unit itself can achieve this function.

The inverter unit can realize 16-step speed control, and provide four groups of ACC/DEC time for you to choose.

After the set PLC completes one cycle (or one step), one ON signal can be output by the multifunction relay.



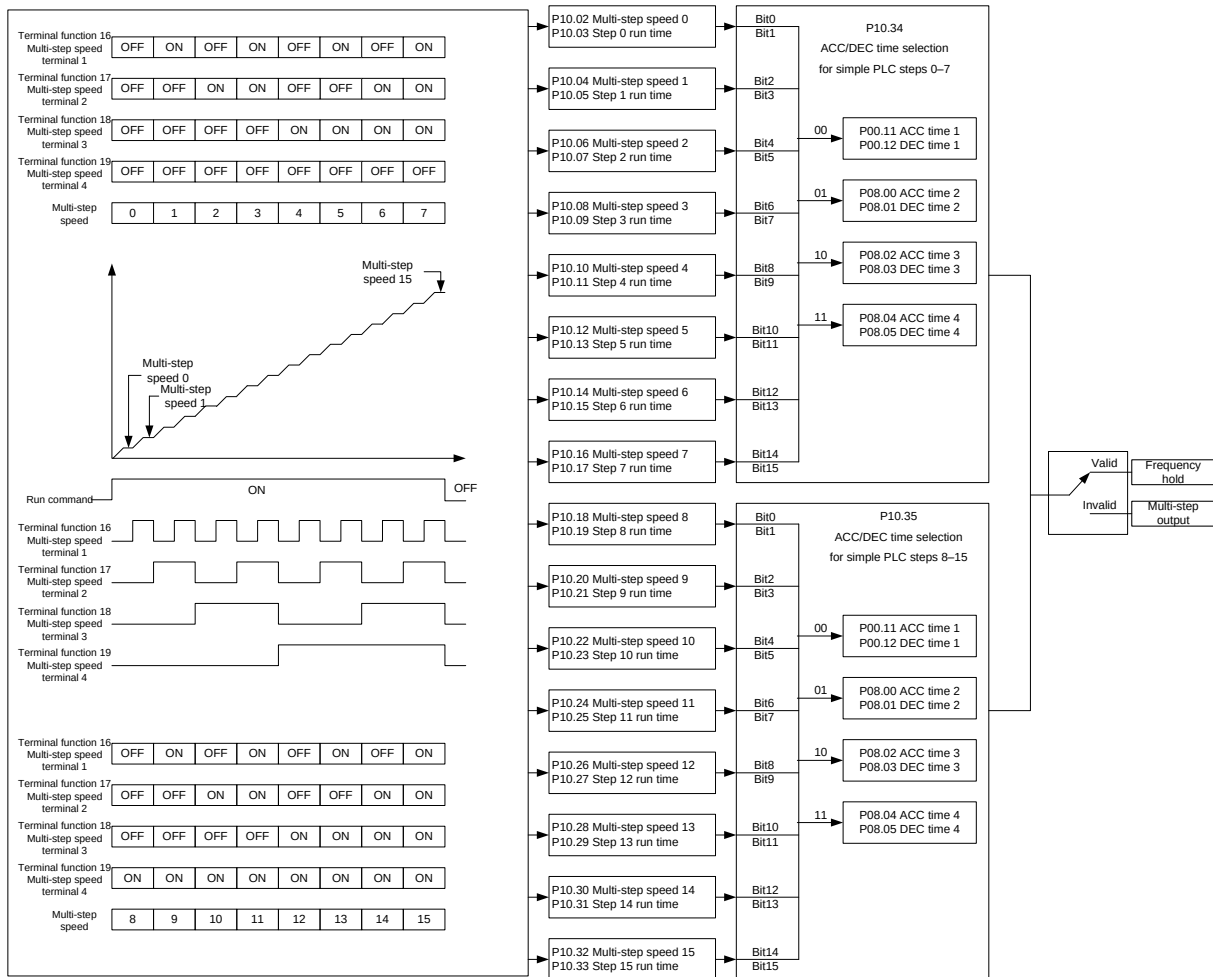
Related parameter list:

Inverter function code	Name	Description	Default
P05.01–P05.04	Digital input function selection	23: Simple PLC stop and reset 24: Simple PLC pause 25: PID control pause	/
P06.01–P06.04	Digital output function selection	16: Simple PLC stage reached 17: Simple PLC cycle reached	/
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0
P10.01	Simple PLC power-loss memory	0: Disable 1: Enable	0
P10.02	Multi-step speed 0	Setting range: -100.0%–100.0%	0.0%
P10.03	Step 0 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.04	Multi-step speed 1	Setting range: -100.0%–100.0%	0.0%
P10.05	Step 1 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.06	Multi-step speed 2	Setting range: -100.0%–100.0%	0.0%
P10.07	Step 2 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.08	Multi-step speed 3	Setting range: -100.0%–100.0%	0.0%
P10.09	Step 3 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.10	Multi-step speed 4	Setting range: -100.0%–100.0%	0.0%
P10.11	Step 4 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.12	Multi-step speed 5	Setting range: -100.0%–100.0%	0.0%
P10.13	Step 5 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.14	Multi-step speed 6	Setting range: -100.0%–100.0%	0.0%
P10.15	Step 6 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.16	Multi-step speed 7	Setting range: -100.0%–100.0%	0.0%

Inverter function code	Name	Description	Default
P10.17	Step 7 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.18	Multi-step speed 8	Setting range: -100.0%–100.0%	0.0%
P10.19	Step 8 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.20	Multi-step speed 9	Setting range: -100.0%–100.0%	0.0%
P10.21	Step 9 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.22	Multi-step speed 10	Setting range: -100.0%–100.0%	0.0%
P10.23	Step 10 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.24	Multi-step speed 11	Setting range: -100.0%–100.0%	0.0%
P10.25	Step 11 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.26	Multi-step speed 12	Setting range: -100.0%–100.0%	0.0%
P10.27	Step 12 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.28	Multi-step speed 13	Setting range: -100.0%–100.0%	0.0%
P10.29	Step 13 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.30	Multi-step speed 14	Setting range: -100.0%–100.0%	0.0%
P10.31	Step 14 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.32	Multi-step speed 15	Setting range: -100.0%–100.0%	0.0%
P10.33	Step 15 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.34	ACC/DEC time selection for simple PLC steps 0–7	Setting range: 0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time selection for simple PLC steps 8–15	Setting range: 0x0000–0xFFFF	0x0000
P10.36	PLC restart mode	0: Restart from the first step 1: Continue running at the step frequency active at the time of interruption.	0
P17.00	Set frequency	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	0.00Hz
P17.27	Present step of simple PLC	Displays the present step of the simple PLC function. Setting range: 0–15	0

5.6.15 Multi-step speed running

Set the parameters for multi-step speed operation of the inverter unit. The inverter unit supports 16 multi-step speeds. These speeds are selected by the combinations of multi-step speed terminals 1–4 and correspond to multi-step speeds 0 through 15.



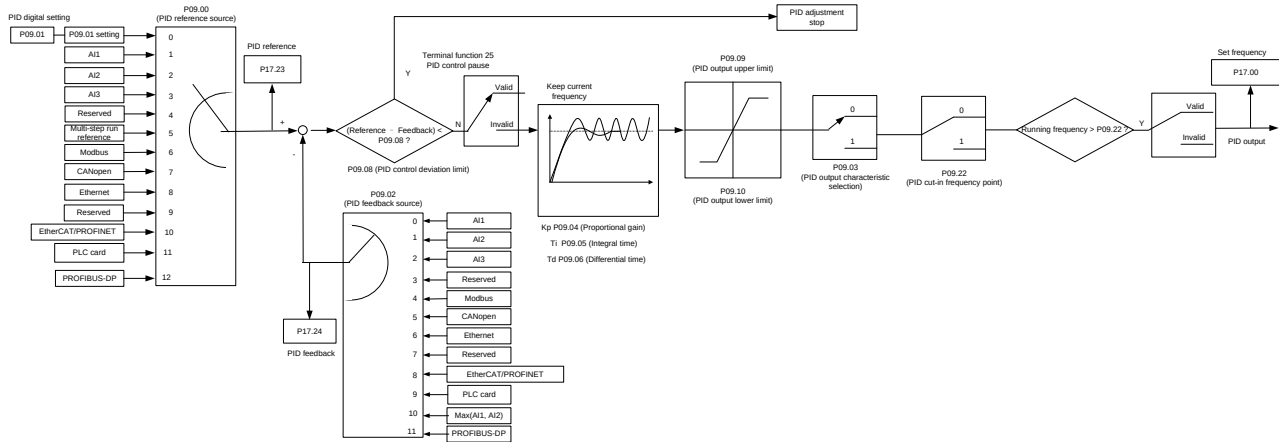
Related parameter list:

Inverter function code	Name	Description	Default
P05.01–P05.04	Digital input function selection	16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Multi-step speed pause	/
P10.02	Multi-step speed 0	Setting range: -100.0%–100.0%	0.0%
P10.03	Step 0 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.04	Multi-step speed 1	Setting range: -100.0%–100.0%	0.0%
P10.05	Step 1 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.06	Multi-step speed 2	Setting range: -100.0%–100.0%	0.0%
P10.07	Step 2 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.08	Multi-step speed 3	Setting range: -100.0%–100.0%	0.0%
P10.09	Step 3 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.10	Multi-step speed 4	Setting range: -100.0%–100.0%	0.0%

Inverter function code	Name	Description	Default
P10.11	Step 4 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.12	Multi-step speed 5	Setting range: -100.0%–100.0%	0.0%
P10.13	Step 5 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.14	Multi-step speed 6	Setting range: -100.0%–100.0%	0.0%
P10.15	Step 6 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.16	Multi-step speed 7	Setting range: -100.0%–100.0%	0.0%
P10.17	Step 7 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.18	Multi-step speed 8	Setting range: -100.0%–100.0%	0.0%
P10.19	Step 8 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.20	Multi-step speed 9	Setting range: -100.0%–100.0%	0.0%
P10.21	Step 9 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.22	Multi-step speed 10	Setting range: -100.0%–100.0%	0.0%
P10.23	Step 10 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.24	Multi-step speed 11	Setting range: -100.0%–100.0%	0.0%
P10.25	Step 11 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.26	Multi-step speed 12	Setting range: -100.0%–100.0%	0.0%
P10.27	Step 12 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.28	Multi-step speed 13	Setting range: -100.0%–100.0%	0.0%
P10.29	Step 13 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.30	Multi-step speed 14	Setting range: -100.0%–100.0%	0.0%
P10.31	Step 14 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.32	Multi-step speed 15	Setting range: -100.0%–100.0%	0.0%
P10.33	Step 15 run time	Setting range: 0.0–6553.5s(min)	0.0s
P10.34	ACC/DEC time selection for simple PLC steps 0–7	Setting range: 0x0000–0xFFFF	0x0000
P10.35	ACC/DEC time selection for simple PLC steps 8–15	Setting range: 0x0000–0xFFFF	0x0000
P17.27	Present step of simple PLC	Displays the present step of the simple PLC function. Setting range: 0–15	0

5.6.16 PID control

PID control is a widely used method in process control. By comparing the feedback signal of the controlled variable with the target signal, it performs proportional, integral, and derivative calculations to adjust the output frequency or voltage of the inverter unit. This forms a negative feedback system to ensure the controlled variable remains stable at the target value. PID control is applicable to various process control scenarios, such as flow, pressure, and temperature. The following is the basic schematic block diagram for output frequency regulation.



Introduction to the working principles and control methods for PID control:

Proportional control (Kp): When the feedback is different from the reference, the output will be proportional to the difference. If such a difference is constant, the regulating variable will also be constant. Proportional control can respond to feedback changes rapidly, however, it cannot eliminate the difference by itself. A larger proportional gain indicates a faster regulating speed, but a too large gain will result in oscillation. To solve this problem, set the integral time to a large value and the differential time to 0, run the system only with proportional control, and then change the reference to observe the difference (that is, static difference) between the feedback signal and reference. If the static difference occurs in the direction of reference change (such as reference increase, where the feedback is always less than the reference after system stabilizes), continue increasing the proportional gain; otherwise, decrease the proportional gain. Repeat this process until the static difference becomes small.

Integral time (Ti): When feedback is different from reference, the output regulating variable accumulates continuously, if the difference persists, the regulating variable will increase continuously until difference disappears. The integral regulator can be used to eliminate static difference. However, too large regulation may lead to repetitive overshoot, which will cause system instability and oscillation. The feature of oscillation caused by strong integral effect is that the feedback signal fluctuates up and down based on the reference variable, and fluctuation range increases gradually until oscillation occurs. The integral time parameter is generally regulated gradually from large to small until the stabilized system speed fulfills the requirement.

Differential time (Td): When the difference between feedback and reference changes, there is output of the regulating variable that is proportional to the difference variation rate, and this regulating variable is only related to the direction and magnitude of the difference change rather than the direction and magnitude of the difference itself. Differential control is used to control the feedback signal variation based on the change trend. Exercise caution before using the differential regulator since it may enlarge the system interferences, especially those with high change frequency.

When the frequency command selection (P00.06, P00.07) is 7 or the voltage setting channel selection (P04.27) is 6, the inverter unit is process PID controlled.

5.6.16.1 General procedure for PID parameter setting

1. Determine proportional gain P.

When proportional gain P is determined, remove the integral term and derivative term of PID first by setting $T_i=0$ and $T_d=0$ (see PID parameter setup for details), thus turning the system into pure proportional control. Set the input to 60%–70% of the max. allowable value. Increase the proportional gain P gradually from 0 until system oscillation occurs. Then decrease the proportional gain P gradually until system oscillation disappears. Record the proportional gain P at this point, and set the PID proportional gain P to 60%–70% of the present value. This is the entire commissioning procedure of proportional gain P.

2. Determine integral time T_i .

After proportional gain P is determined, set the initial value of a larger integral time T_i , and decrease T_i gradually until

system oscillation occurred, and then in turn, increase T_i until system oscillation disappears. Record the value of T_i at this point, and set the integral time constant T_i of PID to 150%–180% of this value. This is the commissioning procedure of integral time constant T_i .

3. Determine derivative time T_d .

The derivative time T_d is generally set to 0.

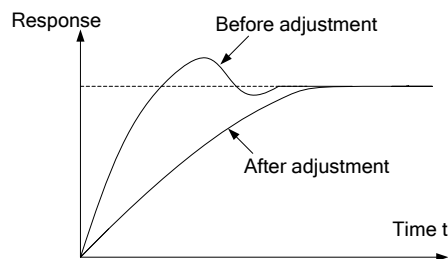
If you need to set T_d to another value, the setting method is similar to that for P and T_i , namely, set T_d to 30% of the value when there is no oscillation.

4. Empty system load, perform load-carrying joint debugging, and then adjust PID parameters until fulfilling the requirement.

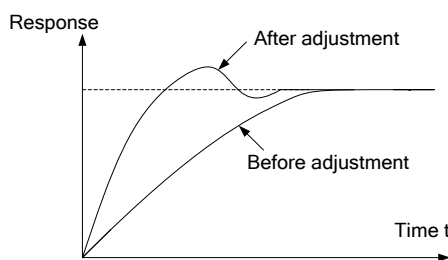
5.6.16.2 PID fine-tuning methods

After setting the PID control parameters, you can fine-tune these parameters using the following methods.

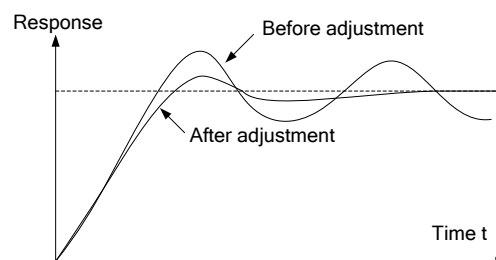
Control overshoot: When overshoot occurred, shorten the differential time (T_d) and prolong integral time (T_i).



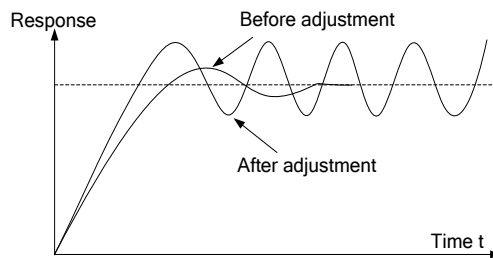
Stabilize the feedback value as fast as possible: When overshoot occurred, shorten integral time (T_i) and prolong differential time (T_d) to stabilize control as fast as possible.



Control long-term vibration: If the cycle of periodic vibration is longer than the set value of integral time (T_i), it indicates the integral action is too strong, prolong the integral time (T_i) to control vibration.



Control short-term vibration: If the vibration cycle is as short almost the same as the set value of differential time (T_d), it indicates the differential action is too strong. Shorten the differential time (T_d) to suppress oscillation. When the differential time (T_d) is set to 0.00 (namely no differential control), and there is no way to suppress oscillation, decrease the proportional gain.



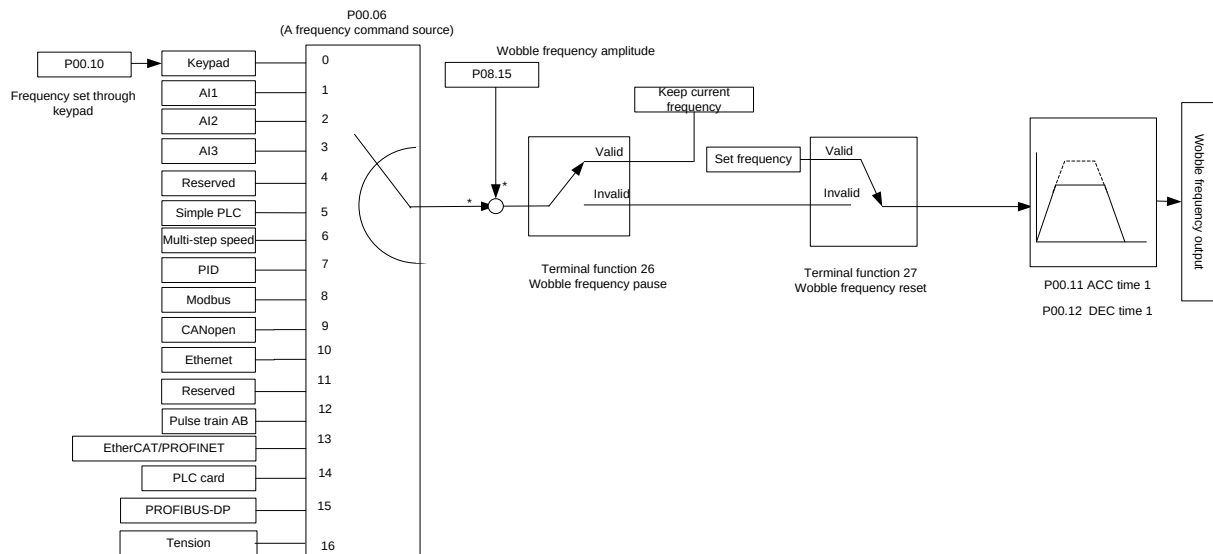
Related parameter list:

Inverter function code	Name	Description	Default
P09.00	PID reference source	0: Set by P09.01 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step running 6: Modbus communication 7: CANopen communication 8: Ethernet communication 9: Reserved 10: EtherCAT/PROFINET communication 11: PLC card 12: PROFIBUS-DP communication	0
P09.01	PID digital setting	Setting range: -100.0%–100.0%	0.0%
P09.02	PID feedback source	0: AI1 1: AI2 2: AI3 3: Reserved 4: Modbus communication 5: CANopen communication 6: Ethernet communication 7: Reserved 8: EtherCAT/PROFINET communication 9: PLC card 10: MAX(AI1, AI2) 11: PROFIBUS-DP communication	0
P09.03	PID output characteristic selection	0: PID output is positive. 1: PID output is negative.	0
P09.04	Proportional gain (Kp)	Setting range: 0.00–100.00	1.80
P09.05	Integral time (Ti)	Setting range: 0.01–10.00s	0.90s
P09.06	Differential time (Td)	Setting range: 0.00–10.00s	0.00s
P09.07	Sampling cycle (T)	Setting range: 0.000–10.000s	0.100s
P09.08	PID control deviation limit	Setting range: 0.0–100.0%	0.0%
P09.09	PID output upper limit	Setting range: P09.10–100.0% (Max. frequency or voltage)	100.0%
P09.10	PID output lower limit	Setting range: -100.0%–P09.09 (Max. frequency or voltage)	0.0%

Inverter function code	Name	Description	Default
P09.11	Feedback disconnection detection value	Setting range: 0.0–100.0%	0.0%
P09.12	Feedback disconnection detection time	Setting range: 0.0–3600.0s	1.0s
P09.13	PID control selection	Setting range: 0x0000–0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: Same as the main reference direction. 1: Contrary to the main reference direction. Hundreds place: 0: Limit according to max. frequency 1: Limit according to A frequency Thousands place: 0: A+B frequency. ACC/DEC buffering for main frequency reference A does not take effect. 1: A+B frequency. ACC/DEC buffering for main frequency reference A takes effect. The ACC/DEC is determined by P08.04 (ACC time 4).	0x0001
P09.14	Low frequency proportional gain (Kp)	Setting range: 0.00–100.00	1.00
P09.15	PID command ACC/DEC time	Setting range: 0.0–1000.0s	0.0s
P09.16	PID output filter time	Setting range: 0.000–10.000s	0.000s
P09.17	Reserved	/	/
P09.18	Low frequency integral time (Ti)	Setting range: 0.00–10.00s	0.90s
P09.19	Low frequency differential time (Td)	Setting range: 0.00–10.00s	0.00s
P09.20	Low frequency point for PID parameter switching	Setting range: 0.00Hz–P09.21	5.00Hz
P09.21	High frequency point for PID parameter switching	Setting range: P09.20–P00.03(Hz)	10.00Hz
P09.22	PID cut-in frequency	Setting range: 0.00Hz–P00.03	0.00Hz
P17.00	Set frequency	Range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz
P17.23	PID reference value	Range: -100.0%–100.0%	0.0%
P17.24	PID feedback value	Range: -100.0%–100.0%	0.0%

5.6.17 Wobble frequency operation

The wobble frequency function is mainly used in applications that require traverse motion and winding, such as the textile and chemical fiber industries. The typical working process is shown as follows.



Inverter function code	Name	Description	Default
P00.03	Max. output frequency	Setting range: Max(P00.04,10.00)–590.00Hz	50.00Hz
P00.06	A frequency command source	0: Keypad 1: AI1 2: AI2 3: AI3 4: Reserved 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: CANopen communication 10: Ethernet communication 11: Reserved 12: Pulse train AB 13: EtherCAT/PROFINET communication 14: PLC card 15: PROFIBUS-DP communication 16: Tension setting (valid only for A frequency command)	0
P00.11	ACC time 1	Setting range: 0.0–3600.0s	Depends on model
P00.12	DEC time 1	Setting range: 0.0–3600.0s	Depends on model
P05.01–P05.04	Digital input function selection	26: Pause wobbling frequency (stopped at the present frequency) 27: Reset wobbling frequency (returned to the center frequency)	/
P08.15	Amplitude of wobble frequency	Setting range: 0.0–100.0% (of the set frequency)	0.0%

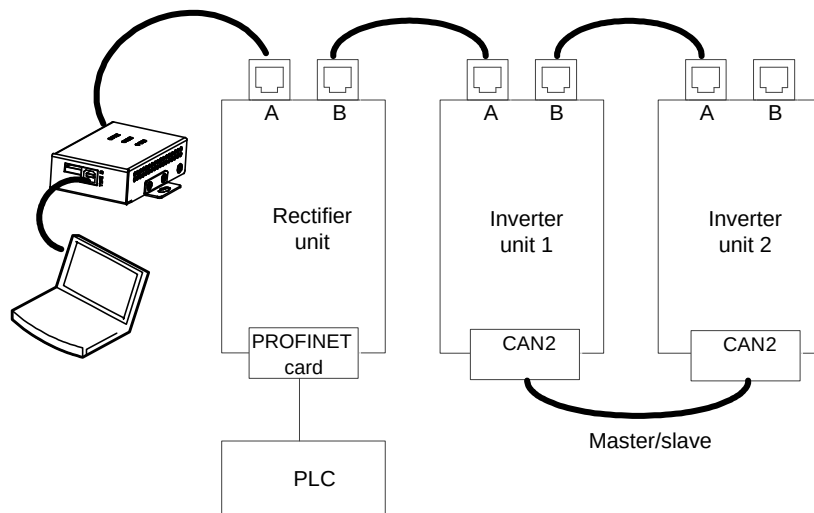
Inverter function code	Name	Description	Default
P08.16	Amplitude of sudden jump frequency	Setting range: 0.0–50.0% (of the amplitude of wobble frequency)	0.0%
P08.17	Rise time of wobble frequency	Setting range: 0.1–3600.0s	5.0s
P08.18	Fall time of wobble frequency	Setting range: 0.1–3600.0s	5.0s

5.6.18 Master/slave control

The inverter unit supports master/slave control, enabling multiple inverter units to drive the same load. Master/slave control can be applied to speed synchronization and power balance.

5.6.18.1 Function description

The master and slave inverter units are connected via CAN2 terminals, as shown in the following figure.



Master/slave power balance control is a control method that distributes the load among two or more motors to achieve a uniform balance. When a transmission device is driven by two or more motors, and two or more motor shafts are coupled with each other through gears, chains or conveyor belts, it is necessary to distribute the load between the motors through the master/slave control method to meet the control accuracy requirements.

Generally, a system where multiple VFDs control multiple motors coupled via belts is referred to as a flexible connection (or soft connection). In such cases, it is recommended that the slave unit operates in speed control mode and utilizes the droop function to achieve optimal power balance. Master/slave mode 0 is recommended.

In general, a system where multiple VFDs control multiple motors via coaxial, gear, or chain connections is referred to as a rigid connection (hard connection). In such cases, it is more effective for the slave unit to adopt torque control mode. Master/slave mode 1 is recommended.

5.6.18.2 Master/slave control

The following master/slave modes are available. Master/slave modes 0–2 are used for power balance. Master/slave mode 0 and master/slave mode 1 are used often.

Master/slave mode 0 (P28.02 ones place=0)

Basic principle: Both the master and slave adopt the speed control mode, and the power balance is achieved by the droop control.

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 0

both for the master and slave to select master/slave mode 0, and adjust P28.03 for the slave based on the actual situation.

The master sends the run command and speed to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the speed given by the master. At this time, adjust the droop frequency of the slave P08.30 to meet the power balance requirement.

Master/slave mode 1 (P28.02 ones place=1)

Basic principle: The master and slave must use the vector control mode of the same type, the master uses speed control, and the slave will be forced to use the torque control mode and use the master output torque as the reference torque.

Commissioning method: Set P28.00 to 1 for the master, set P28.00 to 2 for the slave, set the ones place of P28.02 to 1 both for the master and slave to select master/slave mode 1, and adjust P28.04 for the slave based on the actual situation. The slave will switch to torque mode automatically, and therefore P03 parameters do not need to be adjusted.

The master sends the run command and torque to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the torque given by the master.

Master/slave mode 2 (Combined mode, P28.02 ones place=2)

Basic principle: The slave starts in the speed control mode (master/slave mode 0) and then switches to the torque mode (master/slave mode 1) at a certain frequency point.

Commissioning method: Set P28.00 to 1 on the master VFD and set P28.00 to 2 on the slave VFD. Then, set the ones place of P28.02 to 2 for both the master and slave to select master/slave mode 2. The slave can set P28.03 (slave speed gain) and P28.04 (slave torque gain) based on actual requirements, and set P28.05 (master/slave mode 2 switching frequency).

The master sends the running command, speed and torque to the slave through CAN communication. The slave starts according to the command given by the master and runs according to the speed given by the master if the switching frequency point is not reached but runs according to the torque given by the master if the switching frequency point is reached.

Inverter function code	Name	Description	Recommended value (Master)	Recommended value (Slave)
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	1	2
P28.01	Master/slave communication data selection	0: Local CAN master/slave communication channel 1: Reserved	0	0
P28.02	Master/slave control mode	Setting range: 0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0 (Master: speed; Slave: speed) 1: Master/slave mode 1 (Master: speed; Slave: torque) 2: Master/slave mode 2 (Master: speed; Slave: speed then torque) Tens place: Slave start command source 0: Master 1: P00.01 setting Hundreds place: Enable master/slave to transmit/receive data	0x001	0x001

Inverter function code	Name	Description	Recommended value (Master)	Recommended value (Slave)
		0: Enable 1: Disable		
P28.03	Slave speed gain	Setting range: 0.0–500.0%	100.0%	100.0%
P28.04	Slave torque gain	Setting range: 0.0–500.0%	100.0%	100.0%
P28.05	Master/slave mode 2 switching frequency	Setting range: 0.00Hz–P00.03	5.00Hz	5.00Hz
P28.06	Slave count	Setting range: 1–15	Slave count	/
P28.07	Master/slave CAN communication timeout time	Setting range: 0.0–60.0s	5.0s	5.0s
P28.08	Master/slave CAN communication address	Setting range: 0–127 Note: No communication address setting is required for the master. The communication addresses for slaves must be consecutive, starting from 1.	1	2
P28.09	Master/slave CAN communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500Kbps 5: 800kbps 6: 1Mbps	4	4
P28.10	CAN slave torque offset	Setting range: -100.0%–100.0%	0.0%	0.0%
P28.11	Slave speed deviation window enable	0: Disable 1: Enable	0	0
P28.12	Slave positive speed deviation window upper limit	Setting range: 0.00–50.00Hz	5.00Hz	5.00Hz
P28.13	Slave negative speed deviation window lower limit	Setting range: 0.00–50.00Hz	5.00Hz	5.00Hz
P28.14	Slave torque mode frequency limiting selection	Setting range: 0x00–0x11 Ones place: 0: The slave's set frequency is 5Hz higher than the master's. 1: The slave's set frequency equals the master's. Tens place: 0: Standard mode 1: In slave torque mode, the REV running frequency under regenerative conditions is limited to 0Hz.	0x00	0x00
P28.15	Starting torque of slave zero-speed limiting in reverse direction	Setting range: 0.0–100.0%	10.0%	10.0%

Inverter function code	Name	Description	Recommended value (Master)	Recommended value (Slave)
P28.21	Droop negative limit	Setting range: 0.00–20.00Hz	0.00Hz	0.00Hz
P28.22	Slave torque direction selection in torque mode	Setting range: 0x00–0x12 Ones place: Forcible torque follow-up 0: Standard mode 1: Forced to follow the master torque direction 2: Reserved Tens place: Forcible speed follow-up 0: Standard mode 1: Forced to follow the master speed direction	0x00	0x00

5.6.19 Commissioning procedures for closed-loop control, position control and spindle positioning

5.6.19.1 Commissioning procedure for asynchronous motor closed-loop vector control

Step 1 Restore to default values through the keypad.

Step 2 Set P00.03, P00.04 and motor nameplate parameters in group P02.

Step 3 Perform motor parameter autotuning.

If the motor can be disconnected from the load, you can perform rotary parameter autotuning; otherwise, perform static parameter autotuning. The parameters obtained from autotuning are automatically saved to motor parameters in group P02.

Step 4 Verify whether the encoder is installed and set properly.

- Determine the encoder direction and parameter settings.

Set P20.01 (Encoder PPR), set P00.00 to 2, and set P00.10 to 5.00Hz. Run the inverter unit, and the motor will rotate at 5Hz. Observe the speed measurement in P18.00. If the value is negative, the encoder direction is reversed; in this case, set the ones place of P20.02 to 1. If the speed value deviates significantly, P20.01 is set incorrectly. Check whether P18.02 (encoder Z pulse count value) fluctuates. If yes, it indicates the encoder suffers interference or P20.01 is set improperly. Then check the wiring and the shield layer.

- Determine the Z pulse direction.

Set P00.10 to 5.00 Hz and set P00.13 (Running direction selection) to forward and reverse respectively. Observe the difference between forward and reverse rotations in P18.02, which should be less than 5. If the issue persists after setting the Z-pulse direction to reverse in P20.02, power off the unit and swap the encoder phase A and phase B wires. Then, observe the difference in P18.02 again. The Z pulse direction only affects the forward/reverse positioning precision of the spindle positioning carried out with Z pulses.

Step 5 Perform closed-loop vector pilot-run.

Set P00.00 to 3 to perform closed-loop vector control. Adjust P00.10 and the speed and current loop PI parameters in the P03 group to ensure stable operation across the entire speed range.

Step 6 Perform flux-weakening control.

Set the flux-weakening proportional gain (P03.26) and observe the flux-weakening control effect. Flux-weakening adjustment parameters P03.22–P03.24 can be adjusted as needed.

5.6.19.2 Commissioning procedure for synchronous motor closed-loop vector control

Step 1 Set P00.18=1 to restore factory default settings.

Step 2 Set P00.00=3 (Closed-loop vector control), set P00.03, P00.04, and the motor nameplate parameters in group P02.

Step 3 Set P20.01.

When using a resolver encoder, set the encoder PPR to (Resolver pole pairs * 1024). For example, for a 4-pole pair resolver, set P20.01 to 4096.

Step 4 Verify that the encoder is installed and set properly.

When the motor is at a standstill, observe the value in P18.21 (Resolver angle), which should be stable or show minimal fluctuation. If significant fluctuation occurs, check the wiring and grounding. Rotate the motor slowly, and check whether P18.21 changes accordingly. If yes, it indicates that the motor is connected correctly; if the value of P18.02 remains unchanged as a non-zero value after multiple turns of rotation, it indicates that the encoder Z signal is correct.

Step 5 Autotune the initial position of magnetic pole.

Set P20.11 to 2 (Static autotuning) or 3 (Rotary autotuning), and press the **DATA/ENT** key to run the inverter unit.

- Rotary autotuning (P20.11=3)

Detect the present magnetic pole position when autotuning starts, and then accelerate to 10Hz to autotune the magnetic pole position of encoder Z pulses, and then decelerate to stop.

If the ENC1O or ENC1D fault occurs during running, set P20.02 ones place to 1 and perform autotuning again.

After autotuning is completed, the angle obtained from autotuning is saved to P20.09 and P20.10 automatically.

- Static autotuning

In the scenarios where the load can be disconnected, you are recommended to adopt rotary autotuning (P20.11=3) for high angle precision. If the load cannot be disconnected, you can adopt static autotuning (P20.11=2). The magnetic pole position obtained from autotuning is saved to P20.09 and P20.10 automatically.

Step 6 Perform closed-loop vector pilot-run.

Adjust P00.10 and speed loop and current loop PI parameters in group P03 to ensure a stable run across the entire range. If oscillation occurs, in most cases, you should reduce the values of P03.00 and P03.03, as well as P03.54 (Current loop bandwidth). If current oscillation noise occurs during low speed running, adjust P20.05.

Note: You must re-determine P20.02 (Encoder direction) and perform magnetic pole position autotuning again if the motor or encoder wires are swapped.

5.6.19.3 Commissioning procedure for pulse train control

Pulse input is operated based on closed-loop vector control; speed detection is needed in the subsequent spindle positioning, zeroing operation and division operation.

Step 1 Restore to default values through the keypad.

Step 2 Set P00.03, P00.04 and motor nameplate parameters in group P02.

Step 3 Motor parameter autotuning: rotary parameter autotuning or static parameter autotuning.

Step 4 Verify that the encoder is installed and set properly. Set P00.00=3 and P00.10=20Hz, then perform a run to test the control performance and effectiveness of the system.

Step 5 Set P21.00=0x0001 to set the positioning mode to position control, namely pulse train control. There are four types of pulse command mode, which can be set by P21.01 (Pulse command mode).

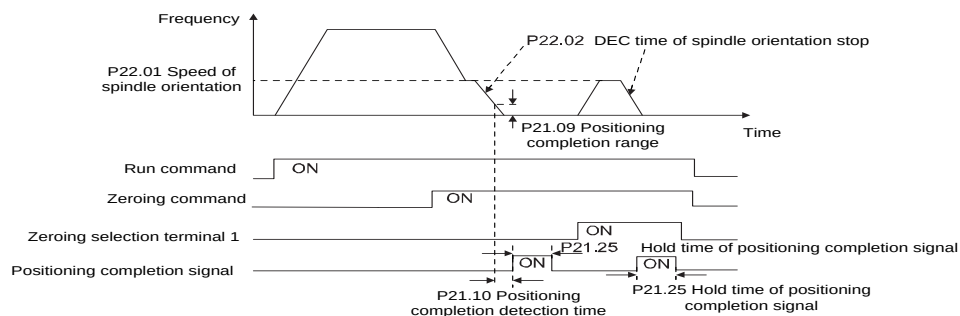
In position control mode, you can view the high bits and low bits of position reference and feedback and other key

parameters, including P18.02 (Z-pulse count), P18.00 (Measured encoder frequency), P18.17 (Pulse command frequency), and P18.19 (Position regulator output). From these parameters, you can identify the relationship between P18.08 (Position reference point) and P18.02 (Z-pulse count), as well as the correlation among P18.17 (Pulse command frequency), P18.18 (Pulse command feedforward), and P18.19 (Position regulator output).

- Step 6 The position regulator has two gains, namely P21.02 and P21.03, and they can be switched by speed command, torque command and terminals.
- Step 7 When P21.08 (Position regulator output limit) is set to 0, position control becomes invalid. In this case, the pulse train serves as the frequency source. P21.13 (Position feedforward gain) must be set to 100%, and the acceleration/deceleration time is determined by that of the pulse train, which is adjustable. If the pulse train acts as the frequency source for speed control, you can also set P21.00 to 0x0000, and set the frequency source reference P00.06 or P00.07 to 12 (AB pulse train). In this case, the acceleration/deceleration time is determined by the inverter unit, while the parameters for the AB pulse train are still configured via group P21. In speed mode, the filter time of AB pulse train is determined by P21.29.
- Step 8 The input frequency of pulse train is consistent with the feedback frequency of encoder pulse, the relationship between them can be changed by modifying P21.11 (Numerator of position command ratio) and P21.12 (Denominator of position command ratio).
- Step 9 When the run command is valid or the servo enable is active (via the configuration of P21.00 or terminal function 63), the system enters the pulse train servo running mode.

5.6.19.4 Commissioning procedure for spindle orientation

Spindle orientation is to realize orientation functions like zeroing and division based on closed-loop vector control.



Steps 1 to 4 are identical to the first four steps in 5.6.19.2 Commissioning procedure for synchronous motor closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control, thus realizing spindle orientation in either position control or speed control mode.

- Step 5 Set P22.00 (Spindle orientation mode selection) bit 0=1 to enable spindle orientation. Set P22.00 bit 1 to select the spindle zero point input: set P22.00 bit 1=0 to select Z-pulse input when the system uses an encoder for speed measurement, or set P22.00 bit 1=1 to select the photoelectric switch as the reference point input when the system uses a photoelectric switch for speed measurement. Set P22.00 bit 2 to select the reference point search mode, and set P22.00 bit 3 to enable or disable reference point correction. Select the reference point correction mode by setting P22.00 bit 7.

- ### Step 6 Spindle homing operation:

Select the positioning direction by setting P22.00 bit 4.

Group P22 provides four zero positions. By setting the homing input terminal selection (46, 47) in group P05, you can select one of the four zero positions. When the homing function is executed, the motor stops precisely at the corresponding zero position according to the preset positioning direction. The status can be monitored via P18.10.

The positioning distance for spindle homing is determined by the orientation deceleration time and the orientation speed.

Step 7 Spindle indexing operation:

Group P22 provides seven indexing positions. By configuring the indexing input terminal selection (48, 49, 50) in group P05, you can select one of the seven indexing positions. When the indexing terminal is enabled after the motor has reached the orientation position, the motor retrieves the status from the indexing position table and moves to the corresponding position incrementally. The status can be monitored via P18.09.

Step 8 Priority level of speed control, position control, homing, and indexing:

Speed control has a higher priority than indexing. When the system is in indexing mode, the motor will switch to speed or position control mode as long as the spindle orientation disable command is active. Homing also has a higher priority than indexing.

Homing has a higher priority than indexing.

An indexing command becomes valid when the indexing terminals switch from a 000 state to a non-000 state. For example, if the state changes from 000 to 011, the spindle executes indexing 3. The transition time during terminal switchover must be less than 10ms; otherwise, an incorrect indexing command may be executed.

Step 9 Position hold:

The position loop gain during positioning is P21.03; while the position loop gain in positioning-completion-hold state is P21.02. To maintain sufficient torque without system oscillation, please adjust P03.00, P03.01, P20.05, and P21.02.

Step 10 Positioning command selection (P22.00 bit 6):

Level signal: Positioning commands (homing and indexing) require an active run command or servo enable to be executed.

Step 11 Spindle reference point selection (P22.00 bit 0):

Encoder Z pulse positioning supports the following spindle orientation methods:

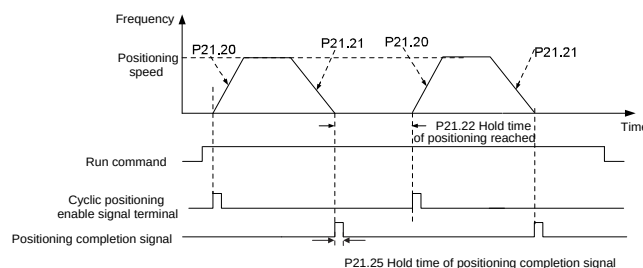
- Encoder installed on the motor shaft: The motor shaft and the spindle are rigidly connected with a 1:1 ratio.
- Encoder installed on the motor shaft: The motor shaft and the spindle are connected via a belt with a 1:1 ratio. At this point, the belt may slip during high-speed running and cause inaccurate positioning, it is recommended to install proximity switch on the spindle.
- Encoder installed on the spindle: The motor shaft and the spindle are connected via a belt, and the transmission ratio may not be 1:1. In this case, set P20.06 (Encoder installation transmission ratio) while keeping P22.14 (Spindle transmission ratio) set to 1. As the encoder is not installed on the motor, the control performance of closed-loop vector will be affected.

Proximity switch positioning supports the following spindle positioning modes:

When the encoder is installed on the motor shaft, the transmission ratio between the motor shaft and the spindle may not be 1:1. In this case, P22.14 (Spindle transmission ratio) must be configured.

5.6.19.5 Commissioning procedure for digital positioning

The diagram for digital positioning is shown as follows.



Steps 1 to 4 are identical to the first four steps in 5.6.19.2 Commissioning procedure for synchronous motor closed-loop

vector control, which aim to fulfill the control requirements of closed-loop vector control.

Step 5 Set the ones place and tens place of P21.00 to 0x11 to enable digital positioning. Set P21.17 and P21.11/P21.12 as required by the application to define the positioning displacement. Set P21.18 and P21.19 to define the positioning speed. Set P21.20 and P21.21 to define the positioning acceleration time and deceleration time.

Step 6 Single positioning operation:

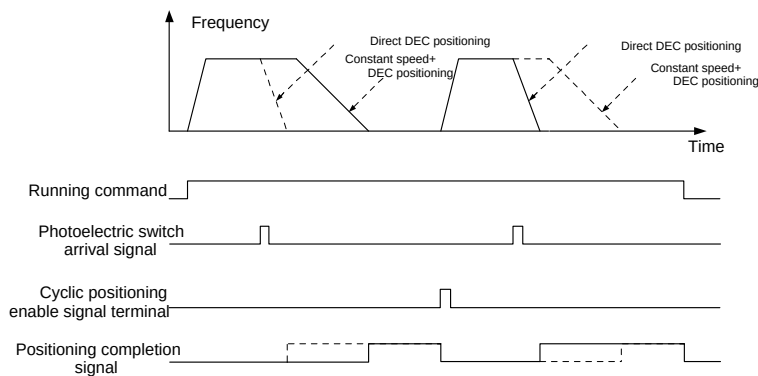
Set P21.16.bit1=0, and the motor will execute a single positioning action according to the settings in step (5) and maintain the position.

Step 7 Cyclic positioning operation:

Set P21.16 bit1=1 to enable cyclic positioning. The cyclic positioning is divided into continuous mode and repetitive mode. You can also carry out cyclic positioning through terminal function (no. 55, enable digital positioning cycle)

5.6.19.6 Commissioning procedure for photoelectric switch orientation positioning

Photoelectric switch positioning is to realize positioning function based on closed-loop vector control.



Steps 1 to 4 are identical to the first four steps in 5.6.19.2 Commissioning procedure for synchronous motor closed-loop vector control, which aim to fulfill the control requirements of closed-loop vector control.

Step 5 Set P21.00=0x0021 to enable photoelectric switch positioning, but note that the photoelectric switch signal can be connected to S8 only, and set P05.08=43; meanwhile, set P21.17, P21.11 and P21.12 (to set positioning displacement) based on actual needs; set P21.21 (DEC time of positioning). However, when the current running speed is too fast or the set positioning displacement is too small, the DEC time of positioning is invalid, and it enters direct deceleration positioning mode.

Step 6 Cyclic positioning operation:

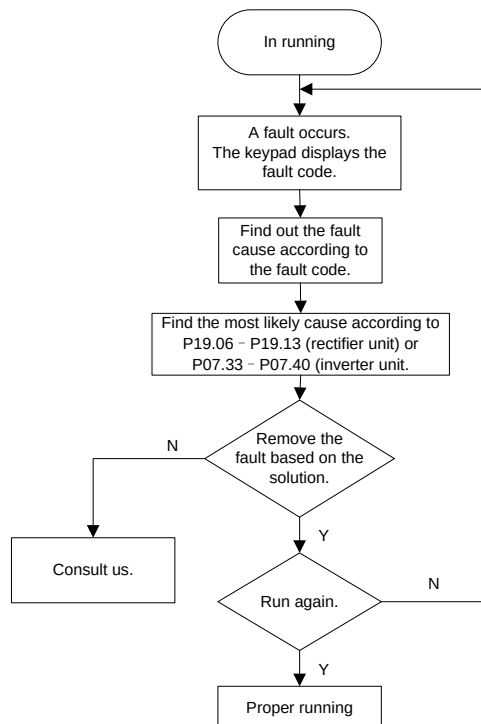
After positioning is done, the motor will stay in current position. You can set cyclic positioning through input terminal function selection (55: enable cyclic digital positioning) in P05 group; when the terminal receives cyclic positioning enable signal (pulse signal), the motor will continue running at the set speed as per the speed mode and re-enter positioning state after encountering the photoelectric switch.

Step 7 Position hold:

The position loop gain during positioning is P21.03; while the position loop gain in positioning-completion-hold state is P21.02. In order to keep sufficient position-hold force and ensure no system oscillation occurred, adjust P03.00, P03.01, P20.05 and P21.02.

5.6.20 Fault handling

This section describes the fault information for the Goodrive600A rectifier and inverter units to help users diagnose and troubleshoot faults.



For rectifier unit parameters, refer to the gateway-type rectifier function parameter group or the non-gateway-type rectifier function parameter group P19. For inverter unit parameters, refer to P07.27 to P07.56 in inverter function parameter group P07.

5.7 Introduction to the host controller software Workshop

The Workshop software is commissioning software that supports the Goodrive600A series. Its icon is shown below.



INVT
Workshop

With the Workshop, you can perform real-time monitoring, parameter setting, oscilloscope operation, and emergency stop on a PC. For detailed software information and operating instructions, visit the official INVT website.

Note: To connect to a PC, use the optional USB-to-RS485 communication module (model: EC-TM485-USB). For details, refer to appendix E.9.3 USB-RS485 communication module.

6 Communication networking

6.1 What this chapter contains

This chapter describes the standard communication protocols of the Goodrive600A series rectifier and inverter units, as well as various networking modes between the rectifier and inverter units.

The Goodrive600A series rectifier units and inverter units are equipped as standard with RS485 and CAN communication interfaces, and support the Modbus and CANopen slave communication protocols.

In addition to supporting the Modbus and CANopen slave communication protocols, the rectifier units also support the CANopen master function. By enabling the CANopen master function of a rectifier unit, a CANopen communication network can be established with inverter units.

Each rectifier unit and inverter unit is equipped as standard with two expansion interfaces for different types of communication expansion cards. Through expansion cards, the rectifier and inverter units can be connected to various communication networks.

In addition, the rectifier unit supports the CANopen master function, which can convert different communication protocols into CANopen messages for communication with inverter units, thereby forming a communication network.

6.2 Standard communication interface

The rectifier/inverter unit is equipped as standard with CANopen and RS485 communication interfaces. The communication terminal definitions are as follows:

Table 6-1 Rectifier/inverter unit RJ45 interface definition

Interface type	Network signal	Signal description	Description
RJ45 interface	RS485+	RS485 communication	Internal RS485 communication terminal, used to connect to the external keypad or PC. The interface type is RJ45.
	RS485-		
	CAN1H CAN1L	CAN communication	Internal CAN communication terminal. The interface type is RJ45. The CAN communication supports CANopen.
	8V CGND	External keypad power supply	Voltage is accurate to 10% and current to 100mA.

Table 6-2 Standard communication terminals on the rectifier/inverter panel

Interface type	Network signal	Signal description	Description
IO interface	C485+ C485-	RS485 communication	Terminal for external RS485 communication, supporting the Modbus communication protocol

6.3 Modbus networking

6.3.1 Network topology

The Modbus bus network wiring is shown in Figure 6-1. Use shielded twisted-pair cable. Connect the shield to CGND, and connect a 120 Ω termination resistor at each end of the bus to prevent signal reflections.

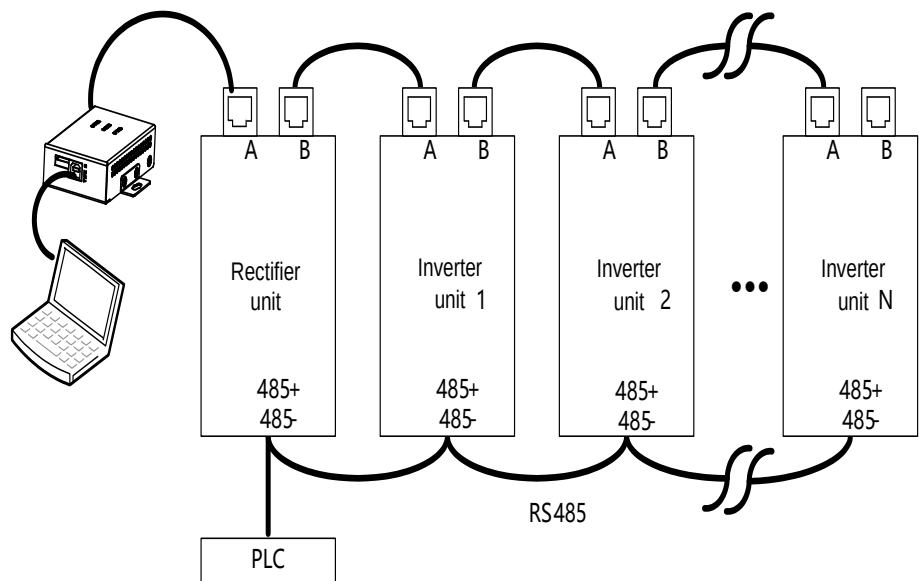


Figure 6-1 Network topology

6.3.2 RTU mode

6.3.2.1 RTU communication frame structure

When a controller is set to use the RTU communication mode on a Modbus network, every byte (8 bits) in the message includes 2 hexadecimal characters (each includes 4 bits). Compared with the ASCII mode, the RTU mode achieves transmission of more data at the same baud rate.

Coding system

- 1 start bit
- 7 or 8 data bits, with the least significant bit transmitted first Each 8-bit byte of the frame contains two hexadecimal characters (0–9, A–F)
- 1 parity bit (odd/even), if used; none if not used
- 1 stop bit (with parity) or 2 stop bits (without parity)

Error detection domain

- Cyclic redundancy check (CRC)

The following table describes the data format.

11-bit character frame (bits 1 to 8 are data bits):

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Bit8	Check bit	Stop bit
-----------	------	------	------	------	------	------	------	------	-----------	----------

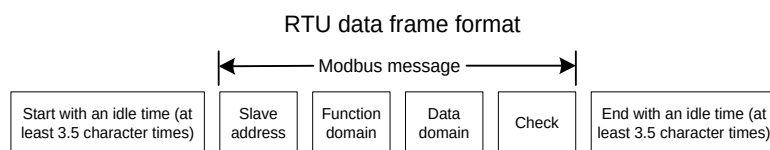
10-bit character frame (bits 1 to 7 are data bits):

Start bit	Bit1	Bit2	Bit3	Bit4	Bit5	Bit6	Bit7	Check bit	Stop bit
-----------	------	------	------	------	------	------	------	-----------	----------

In a character frame, the data bits are the bits that actually carry the data. The start bit, parity bit, and stop bit are added only to ensure correct transmission of the data bits to the receiving device. In practical applications, you must set the data bits, parity check bits, and stop bits consistently.

In RTU mode, a new frame always begins after an idle interval of at least 3.5 character times. On a network where the transmission rate is determined by the baud rate, the transmission time of 3.5 character times can be easily calculated. The fields in a frame are transmitted in the following sequence: slave address, command code, data, and CRC check. Each transmitted byte is represented by two hexadecimal characters (0–9, A–F). Devices on the network continuously monitor the communication bus. After receiving the first field (address information), each device checks whether the

address matches. After the last byte is transmitted, another interval of approximately 3.5 character times is used to indicate the end of the frame, after which transmission of a new frame begins.



A frame must be transmitted as a continuous data stream. If an interval longer than 1.5 character times occurs before the entire frame is transmitted, the receiving device clears the incomplete frame and incorrectly treats the next byte as the address field of a new frame. Likewise, if the interval between the start of a new frame and the end of the previous frame is less than 3.5 character times, the receiving device treats it as a continuation of the previous frame. As a result of the corrupted frame, the final CRC check value is incorrect, causing a communication fault.

If the slave detects a communication error, or if a read/write operation fails for any other reason, it returns an error frame.

START (frame header)	T1-T2-T3-T4 (3.5 character times)
ADDR (slave address domain)	Communication address: 0–247 (decimal system; 0 is the broadcast address)
CMD (function domain)	03H: read slave parameters 06H: write slave parameters
Data domain DATA (N-1) ... DATA (0)	Data of 2*N bytes, main content of the communication as well as the core of data exchanging.
CRC CHK LSB	Detection value: CRC verification value (16 bits)
CRC CHK MSB	
END (frame tail)	T1-T2-T3-T4 (3.5 character times)

6.3.2.2 RTU communication frame error check methods

During the transmission of data, errors may occur due to various factors. Without check, the data receiving device cannot identify data errors and may make an incorrect response. The incorrect response may cause severe problems. Therefore, the data must be checked.

The check is implemented as follows: The transmitter calculates the to-be-transmitted data based on a specific algorithm to obtain a result, adds the result to the rear of the message, and transmits them together. After receiving the message, the receiver calculates the data based on the same algorithm to obtain a result, and compares the result with that transmitted by the transmitter. If the results are the same, the message is correct. Otherwise, the message is considered incorrect.

The error check of a frame includes two parts, namely, bit check on individual bytes (that is, odd/even check using the check bit in the character frame), and whole data check (CRC check).

Bit check on individual bytes (odd/even check)

You can select the bit check mode as required, or you can choose not to perform the check, which will affect the check bit setting of each byte.

Definition of even check: Before the data is transmitted, an even check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is even, the check bit is set to "0"; and if it is odd, the check bit is set to "1".

Definition of odd check: Before the data is transmitted, an odd check bit is added to indicate whether the number of "1" in the to-be-transmitted data is odd or even. If it is odd, the check bit is set to "0"; and if it is even, the check bit is set to "1".

For example, the data bits to be sent are "11001110", including five "1". If the even check is applied, the even check bit is set to "1"; and if the odd check is applied, the odd check bit is set to "0". During the transmission of the data, the odd/even

check bit is calculated and placed in the check bit of the frame. The receiving device performs the odd/even check after receiving the data. If it finds that the odd/even parity of the data is inconsistent with the preset information, it determines that a communication error occurs.

Cyclic redundancy check (CRC)

A frame in the RTU format includes an error detection domain based on the CRC calculation. The CRC domain checks all the content of the frame. The CRC domain consists of two bytes, including 16 binary bits. It is calculated by the transmitter and added to the frame. The receiver calculates the CRC of the received frame, and compares the result with the value in the received CRC domain. If the two CRC values are not equal to each other, errors occur in the transmission.

During CRC, 0xFFFF is stored first, and then a process is invoked to process a minimum of 6 contiguous bytes in the frame based on the content in the current register. CRC is valid only for the 8-bit data in each character. It is invalid for the start, stop, and check bits.

During the generation of the CRC values, the "exclusive or" (XOR) operation is performed on the each 8-bit character and the content in the register. The result is placed in the bits from the least significant bit (LSB) to the most significant bit (MSB), and 0 is placed in the MSB. Then, LSB is detected. If LSB is 1, the XOR operation is performed on the current value in the register and the preset value. If LSB is 0, no operation is performed. This process is repeated for 8 times. After the last bit (8th bit) is detected and processed, the XOR operation is performed on the next 8-bit byte and the current content in the register. The final values in the register are the CRC values obtained after operations are performed on all the bytes in the frame.

The calculation adopts the international standard CRC check rule. You can refer to the related standard CRC algorithm to compile the CRC calculation program as required.

The following example is a simple CRC calculation function for your reference (using the C programming language):

```
Unsigned int crc_cal_value (unsigned char*data_value, unsigned char data_length)
{
    int i;
    unsigned int crc_value=0xffff;
    while (data_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) ;
}
```

In the ladder logic, CKSM uses the table look-up method to calculate the CRC value according to the content in the frame. The program of this method is simple, and the calculation is fast, but the ROM space occupied is large. Use this program with caution in scenarios where there are space occupation requirements on programs.

6.3.3 RTU command code and communication data

6.3.3.1 Command code 03H: Read N words (up to 16 consecutive words can be read)

The command code 03H is used by the master to read data from the VFD. The count of data to be read depends on the "data count" in the command. A maximum of 16 pieces of data can be read. The addresses of the read parameters must be contiguous. Each piece of data occupies 2 bytes, that is, one word. The command format is presented using the hexadecimal system (a number followed by "H" indicates a hexadecimal value). One hexadecimal value occupies one byte.

The 03H command is used to read information including the parameters and running status of the VFD.

For example, if the master reads two contiguous pieces of data (that is, to read content from the data addresses 0004H and 0005H) from the VFD whose address is 01H, the frame structures are described in the following.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (3.5 character times)
ADDR (address)	01H
CMD (command code)	03H
Start address MSB	00H
Start address LSB	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	85H
CRC MSB	CAH
END	T1-T2-T3-T4 (3.5 character times)

The value in START and END is "T1-T2-T3-T4 (transmission time of 3.5 bytes)", indicating that the RS485 needs to stay idle for at least the transmission time of 3.5 bytes. An idle time is required to distinguish on message from another to ensure that the two messages are not regarded as one.

"ADDR" is "01H", indicating that the command is sent to the VFD whose address is 01H. "ADDR" occupies one byte.

CMD=03H means the command message is sent to read data from the VFD and CMD occupies one byte.

"Start address" means reading data from the address and it occupies two bytes with the MSB on the left and LSB on the right.

"Data count" indicates the count of data to be read (unit: word). "Start address" is "0004H" and "Data count" is 0002H, indicating that data is to be read from the data addresses of 0004H and 0005H.

CRC check occupies two bytes, with the LSB on the left, and MSB on the right.

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (3.5 character times)
ADDR	01H
CMD	03H
Number of bytes	04H
Address 0004H data MSB	13H
Address 0004H data LSB	88H
Address 0005H data MSB	00H
Address 0005H data LSB	00H
CRC LSB	7EH
CRC MSB	9DH
End	T1-T2-T3-T4 (3.5 character times)

The definition of the response information is described as follows:

"ADDR" is "01H", indicating that the command is sent from the VFD whose address is 01H. "ADDR" occupies one byte.

"CMD" is "03H", indicating that the message is a response of the VFD to the 03H command of the master for reading data. The CMD information occupies one byte.

"Number of bytes" indicates the number of bytes between a byte (not included) and the CRC byte (not included). The value "04" indicates that there are four bytes of data between "Number of bytes" and "CRC LSB", that is, "MSB of data in 0004H", "LSB of data in 0004H", "MSB of data in 0005H", and "LSB of data in 0005H".

A piece of data contains two bytes, with the MSB on the left and LSB on the right. From the response, the data in 0004H is

1388H, and that in 0005H is 0000H.

CRC occupies two bytes with the MSB on the left and LSB on the right.

6.3.3.2 Command code 06H: Write one word

This command indicates that the master writes data to the VFD. Each command can write only one data item; multiple data items cannot be written with a single command. It is used to change VFD parameters, operating modes, and other settings.

For example, if the master writes 5000 (1388H) to 0004H of the VFD whose address is 02H, the frame structure is as follows.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (3.5 character times)
ADDR	02H
CMD	06H
Write data address MSB	00H
Write data address LSB	04H
Data content MSB	13H
Data content LSB	88H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (3.5 character times)

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (3.5 character times)
ADDR	02H
CMD	06H
Write data address MSB	00H
Write data address LSB	04H
Data content MSB	13H
Data content LSB	88H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (3.5 character times)

Note: The sections 6.3.3.1 and 6.3.3.2 mainly describe the command formats. For the detailed application, see the examples in section 6.3.7.

6.3.3.3 Command code 10H: Continuous write

The command code 10H is used by the master to write data to the VFD. The number of data items to be written is determined by the "Data count" field in the command. A maximum of 16 data items can be written consecutively.

For example, to write 5000 (1388H) and 50 (0032H) respectively to 0004H and 0005H of the VFD whose slave address is 02H, the frame structure is as follows.

RTU master command (from the master to the VFD)

START	T1-T2-T3-T4 (3.5 character times)
ADDR	02H
CMD	10H
Write data address MSB	00H
Write data address LSB	04H
Data count MSB	00H
Data count LSB	02H

Number of bytes	04H
MSB of data to be written to 0004H	13H
LSB of data to be written to 0004H	88H
MSB of data to be written to 0005H	00H
LSB of data to be written to 0005H	32H
CRC LSB	C5H
CRC MSB	6EH
END	T1-T2-T3-T4 (3.5 character times)

RTU slave response (from the VFD to the master)

START	T1-T2-T3-T4 (3.5 character times)
ADDR	02H
CMD	10H
Write data address MSB	00H
Write data address LSB	04H
Data count MSB	00H
Data count LSB	02H
CRC LSB	C5H
CRC MSB	6EH
End	T1-T2-T3-T4 (3.5 character times)

6.3.4 Data address definition

This section describes the address definition of communication data. The addresses are used for controlling the running, obtaining the state information, and setting related function parameters of the VFD.

6.3.4.1 Function code address format rules

The address of a function code consists of two bytes, with the MSB on the left and LSB on the right. The MSB ranges from 00 to ffH, and the LSB also ranges from 00 to ffH. The MSB is the hexadecimal form of the group number before the dot mark, and LSB is that of the number behind the dot mark. Take P05.02 as an example: The group number is 05, that is, the MSB of the parameter address is the hexadecimal form of 05; and the number behind the dot mark is 02, that is, the LSB is the hexadecimal form of 02. Therefore, the function code address is 0502H in the hexadecimal form. For P10.01, the parameter address is 0A01H.

Inverter function code	Name	Description	Default
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0
P10.01	Simple PLC power-loss memory	0: Disable 1: Enable	0

Note:

- The parameters in the P99 group are set by the manufacturer and cannot be read or modified. Some parameters cannot be modified when the VFD is running; some cannot be modified regardless of the VFD status. Pay attention to the setting range, unit, and description of a parameter when modifying it.
- The service life of the Electrically Erasable Programmable Read-Only Memory (EEPROM) may be reduced if it is frequently used for storage. Some function codes do not need to be stored during communication. The application requirements can be met by modifying the value of the on-chip RAM, that is, modifying the MSB of the corresponding function code address from 0 to 1. For example, the function code P00.07 is not stocked into EEPROM. Only by changing the value in RAM can set the address to 8007H. The address can be used only for

writing data to the on-chip RAM, and it is invalid when used for reading data.

6.3.4.2 Other Modbus function addresses

In addition to modifying the parameters of the VFD, the master can also control the VFD, such as starting and stopping it, and monitoring the operation status of the VFD. The following table lists other function parameters.

Table 6-3 Rectifier unit address description

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward run	R/W
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
Rectifier unit status word	2100H	0001H: Running	R
		0003H: Stopped	
		0004H: Faulty	
		0005H: POFF	
Rectifier unit fault code	2102H	See the description of fault types.	R
Rectifier ID	2103H	GD600A rectifier unit---0x01B1	R
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1V)	R
Input IO status	3009H	0x000–0x1FF	R
Output IO status	300AH	0x000–0x1FF	R

Table 6-4 Inverter unit address description

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward run	R/W
		0002H: Reverse run	
		0003H: Forward jog	
		0004H: Reverse jog	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jog stop	
		0009H: Emergency stop (stop with the deceleration time set in P01.26)	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, 1000 corresponds to 100.0%)	R/W
	2003H	PID feedback(0–1000, 1000 corresponds to 100.0%)	R/W
	2004H	Torque setting (-3000–3000, 1000 corresponds to 100.0% of the motor rated current)	R/W
	2005H	Upper limit setting of forward running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2006H	Upper limit setting of reverse running frequency (0–Fmax; unit: 0.01Hz)	R/W
	2007H	Motoring torque upper limit (0–3000, 1000 corresponds to 100.0% of the VFD rated current)	R/W
	2008H	Braking torque upper limit (0–3000, 1000 corresponds to 100.0% of the motor rated current)	R/W

Function	Address	Data description	R/W
	2009H	Special CW Bit1–bit0: =00: Motor 1 =01: Motor 2 Bit2: 1: Speed/torque control mode switching enabled 0: Disabled Bit3: =1: Clear energy consumption data =0: Keep energy consumption data Bit4: 1: Pre-excitation enabled 0: Pre-excitation disabled Bit5: 1: DC braking enabled 0: DC braking disabled	R/W
	200AH	Virtual input terminal command (0x000–0x3FF) Corresponding to S8/S7/S6/S5/Reserved/Reserved/S4/S3/S2/S1	R/W
	200BH	Virtual output terminal command (0x00–0x0F) Corresponding to RO2/RO1/Reserved/Y1	R/W
	200CH	Voltage setting (used for V/F separation) (0–1000, 1000 corresponds to 100.0% of the motor rated voltage)	R/W
	200DH	AO1 output setting 1 (-1000–1000, 1000 corresponds to 100.0%)	R/W
	200EH	AO2 output setting 1 (-1000–1000, 1000 corresponds to 100.0%)	R/W
	200FH	Tension control line speed (0–P90.14; 1000 corresponds to 100.0 m/min)	R/W
	2010H	Tension setting (0–P90.57, 1000 corresponds to 1000N)	R/W
	2011H	Tension taper setting (0–10000, 10000 corresponds to 100.00%)	R/W
VFD status word 1	2100H	0001H: Forward running	R
		0002H: Reverse running	
		0003H: Stopped	
		0004H: Fault	
		0005H: VFD in POFF state	
		0006H: VFD in pre-exciting state	
VFD status word 2	2101H	Bit0: =0: Not ready to run =1: Ready to run Bit2–bit1: =00: Motor 1 =01: Motor 2 Bit3: =0: Asynchronous motor (AM) =1: Synchronous motor (SM) Bit4: =0: Disable overload alarm =1: Enable overload alarm Bit6–bit5: =00: Keypad-based control =01: Terminal-based control =10: Communication-based control Bit7: Reserved Bit8: =0: Speed control =1: Torque control Bit9: =0: Non-position control =1: Position control Bit11–bit10: 00: Vector 0 01: Vector 1 10: Closed-loop vector 11: SVPWM Bit12: =0: Close brake =1: Release brake	R

Function	Address	Data description		R/W
		Bit13: =0: Position not reached =1: Position reached		
VFD fault code	2102H	See the description of fault types.		R
VFD identification code	2103H	GD600A inverter unit---0x01B2		R
Running frequency	3000H	0–Fmax (Unit: 0.01Hz)	Compatible with CHF100A and CHV100 communication addresses	R
Set frequency	3001H	0–Fmax (Unit: 0.01Hz)		R
Bus voltage	3002H	0.0–2000.0V (Unit: 0.1V)		R
Output voltage	3003H	0–1200V (Unit: 1V)		R
Output current	3004H	0.0–3000.0A (Unit: 0.1A)		R
Rotational speed	3005H	0–65535 (Unit: 1RPM)		R
Output power	3006H	-300.0%–300.0% (Unit: 0.1%)		R
Output torque	3007H	-250.0–250.0% (Unit: 0.1%)		R
PID setting	3008H	-100.0%–100.0% (Unit: 0.1%)		R
PID feedback	3009H	-100.0%–100.0% (Unit: 0.1%)		R
Terminal input status	300AH	0x000–0x1FF	Compatible with CHF100A and CHV100 communication addresses	R
Terminal output status	300BH	0x000–0x1FF		R
Analog input 1	300CH	0.00–10.00V (Unit: 0.01V)		R
Analog input 2	300DH	0.00–10.00V (Unit: 0.01V)		R
Analog input 3	300EH	-10.00–10.00V (Unit: 0.01V)		R
Reserved	300FH	-		R
Reserved	3010H	-		R
Reserved	3011H	-		R
Read the actual step of multi-step speed	3012H	0–15		R
Reserved	3013H	-		R
External counting value	3014H	0–65535		R
Torque setting	3015H	-300.0%–300.0% (Unit: 0.1%)		R
VFD identification code	3016H	GD600A inverter unit---0x01B2		R
Fault code	5000H	See the description of fault types.		R

The Read/Write (R/W) characteristics indicate whether a function parameter can be read and written. For example, "Communication-based control command" can be written, and therefore the command code 06H is used to control the VFD. The R characteristic indicates that a function parameter can only be read, and W indicates that a function parameter can only be written.

Note: Some parameters in the preceding table take effect only after they are enabled. Take the running and stop operations as examples, you need to set "Channel of run commands" (P00.01) to "Communication", and set "Communication mode of run commands" (P00.02) to Modbus. For another example, when modifying "PID reference", you need to set "PID reference source" (P09.00) to Modbus communication.

The following table describes the encoding rules of device codes (corresponding to the VFD identification code 2103H).

8 MSBs	Meaning	8 LSBs	Meaning
0x01	Goodrive	0x01B1	GD600A rectifier unit
		0x01B2	GD600A inverter unit

6.3.5 Fieldbus scale

In practical applications, communication data is represented in the hexadecimal form, but hexadecimal values cannot represent decimals. For example, 50.12Hz cannot be represented in the hexadecimal form. In such cases, multiply 50.12 by 100 to obtain an integer 5012, and then 50.12 can be represented as 1394H in the hexadecimal form (5012 in the decimal form).

In the process of multiplying a non-integer by a multiple to obtain an integer, the multiple is referred to as a fieldbus scale.

The fieldbus scale depends on the number of decimal places in the value specified in "Setting range" or "Default". If there are n (for example, 1) decimal places in the value, the fieldbus scale m (then $m=10$) is the result of 10 to the power of n . Take the following table as an example.

Inverter function code	Name	Description	Default
P01.20	Wake-up-from-sleep delay	Setting range: 0.0–3600.0s Note: Valid only when the ones place of P01.19 is set to 2.	0.0s
P01.21	Power-loss restart selection	0: Disable restart 1: Enable restart	0

The value specified in "Setting range" or "Default" contains one decimal place, and therefore the fieldbus scale is 10. If the value received by the host controller is 50, "Wake-up-from-sleep delay" of the VFD is 5.0 (5.0=50/10).

To set "Wake-up-from-sleep delay" to 5.0s through Modbus communication, you need first to multiply 5.0 by 10 according to the scale to obtain an integer 50, that is, 32H in the hexadecimal form, and then send the following write command:

01 06 01 14 00 32 49 E7
VFD Write Parameter Parameter CRC
address command address data

After receiving the command, the VFD converts 50 into 5.0 based on the fieldbus scale, and then sets "Wake-up-from-sleep delay" to 5.0s.

For another example, after the host controller sends the "Wake-up-from-sleep delay" parameter read command, the master receives the following response from the VFD:

01 03 02 00 32 39 91
VFD Read 2-byte Parameter CRC
address command data data

The parameter data is 0032H, that is, 50, and therefore 5.0 is obtained based on the fieldbus scale (50/10=5.0). In this case, the master identifies that "Wake-up-from-sleep delay" is 5.0s.

6.3.6 Error message response

Operation errors may occur in communication-based control. For example, some parameters can only be read, but a write command is sent. In this case, the VFD returns an error message response.

Error message responses are sent from the VFD to the master. The following table lists the codes and definitions of the error message responses.

Code	Name	Meaning
01H	Invalid command	The command code received from the host controller is not allowed to be executed. The possible causes are as follows: • The function code is applicable only on new devices and is not implemented on this device. • The slave is in faulty state when processing this request.
02H	Invalid data address	For the VFD, the data address in the request of the host controller is not allowed. In particular, the combination of the register address and the

Code	Name	Meaning
		number of the to-be-sent bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that is specified by P07.00.
06H	Incorrect data frame	This occurs when the length of the data frame in the message sent by the host controller is incorrect, or when the parity bit does not match the parity calculated by the lower-level device.
07H	Parameter read-only	The parameter to be modified in the write operation of the host controller is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the host controller cannot be modified during the running of the VFD.
09H	Password protection	If the host controller does not provide the correct password to unlock the system to perform a read or write operation, the error of "system being locked" is reported.

When returning a response, the slave uses a function code domain and fault address to indicate whether it is a normal response (no error) or exception response (an error occurs). In a normal response, the slave returns the corresponding function code and data address or sub-function code. In an exception response, the slave returns a code that is equal to a normal code, but the first bit is logic 1.

For example, if the master sends a request message to a slave for reading a group of function code address data, the following code is generated:

0 0 0 0 0 1 1 (03H in the hexadecimal form)

In a normal response, the slave returns the same code. In an exception response, the slave returns the following code:

1 0 0 0 0 1 1 (83H in the hexadecimal form)

In addition to the modification of the code, the slave returns a byte of exception code that describes the cause of the exception. After receiving the exception response, the typical processing of the master is to transmit the request message again or modify the command based on the fault information.

For example, to set the "Channel of run commands" (P00.01, the parameter address is 0001H) of the VFD whose address is 01H to 03, run the following command:

<u>01</u>	<u>06</u>	<u>00 01</u>	<u>00 03</u>	<u>98 0B</u>
VFD address	Write command	Parameter address	Parameter data	CRC

However, the "Channel of run commands" ranges from 0 to 2. The value 3 is out of the setting range. In this case, the VFD returns an error message response as shown in the following:

<u>01</u>	<u>86</u>	<u>04</u>	<u>43 A3</u>
VFD address	Exception response code	Error code	CRC

The exception response code 86H (generated based on the highest-order bit "1" of the write command 06H) indicates that it is an exception response to the write command (06H). The error code is 04H, which indicates "Operation failure".

6.3.7 Read/write operation examples

For the formats of the read and write commands, see sections 6.3.3.1 and 6.3.3.2.

6.3.7.1 Example of read command 03H

Example 1: Read SW 1 of the VFD whose address is 01H. According to the rectifier and inverter address tables in section

6.3.4.2 Other Modbus function addresses, the parameter address of status word 1 of the VFD is 2100H.

The read command transmitted to the VFD is as follows:

<u>01</u>	<u>03</u>	<u>21 00</u>	<u>00 01</u>	<u>8E 36</u>
VFD address	Read command	Parameter address	Data quantity	CRC

Assume that the following response is returned:

<u>01</u>	<u>03</u>	<u>02</u>	<u>00 03</u>	<u>F8 45</u>
VFD address	Read command	Number of bytes	Data content	CRC

The data content returned by the VFD is 0003H, which indicates that the VFD is in the stopped state.

Example 2: View information about the VFD whose address is 03H, including "Type of present fault" (P07.27) to "Type of 5th-last fault" (P07.32) of which the parameter addresses are 071BH–0720H (contiguous 6 parameter addresses starting from 071BH).

The command transmitted to the VFD is as follows:

<u>03</u>	<u>03</u>	<u>07 1B</u>	<u>00 06</u>	<u>B5 59</u>
VFD address	Read command	Start address	6 parameters in total	CRC

Assume that the following response is returned:

<u>03</u>	<u>03</u>	<u>0C</u>	<u>00 23</u>	<u>00 23</u>	<u>00 23</u>	<u>00 23</u>	<u>00 23</u>	<u>00 23</u>	<u>00 23</u>	<u>5F D2</u>
VFD address	Read command	Number of bytes	Present fault type	Last fault type	2nd-last fault type	3rd-last fault type	4th-last fault type	5th-last fault type		CRC

From the returned data, we can see that all the fault types are 0023H, that is, 35 in the decimal form, which means the maladjustment fault (STo).

6.3.7.2 Example of write command 06H

Example 1: Set the VFD whose address is 03H to be forward running. According to section 6.3.4.2 Other Modbus function addresses, the address of "Communication-based control command" is 2000H, and 0001H indicates forward running.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward run	R/W
		0002H: Reverse run	
		0003H: Forward jog	
		0004H: Reverse jog	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jog stop	

The command transmitted from the master is as follows:

<u>03</u>	<u>06</u>	<u>20 00</u>	<u>00 01</u>	<u>42 28</u>
VFD address	Write command	Parameter address	Forward running	CRC

If the operation is successful, the following response is returned (same as the command sent from the master):

<u>03</u>	<u>06</u>	<u>20 00</u>	<u>00 01</u>	<u>42 28</u>
VFD address	Write command	Parameter address	Forward running	CRC

Example 2: Set the max. output frequency to 100Hz for the VFD with the address of 03H.

Inverter function code	Name	Description	Default
P00.03	Max. output frequency	Setting range: Max(P00.04,10.00)–590.00Hz	50.00Hz

See the figures behind the radix point, the fieldbus ratio value of max. output frequency (P00.03) is 100. 100Hz timed by 100 is 10000 and the corresponding hex is 2710H.

The command transmitted from the master is as follows:

<u>03</u>	<u>06</u>	<u>00 03</u>	<u>27 10</u>	<u>62 14</u>
VFD address	Write command	Parameter address	Parameter data	CRC

If the operation is successful, the following response (same as the command transmitted from the master) is returned:

<u>03</u>	<u>06</u>	<u>00 03</u>	<u>27 10</u>	<u>62 14</u>
VFD address	Write command	Parameter address	Parameter data	CRC

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

6.3.7.3 Example of continuous write command 10H

Example 1: Set the VFD whose address is 01H to be forward running at the frequency of 10Hz. According to other Modbus function addresses, the address of "Communication-based control command" is 2000H, 0001H indicates forward running, the address of "Communication-based frequency setting" is 2001H, and 10Hz is 03E8H in the hexadecimal form.

Function	Address	Data description	R/W
Communication-based control command	2000H	0001H: Forward run	R/W
		0002H: Reverse run	
		0003H: Forward jog	
		0004H: Reverse jog	
		0005H: Stop	
		0006H: Coast to stop	
		0007H: Fault reset	
		0008H: Jog stop	
		0009H: Emergency stop (Decelerate to stop within the time specified in P01.26)	
Communication-based setting address	2001H	Communication-based frequency setting (0–Fmax, unit: 0.01Hz)	R/W
	2002H	PID reference (0–1000, 1000 corresponds to 100.0%)	

In the actual operation, set P00.01 to 2 and P00.06 to 8.

The command sent from the master is as follows:

<u>01</u>	<u>10</u>	<u>20 00</u>	<u>00 02</u>	<u>04</u>	<u>00 01</u>	<u>03 E8</u>	<u>3B 10</u>
VFD address	Continuous write command	Parameter address	Parameter quantity	Number of bytes	Forward running	10 Hz	CRC

If the operation is successful, the following response is returned:

01 10 20 00 00 02 4A 08
VFD Continuous Parameter Parameter CRC
address write address quantity
 command

Example 2: Set "Acceleration time" of the VFD whose address is 01H to 10s, and "Deceleration time" to 20s.

Inverter function code	Name	Description	Default
P00.11	ACC time 1	Setting range: 0.0–3600.0s	Depends on model
P00.12	DEC time 1	Setting range: 0.0–3600.0s	Depends on model

The address of P00.11 is 000B, 10s is 0064H in the hexadecimal form, and 20s is 00C8H in the hexadecimal form.

The command sent from the master is as follows:

01 10 00 0B 00 02 04 00 64 00 C8 F2 55
VFD Continuous Parameter Parameter Number of 10s 20s CRC
address write address quantity bytes

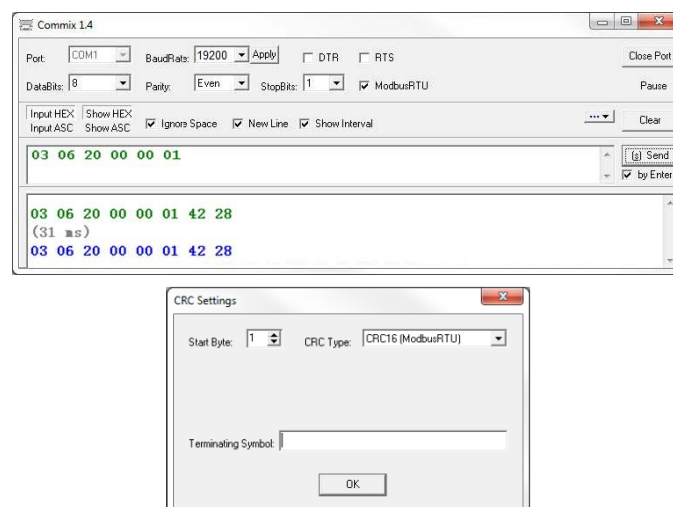
If the operation is successful, the following response is returned:

01 10 00 0B 00 02 30 0A
VFD Continuous Parameter Parameter CRC
address write address quantity

Note: In the preceding command description, spaces are added to a command just for explanatory purposes. In practical applications, no space is required in the commands.

6.3.7.4 Example of Modbus communication commissioning

In the following example, a PC is used as the master, an RS232-to-RS485 converter is used for signal conversion. The converter uses COM1 (an RS232 port) on the PC. The PC-side commissioning software used in this example is Commix1.4, a serial port debugging tool that can be searched for and downloaded online. Download a version that supports automatic CRC calculation. The following figure shows the Commix1.4 interface used in this example.



Set **Port** to **COM1**. Set **BaudRate** consistently with P14.01. **DataBits**, **Parity**, and **StopBits** must be set consistently with P14.02. If the RTU mode is selected, choose **Input HEX** and **Show HEX**. To implement automatic CRC, you need to choose **ModbusRTU**, and set **Start Byte** to **1** and **CRC Type** to **CRC16 (ModbusRTU)** in the **CRC Settings** window.

After the automatic CRC is enabled, do not enter CRC in commands. Otherwise, command errors may occur due to repeated CRC.

The commissioning command for setting the VFD whose address is 03H to run forward is as follows:

<u>03</u>	<u>06</u>	<u>20 00</u>	<u>00 01</u>	<u>42 28</u>
VFD address	Write command	Parameter address	Forward running	CRC

Note:

- The inverter unit address (P14.00) must be set to 03H.
- "Channel of run commands" (P00.01) must be set to "Communication", and "Communication channel of run commands" (P00.02) to "Modbus".
- Click **Send**. If the wiring and settings are correct, a response from the rectifier unit will be received.

<u>03</u>	<u>06</u>	<u>20 00</u>	<u>00 01</u>	<u>42 28</u>
VFD address	Write command	Parameter address	Forward running	CRC

6.3.8 Related parameters

Table 6-5 Rectifier unit related parameters

Rectifier function code	Name	Description	Default
P20.00	Local communication address	Setting range: 1–247	1
P20.01	Communication baud rate	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps	4
P20.02	Data bit parity setting	0: No parity (N, 8, 1) for RTU 1: Even parity (E, 8, 1) for RTU 2: Odd parity (O, 8, 1) for RTU 3: No parity (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1
P20.03	Communication response delay	Setting range: 0–200ms	5ms
P20.04	Communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	0.0s
P20.05	Transmission fault handling	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0
P20.06	Communication handling action selection	Setting range: 0x00–0x11 LED ones place: 0: Respond to write operations	0x00

Rectifier function code	Name	Description	Default
		1: Do not respond to write operations LED tens place: Communication password protection 0: Communication password protection is invalid. 1: Communication password protection is valid.	

Table 6-6 Inverter unit related parameters

Inverter function code	Name	Description	Default
P14.00	Local communication address	Setting range: 1–127	1
P14.01	Communication baud rate setting	0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps	4
P14.02	Data bit parity setting	0: No parity (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No parity (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1
P14.03	Communication response delay	Setting range: 0–200ms	5ms
P14.04	Communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	0.0s
P14.05	Transmission error processing	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0
P14.06	Communication processing action	Setting range: 0x00–0x111 LED ones place: 0: Respond to write operations 1: Do not respond to write operations LED tens place: 0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: 0: P14.38 and P14.39 user-defined addresses are invalid. 1: P14.38 and P14.39 user-defined addresses are valid.	0x00

6.4 CANopen bus networking

6.4.1 Network topology

When a PLC is used to establish a direct CANopen network with the rectifier and inverter units, set the PLC as the master and all VFD units as slaves.

When the rectifier unit is located at the beginning or end of the system, connect the CAN bus as shown in Figure 6-2. Connect the PLC or other master device to the rectifier unit CAN bus terminals (CAN1H/CAN1L). The rectifier and inverter units are connected to the CAN bus through the RJ45 ports. Shielded twisted-pair cables are recommended between the master device and the rectifier unit. Connect the shield to CGND. Use the provided network cables for the connections between units. Connect a 120 Ω termination resistor at each end of the bus to prevent signal reflections.

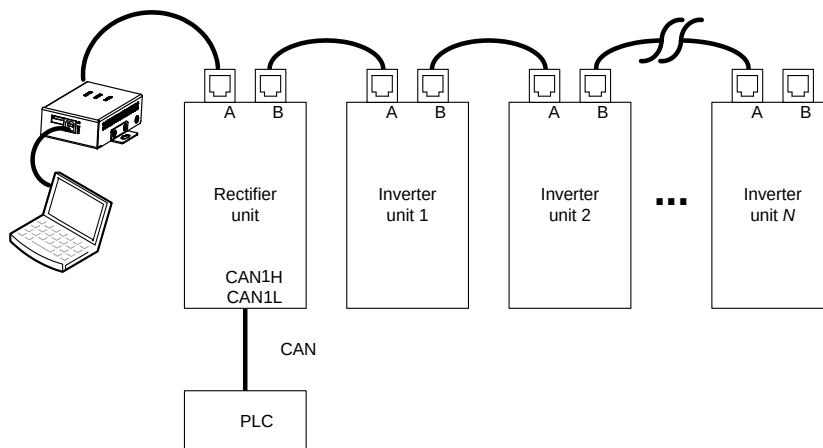


Figure 6-2 CANopen bus network wiring 1

When the rectifier unit is located in the middle of the CANopen bus, wire the CANopen bus as shown in Figure 6-3. The rectifier and inverter units are connected to the CAN bus through the RJ45 ports, and the PLC or other master device is connected to the RJ45 port of the unit at the beginning or end of the bus.

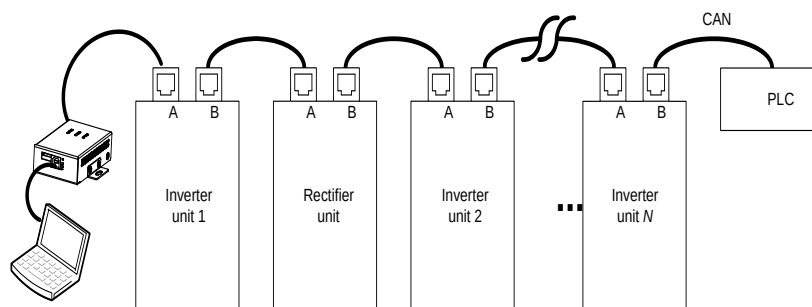


Figure 6-3 CANopen bus network wiring 2

6.4.2 Interface description

The rectifier and inverter units are connected to the CANopen bus through the RJ45 ports. The following diagram shows the RJ45 port.

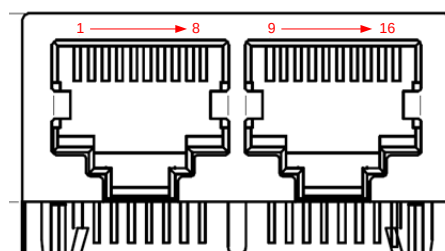


Figure 6-4 CANopen RJ45 port

Table 6-7 RJ45 interface definition

Pin	Network signal	Description
8, 16	CAN_H	CAN bus high level
7, 15	CAN_L	CAN bus low level
3, 6, 10, 11, 14	NC	Not connected
5, 13	RS485+	Internal RS485 communication terminal, used to connect to an external keypad or PC.
4, 12	RS485-	
1, 9	CGND	It can be used as a common ground for the external keypad power supply negative and signal cable.
2	+8V	External keypad power supply +

Note:

- When connecting to our TS series PLC, verify the RJ45 signal definitions first.
- Refer to the following table for the maximum communication distance corresponding to each CAN communication baud rate.

Baud rate (bps)	1M	800%	500%	250%	125%	100%	50%
Maximum distance (m)	25	40	100	180	300	320	600

6.4.3 Networking description

Both the rectifier unit and the inverter unit are configured as CANopen slaves. The PLC acts as the master of the entire communication network. The CANopen slave node ID, baud rate, communication disconnection enable, and PDO data exchange for the rectifier and inverter units are configured through relevant function codes.

Note: For the rectifier unit, set P22.28 to 0. For the inverter unit, set P14.42 to 0 and P14.43 to 1.

6.4.4 Introduction to the CANopen protocol

1. Supported functions

Supports the CAN2.0A protocol

Supports the CANopen DS301.

2. Supported CANopen services

PDO: Supports four pairs of PDO services (PDO1 TX to PDO4 TX, and PDO1 RX to PDO4 RX), where the PDO1 pair is used to read and write parameters of a VFD, and the PDO2 to PDO4 pairs are used to control and obtain the actual parameter values of the VFD in real time.

SDO: SDO information adopts the "client/server" mode and is used to configure slave nodes and provide access to the object dictionary of each node.

- Supports the emergency service.
- Supports node protection (NMT Node Guarding).
- Supports heartbeat packets (Heartbeat Producer).

Network management (NMT)

- Supports NMT module control.
- Supports NMT broadcast addresses.

- Supports NMT error control.
- Supports boot-up.

Supports SYNC (1–240).

Supports asynchronous transmission of 254 and 255.

Supports disabled time.

Supports event timers.

Supports manufacturer-defined object dictionary. You can use SDOs to control and obtain the actual parameter values of a VFD in real time.

3. Non-supported CANopen services

Saves object dictionary parameters at power outage

Time stamp service

6.4.5 CANopen communication frame format

CAN 2.0A frames are used to transmit data between the master node and slave nodes on the bus.

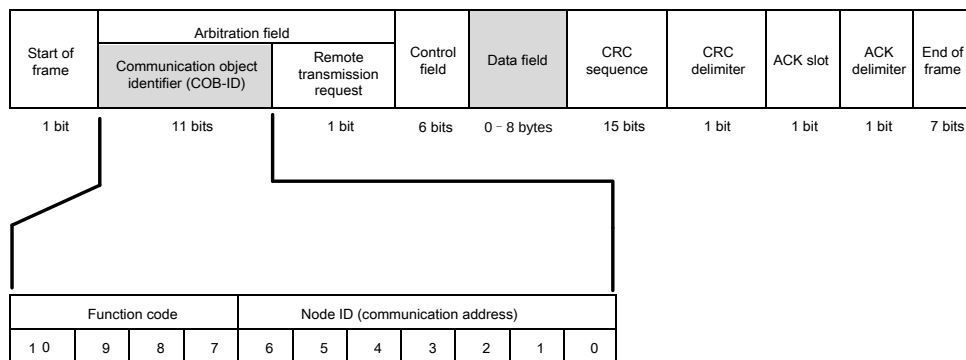


Figure 6-5 Frame structure

Communication object	Function code (binary)	COB-ID (hexadecimal)
NMT	0	0x00
SYNC	1	0x80
EMERGENCY	1	0x81–0xFF
PDO1 Tx	11	0x181–0x1FF
PDO1 Rx	100	0x201–0x27F
PDO2 Tx	101	0x281–0x2FF
PDO2 Rx	110	0x301–0x37F
PDO3 Tx	111	0x381–0x3FF
PDO3 Rx	1000	0x401–0x47F
PDO4 Tx	1001	0x481–0x4FF
PDO4 Rx	1010	0x501–0x57F
SDO Tx	1011	0x581–0x5FF
SDO Rx	1100	0x601–0x67F
Node protection	1110	0x701–0x77F

COB-IDs vary according to communication address, but for one command, the COB-IDs are within a certain range.

Note: The commands described in this manual are all data frames if it is not specified that they are remote frames.

6.4.6 Network management (NMT)

The NMT command is used by the master node to control the NMT states of slave nodes.

■ Command

Master → Slave

COB-ID	Byte0	Byte1
0x000	Command specifier (CS)	Node-ID (node ID)

■ Description

The command COB-ID is fixed to 0x00. If the node ID is 0, the command is broadcast to all CANopen slave nodes, and each slave node must execute the NMT command. Refer to Table 6-8 for the functions of each Command Specifier (CS).

Table 6-8 Function of each CS

NMT CS	NMT service (control action)
0x01	Starts a slave device.
0x02	Stops a slave device.
0x80	Enables a slave to enter the Pre-operational state.
0x81	Resets a slave.
0x82	Reset communication

■ Example

For example, to switch the slave with Node ID = 3 to the Pre-operational state, the command is as follows:

COB-ID	Byte0	Byte1
0x000	0x80	0x03

As another example, to start all slave nodes in the CANopen network, the command is as follows:

COB-ID	Byte0	Byte1
0x000	0x01	0x00

6.4.7 NMT node guarding

By using the node protection service, the NMT master node can detect the current state of each node.

■ Command

Request: Master (remote frame) → Slave

COB-ID	No data
0x700+Node-ID	/

Response: Slave → Master

COB-ID	Byte0 (state value)
0x700+Node-ID	Bit 7: Toggle bit; Bits 0 to 6: Status

■ Description

In the response, the most significant bit (bit 7) of byte 0 (status value) is the toggle bit. This bit alternates between 0 and 1 each time the slave transmits a response frame to distinguish consecutive frames. Bits 0 to 6 represent the slave status. The corresponding states are described in Table 6-9.

Table 6-9 State values and their corresponding states

State value (Byte0: Bits 0–6)	State
0x00	Initializing
0x04	Stopped
0x05	Operational
0x7F	Pre-operational

■ Example

For example, the master uses the following command to detect the status of slave 3.

Master (remote frame) → Slave

COB-ID	No data
0x703	/

After receiving a node guarding command from the master, the slave responds with the following frame.

COB-ID	Byte0 (status value)
0x703	0x85

In the command, bit 7 of byte 0 is 1, and the status value is 0x05, indicating that slave 3 is in the Operational state. If receiving another node protection command, the slave transmits a command frame in which the status value is 0x05 to the master, and the value of bit 7 is alternated to 0.

6.4.8 Heartbeat producer

In some cases, the master requires that a slave automatically transmits a frame of heartbeat packets at an interval, so that it can learn the status of the slave in real time. The interval parameter (data length: 16 bits; unit: ms) is defined in the object dictionary 0x1017. The default heartbeat producer time for the CANopen slave is 500 ms.

■ Command

Slave → Master

COB-ID	Byte 0
0x700+Node-ID	State value

■ Description

The heartbeat packets are in the same format with the node protection response frames. The difference between them is that no triggering bit alternation is performed for heartbeat packets (the triggering bit is always 0). Table 6-9 describes the status values.

■ Example

For example, if slave 3 is in the Operational state and the interval parameter in 0x1017 is set to 100, slave 3 transmits a frame of heartbeat packets every 100 ms.

COB-ID	Byte 0
0x703	0x05

SDOs can be used to disable heartbeat packets, transmitting 2B 17 10 00 00 00 00 00 (setting the interval to 0).

Note: Node guarding and heartbeat messages cannot be used simultaneously in a slave.

6.4.9 NMT boot-up

A boot-up message is sent once the slave initialization is complete.

■ Command

Slave → Master

COB-ID	Byte 0
0x700+Node-ID	0x00

■ Example

For example, if the slave node ID is 3, the boot-up message sent after initialization is as follows:

COB-ID	Byte 0
0x703	0x00

6.4.10 Synchronization object (SYNC)

Generally, SYNC signals are transmitted by the CANopen master cyclically. A SYNC signal does not contain any data and is used mainly to request PDO Tx of a slave node of the synchronous transmission type. 0x1005 in the object dictionary defines COB-IDs of the objects that receive synchronous packets, and they are set to 0x80 in the CANopen pre-defined connection set. A transmission type of 1–240 for each PDO Tx represents a synchronous transmission type.

■ Command

Master → Slave

COB-ID	No data
0x80	/

6.4.11 Emergency object (EMCY)

This message is sent when an internal error occurs or is cleared within the slave or VFD.

■ Command

Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x80+Node-ID	Emergency error code		Error register	VFD error code				
	LSB	MSB		Bit7–Bit0	Bit15–Bit8	Bit23–Bit16	Bit31–Bit24	Bit39–Bit32

■ Description

An emergency error code is two bytes. Byte0 is the least significant byte (LSB), and Byte1 is the most significant byte (MSB). A VFD error code is five bytes. Byte3 is the LSB, and Byte7 is the MSB.

An emergency error code indicates the type of the current error, as described in Table 6-10. The error register stores the type of the current error. You can determine the error type indicated by the current emergency packet according to the value stored in the register. Table 6-11 describes the indication of the bits of the error register. Refer to the inverter function parameter list for fault codes. Function code P07.27 provides the fault codes for the GD600A series VFD.

Table 6-10 Definition of emergency error code

Emergency error code (hex)	Code function description
00xx	Error reset or no error
10xx	Generic Error
20xx	Current
21xx	Current, device input side
22xx	Current, inside the device
23xx	Current, device input side
30xx	Voltage
31xx	Mains voltage
32xx	Voltage inside the device
33xx	Output voltage
40xx	Temperature
41xx	Ambient temperature
42xx	Device temperature
50xx	Device hardware
60xx	Device software
61xx	Internal software
62xx	User software
63xx	Data set

Emergency error code (hex)	Code function description
70xx	Additional modules
80xx	Monitoring
81xx	communication
8110	CAN overrun
8120	Error Passive
8130	Life Guard Error or Heartbeat Error
8140	Recovered from Bus-Off
82xx	Protocol Error
8210	PDO no processed Due to length error
8220	Length exceed
90xx	External error
F0xx	Additional functions
FFxx	Device specific

Table 6-11 Definition of error register bits

Error register bit	Error type
0	Generic error or no error
1	Current error
2	Voltage error
3	Temperature error
4	Communication error
5	Device description error
6	Reserved (=0)
7	Manufacturer specific error

■ Example

For example, if the slave with node ID 3 (an inverter unit) encounters an "Inverter unit U-phase protection" fault (E001), where the fault type is 1 (device error code = 1), the slave sends the following emergency message:

COB-ID	Emergency error code		Error register	VFD error code				
	Byte0	Byte1		Byte3	Byte4	Byte5	Byte6	Byte7
0x83	0x00	0x30	0x04	0x01	0x00	0x00	0x00	0x00

As shown in the command, the Emergency Error Code is 0x3000 (meaning "Voltage"), and the Error Register is 0x04 (bit 2 is "1", indicating a voltage error). The device-specific error code is 0x0000000001. According to the GD600A inverter manual, the error code "1" corresponds to "Inverter unit U-phase protection (E001)".

When the fault is reset, the slave sends the following emergency message to inform the master that the fault has been cleared:

COB-ID	Emergency error code		Error register	VFD error code				
	Byte0	Byte1		Byte3	Byte4	Byte5	Byte6	Byte7
0x83	0x00	0x00	0x00	0x00	0x00	0x00	0x00	0x00

6.4.12 Service data object (SDO)

SDOs are mainly used to transfer non-time-critical data. They allow access to the device object dictionary for reading and writing.

■ Command

Request: Master → Slave

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x600+NodeID	Request code	Object index		Sub-index	Response data			
		LSB	MSB		Bit7–bit0	Bit15–bit8	Bit23–bit16	Bit31–bit24

Response: Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x580+NodeID	Response code	Object index		Sub-index	Response data			
		LSB	MSB		Bit7–bit0	Bit15–bit8	Bit23–bit16	Bit31–bit24

■ Description

An object index is two bytes. Byte1 is the LSB, and Byte2 is the MSB. For information about the indexes and subindexes, see the object dictionary in the appendix. Request codes include request codes for reading and those for writing.

Request codes for writing vary according to the character length of items in the object dictionary, and the request code for reading are 0x40. Refer to Table 6-12.

Response codes indicating successful reading vary according to the character length of items in the object dictionary, and the response code indicating successful writing are 0x60. The response codes indicating reading failure and writing failure are both 0x80. Refer to Table 6-13.

Table 6-12 SDO request codes and requested data

Request code type	Request code	Command description	Requested data			
			Byte4	Byte5	Byte6	Byte7
Write	0x23	Writes 4-byte data	Bit7–bit0	Bit15–bit8	Bit23–bit16	Bit31–bit24
	0x2B	Writes 2-byte data	Bit7–bit0	Bit15–bit8	/	/
	0x2F	Writes 1-byte data	Bit7–bit0	/	/	/
Read	0x40	Reads data	/	/	/	/

Table 6-13 SDO response codes and response data

Response code type	Response code	Command description	Response data			
			Byte4	Byte5	Byte6	Byte7
Read	0x43	Reads 4-byte data	Bit7–bit0	Bit15–bit8	Bit23–bit16	Bit31–bit24
	0x4B	Reads 2-byte data	Bit7–bit0	Bit15–bit8	/	/
	0x4F	Reads 1-byte data	Bit7–bit0	/	/	/
Write	0x60	Writing succeeds	/	/	/	/
Read/write	0x80	Reading/writing fails	Interruption error code			
			Bit7–bit0	Bit15–bit8	Bit23–bit16	Bit31–bit24

Note: The symbol "/" in Table 6-12 and Table 6-13 indicates that the byte is reserved and provides no function.

Table 6-14 Interruption error code

Interruption code	Code function description
0503 0000	Triggering bit not alternated
0504 0000	SDO protocol times out
0504 0001	Invalid or unknown client/server

Interruption code	Code function description
0504 0002	Invalid block size
0504 0003	Invalid sequence number
0504 0004	CRC error
0504 0005	Memory overflow
0601 0000	No access to the object
0601 0001	Attempts to read a write-only object
0601 0002	Attempts to write information to a read-only object
0602 0000	Object cannot be found in the object dictionary
0604 0041	Object cannot be mapped to PDO
0604 0042	Number and length of the object to be mapped exceeds the PDO length
0604 0043	Common parameter incompatibility
0604 0047	Common internal incompatibility of the device
0606 0000	Object access failure caused by hardware error
0607 0010	Data type not matched; service parameter length not matched
0609 0011	Subindex cannot be found in the object dictionary
0609 0030	Parameter value range exceeded
0609 0031	Written parameter value too large
0609 0032	Written parameter value too small
0609 0036	Max. value less than Min. value
0800 0000	Common error
0800 0020	Data failed to be transmitted or stored in the application
0800 0021	Data failed to be transmitted or stored in the application due to device control
0800 0022	Data failed to be transmitted or stored in the application due to the current state of the device
0800 0023	Error occurs dynamically on the object dictionary or object dictionary cannot be found

■ Example

For example, slave 3 reads data from and writes data to the object whose index is 0x1801 and subindex is 03. (The object whose index is 0x1801 and subindex is 03 indicates the disabled time of PDO2 Tx.)

Write operation example: To modify the disabled time of PDO2 Tx to 1000 ms, the master transmits the following write operation command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x01	0x18	0x03	0xe8	0x03	0x00	0x00

After receiving a request from the master, the slave responds with the following frame if the operation is successful.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x60	0x01	0x18	0x03	0x00	0x00	0x00	0x00

Read operation example: To read the disabled time of PDO2 Tx, the master station transmits the following read operation command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7

0x603	0x40	0x01	0x18	0x03	0x00	0x00	0x00	0x00
-------	------	------	------	------	------	------	------	------

After receiving the command transmitted by the master station, the slave station transmits the following command response if the current disabled time of PDO2 Tx is 1000 ms.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x43	0x01	0x18	0x03	0xe8	0x03	0x00	0x00

Read/write error example: The master station transmits the following read operation command to read an object (whose index is 0x6000 and subindex is 0x00) that cannot be found.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x00	0x60	0x00	0x00	0x00	0x00	0x00

The object cannot be found, and therefore the slave station transmits the following read/write error command response.

COB-ID	Response code	Object index		Sub-index	Response data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x80	0x00	0x60	0x00	0x00	0x00	0x02	0x06

The error code in the response is 0x06020000, indicating that "Object cannot be found in the object dictionary".

6.4.13 Process data object (PDO)

Four PDO Tx (index range 0x1800–0x1803) and four PDO Rx (index range 0x1400–0x1403) are available. PDO Rx is a PDO command transmitted by the master station to a slave station, that is, it is a master station command. PDO Tx is a PDO command transmitted by a slave station to the master station.

The control word, status word, setting, and return value for each PDO of this slave are defined in the "Manufacturer-specific Object Dictionary." In this way, the process data of a VFD can be monitored not only through PDOs but also through SDOs. For more information, see the next chapter. Each PDO command is labeled with "manufacturer-defined object dictionary" in the format of 0xXXXX.HH, where XXXX indicates an index, HH indicates a subindex, and both of them are hexadecimal.

6.4.13.1 Triggering mode of PDO Tx

Each PDO Tx is defined with a transmission type, disabled time, and event timer. The corresponding subindex of the transmission type is 0x02, that of the disabled time is 0x03, and that of the event timer is 0x05. Therefore, the object dictionary index corresponding to PDO2 Tx is 0x1801, and the subindex is 0x02. The same principle applies to other PDO Tx commands. For more information, see Appendix A. Both the disabled time and event timer units are milliseconds.

Synchronous triggering: When the transmission type is set to 1 to 240, PDO Tx is synchronous transmission. For example, if you set the transmission type of PDO2 Tx to n ($1 \leq n \leq 240$), a slave transmits one PDO2 Tx command every time after it receives n synchronous packet objects. The same principle applies to other PDO Tx commands.

Asynchronous triggering (254): When the value of the event timer is not zero, a slave transmits PDO Tx commands periodically. For example, if the event timer of PDO2 Tx is set to 200, the slave transmits a PDO2 Tx command at the interval of 200 ms. When the value of the event timer is zero, the slave transmits a PDO Tx command once the corresponding PDO Tx data changes, and the transmission interval is subject to the disabled time. A PDO Tx packet can be transmitted only once in the disabled time, which effectively reduces the load of the bus. When the disabled time is set to a period shorter than 50 ms, 50 ms is used as the disabled time.

Asynchronous triggering (255): When the value of the event timer is not zero, a slave transmits PDO Tx commands periodically. For example, if the event timer of PDO2 Tx is set to 200, the slave transmits a PDO2 Tx command at the interval of 200 ms. When the value of the event timer is zero, the slave transmits a PDO Tx command once a

corresponding PDO Rx command is received. For example, after receiving a PDO2 Rx command, the slave transmits a PDO2 Tx command.

Table 6-15 Supported trigger modes of this CANopen slave

Trigger mode	Transmission type (decimal)	Event triggering	PDO1 TX	PDO2 TX	PDO3 TX	PDO4 TX
Synchronous	1–240	/	Not supported	Supported	Supported	Supported
Asynchronous	254	Event timer	Not supported	Supported	Supported	Supported
		Disabled time	Not supported	Supported	Supported	Supported
	255	Event timer=0	Supported	Supported	Supported	Supported
		Event timer	Not supported	Supported	Supported	Supported

Table 6-16 Default PDO Tx values of this CANopen slave

Item	PDO1 TX	PDO2 TX	PDO3 TX	PDO4 TX
Transmission type	255	254	254	254
Event timer (ms)	0	0	0	0
Disabled time (ms)	500	500	500	500

For details on how to set PDO Tx trigger modes, see 6.4.12 Service data object (SDO).

6.4.13.2 PDO1 Rx

PDO1 is used to read and write parameters of the VFD. The function of PDO1 is similar to that of an SDO. SDOs are used to read and write objects of an object dictionary, and PDO1 is used to read and write parameters of the VFD.

Note: PDO1 Tx support only the transmission type of asynchronous transmission 255. Do not set it to other transmission types, and do not try to set the event timer to periodically transmits PDO1 Tx to the master.

■ PDO1 Rx command

Request: Master → Slave

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x200+NODEID	Request code		Parameter address		0x0000		Requested data	
	0x2100.00		0x2100.01		/		0x2100.02	

■ PDO1 Rx description

A request code is two bytes. Byte0 is the LSB, and Byte1 is the MSB. The manufacturer defines the index 0x2100 and subindex 0x00 for the request codes. Refer to Table 6-17 for the functions of the request codes.

Table 6-17 Request code

Request code	Function
0	No task
1	Reading a parameter value
2	Modifying a parameter value [modifying the value only on RAM]
4	Modifying a parameter value [modifying the value only on both RAM and EEPROM] (reserved)

A parameter address is two bytes. Byte2 is the LSB, and Byte3 is the MSB. It indicates the address of the parameter to be read or modified.

VFD function code address representation rules: The MSB is the hexadecimal form of the number before the dot mark, and LSB is that of the number behind the dot mark. Take P10.01 as an example, the number before the dot mark is 10,

that is, the MSB of the parameter address is 0×0A; and the number behind the dot mark is 01, that is, the LSB is 0×01. Therefore, the function code address is 0×0A01.

Table 6-18 Goodrive600A series VFD parameter addresses

Inverter function code	Name	Description	Default
P10.00	Simple PLC mode	0: Stop after running once 1: Keep running with the final value after running once 2: Cyclic running	0
P10.01	Simple PLC power-loss memory	0: Disable 1: Enable	0

A piece of requested data is two bytes. Byte4 is the LSB, and Byte5 is the MSB. It indicates the data to be modified. When the command is transmitted for reading data, the requested data is not used.

Note: The PDO1 Rx data field size is selected as either 8 or 6 bytes via function code P14.42.

6.4.13.3 PDO1 Tx

■ PDO1 Tx command

Response: Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x180+NODEID	Response code		Fault code		0x0000		Response data	
	0x2000.00		0x2000.01		/		0x2000.02	

■ PDO1 Tx description

Byte 6 and byte 7 are reserved and both are 0x00.

A response code is two bytes. Byte0 is the LSB, and Byte1 is the MSB. Refer to Table 6-19 for the functions of the response codes.

Table 6-19 Response code

Response code	Function
0	No response
1	Reading or writing succeeds
3	A reading or writing error occurs. Table 6-20 describes the error codes.

A piece of response data is four bytes. Byte4 is the LSB, and Byte7 is the MSB. When a write command is responded, the response data is the data to be modified; and when a read command is responded, the response data is the data to be read.

An error code is two bytes. Byte2 is the LSB, and Byte3 is the MSB. The error code occupies two bytes, where Byte 2 is the low byte and Byte 3 is the high byte. The error code is only valid when the response code is 3. The error code indicates the reason why the PDO1 Rx could not be processed; its meanings are shown in Table 6-20.

Table 6-20 Error code

Code	Name	Meaning
00H	No error	/
01H	Invalid command	The operation corresponding to the request code is not allowed to be executed. The possible causes are as follows: The function code is applicable only on new devices and is not implemented on this device.

Code	Name	Meaning
		● The slave is in the faulty state when processing this request.
02H	Invalid data address	For a slave device, the data address in the request of the master is not allowed. In particular, the combination of the register address and the number of the to-be-transmitted bytes is invalid.
03H	Invalid data value	The received data domain contains a value that is not allowed. The value indicates the error of the remaining structure in the combined request.
04H	Operation failure	The parameter is set to an invalid value in the write operation. For example, a function input terminal cannot be set repeatedly.
05H	Incorrect password	The password entered in the password verification address is different from that set by the user.
06H	Incorrect data frame	This occurs when the length of the data frame in the message sent by the host controller is incorrect, or when the parity bit does not match the parity calculated by the lower-level device.
07H	Parameter read-only	The parameter to be modified in the write operation of the master is a read-only parameter.
08H	Parameter cannot be modified in running	The parameter to be modified in the write operation of the master cannot be modified during the running of the VFD.
09H	Password protection	If the master does not provide the correct password to unlock the system to perform a read or write operation, the error of "system being locked" is reported.

■ Example of PDO1

For a Goodrive600A drive with slave address 3, assume function code P14.10 needs to be set to 1.

Command analysis: The parameter address of P14.10 is 0x0E0A. According to the protocol, the request code of PDO1 Rx is 0x02, the parameter address is 0x0E0A, and the requested data is 0x01, and therefore PDO1 Rx transmitted by the master is as follows.

COB-ID	Request code		Parameter address		PKW3		Requested data	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x203	0x02	0x00	0x0A	0x0E	0x00	0x00	0x01	0x00

If the VFD parameter is successfully modified, the following PDO1 Tx command is returned.

COB-ID	Response code		Fault code		PKW3		Response data	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x183	0x01	0x00	0x00	0x00	0x00	0x00	0x01	0x00

6.4.13.4 PDO2 Rx

PDO2 Rx is used to modify CWs and real-time process data (setting 1, setting 2, and setting 3) of a VFD. A CW is used to control the start and stop of a VFD, and settings are used to control the real-time running values of the VFD, such as set frequency.

■ PDO2 Rx command

Master → Slave

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x300+NODEID	Control word		Setting 1		Setting 2		Setting 3	
	0x2101.00		0x2100.03		0x2100.04		0x2100.05	

■ PDO2 Rx description

A CW is two bytes. Byte 0 is the least significant byte (LSB), and byte 1 is the most significant byte (MSB). Refer to Table

6-21 for the definitions of the Goodrive600A inverter unit control words in decimal and Table 6-41 for those in binary.

Table 6-21 Goodrive600A inverter unit control word definitions (decimal)

Bit	Name	Value	Description
0–7	Communication-based control command	1	FWD run
		2	REV run
		3	FWD jog
		4	REV jog
		5	Stop
		6	Coast to stop
		7	Fault reset
		8	Jog stop
		9	Emergency stop (Stops with the deceleration time set in P01.26)
8	PKW write enable	1	Enable PKW write
		0	Disable PKW write
9–10	Motor group setting	00	MOTOR GROUP 1 SELECTION
		01	MOTOR GROUP 2 SELECTION
		02	/
		03	/
11	Torque control selection	1	Torque control enable
		0	Disable torque control
14–15	Reserved	/	/

The function of each setting can be set through the corresponding function code of the VFD. The setting method is the same as that for "PZD Rx" in PROFIBUS-DP communication. For details, see the VFD operation manual. Setting 1, setting 2, and setting 3 correspond to received PZD2, received PZD3, and received PZD4, respectively. To set the function of setting 1 to "Set frequency", you need only to set "PZD2 Rx" to "1: Set frequency". The same principle applies to other settings. When multiple settings are enabled, the failure to set one setting (for example, the set value exceeds the setting range) does not affect the setting of other settings.

■ Example

Assume that the VFD is a Goodrive600A with a slave address of 3. Use CANopen communication to control the inverter unit to run, and to set the running frequency to 50 Hz.

Command analysis: You need to set the VFD start mode and frequency reference mode to CANopen communication (P00.01=2, P00.02=1, P00.06=9) first. In this example, "Setting 2" is used as the frequency reference (P14.11 = 1, that is, PZD3 is set to "1: Frequency setting").

When a CW is 0x01, it indicates that the VFD is to be run. To set the frequency to 50 Hz, you need to set Setting 2 to 5000, that is, 0x1388.

The PDO2 Rx data sent by the master is as follows:

COB-ID	Control word		Setting 1		Setting 2		Setting 3	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x303	0x01	0x00	0x00	0x00	0x88	0x13	0x00	0x00

6.4.13.5 PDO2 Tx

PDO2 Tx is a command transmitted by a VFD to the master. It contains an SW and real-time process data (Returned value 1, returned value 2, and returned value 3). An SW is used to notify of the state of the VFD, and returned values are used to transmit the real-time running values of VFD, such as running frequency.

The default transmission type of PDO2 Tx is 254, and therefore PDO2 Tx is transmitted once data corresponding to an SW or returned value changes.

■ PDO2 Tx command

Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x280+NODEID	Status word		Returned value 1		Returned value 2		Returned value 3	
	0x2001.00		0x2000.03		0x2000.04		0x2000.05	

■ PDO2 Tx description

An SW is two bytes. Byte0 is the LSB, and Byte1 is the MSB. Refer to Table 6-22 for the definitions of the Goodrive600A inverter unit status words in decimal and Table 6-43 for those in binary.

Table 6-22 Goodrive600A inverter unit status word definitions

Bit	Name	Value	Description
0–7	Run status byte	1	Running forward
		2	Running in reverse
		3	VFD in stopped state
		4	VFD in fault
		5	VFD in POFF state
8	Bus voltage established	1	Ready to run
		0	Not ready to run
9–10	Motor group feedback	0	Feedback from motor 1
		1	Feedback from motor 2
		2	/
		3	/
11	Motor type feedback	1	Synchronous motor (SM)
		0	Asynchronous motor (AM)
12	Overload alarm feedback	1	Overload alarm
		0	No overload alarm
13	Exciting in progress	1	Exciting in progress
		0	Magnetic flux established
14–15	Reserved	/	/

The function of each returned value can be set through the corresponding function code of the VFD. The setting method is the same as that for "PZD Tx" in PROFIBUS-DP communication. For details, see the VFD operation manual. Returned value 1, returned value 2, and returned value 3 correspond to transmitted PZD2, transmitted PZD3, and transmitted PZD4, respectively. To set the function of returned value 1 to "Running frequency", you need only to set "PZD2 Tx" to "1: Running frequency". The same principle applies to other returned values. Multiple returned values can be enabled simultaneously.

■ Example

Assume that the VFD unit is a Goodrive600A inverter unit with a slave address of 3. The VFD is running, and the running frequency is 50.00 Hz. Returned value 1 is set to "Running frequency", returned value 2 is set to "Output voltage", and returned value 3 is set to no function.

Command analysis: Returned value 1 is set to the VFD running frequency (P14.21 = 1), returned value 2 to the VFD output voltage (P14.22 = 4), and returned value 3 to not used (P14.23 = 0).

The VFD is running and the bus voltage has been established, and therefore the SW is 0x0101. The running frequency is 50.00 Hz, and therefore returned value 1 is 5000, that is, 0x1388. If the output voltage is 380 V, returned value 2 is 0x017C.

The PDO1 Tx data sent by the VFD is as follows.

COB-ID	Status word		Returned value 1		Returned value 2		Returned value 3	
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x283	0x01	0x01	0x88	0x13	0x7C	0x01	0x00	0x00

6.4.13.6 PDO3 Rx

PDO3 Rx and PDO4 Rx are used to modify the real-time process data of a VFD, such as set frequency.

■ PDO3 Rx command

Master → Slave

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x400+NODEID	Setting 4		Setting 5		Setting 6		Setting 7	
	0x2100.06		0x2100.07		0x2100.08		0x2100.09	

■ PDO4 Rx command

Master → Slave

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x500+NODEID	Setting 8		Setting 9		Setting 10		Setting 11	
	0x2100.0a		0x2100.0b		0x2100.0c		0x2100.0d	

■ Description

The application methods for PDO3 Rx and PDO4 Rx are the same as that for PDO2 Rx. For the mapping between the settings and PROFIBUS-DP PZDs, refer to Table 6-21 and Table 6-22.

6.4.13.7 PDO3 Tx and PDO4 Tx

PDO3 Tx and PDO4 Tx are used by the VFD to transmit real-time process data to the master, such as running frequency.

The default transmission type of PDO3 Tx and PDO4 Tx is 254, and therefore PDO3 Tx or PDO4 Tx is transmitted once data corresponding to a returned value in the same command changes.

■ PDO3 Tx command

Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x380+NODEID	Returned value 4		Returned value 5		Returned value 6		Returned value 7	
	0x2000.06		0x2000.07		0x2000.08		0x2000.09	

■ PDO4 Tx command

Slave → Master

COB-ID	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x480+NODEID	Returned value 8		Returned value 9		Returned value 10		Returned value 11	
	0x2000.0a		0x2000.0b		0x2000.0c		0x2000.0d	

6.4.13.8 Monitoring process data through SDO commands

You can monitor the VFD by using SDOs to read the manufacturer-defined object dictionary.

For the definition and application of the CWs, SWs, settings, and returned values in the manufacturer-defined object dictionary, see the PDO description section. For application of SDOs, see the SDO description section. Do not try to use SDOs to read and write VFD parameters. For the manufacturer-specific object dictionary, refer to Table 6-23 and Table 6-24.

Table 6-23 Objects with the control function in the manufacturer-defined object dictionary

Index (hexadecimal)	Subindex (hexadecimal)	Function	Access permission	Data length	Description
2100	0	Number of sub-indices of 2100	RO	1 bytes	/
	1	PKW1	RW	2 bytes	Command data sent by the master
	2	PKW2	RW	2 bytes	Command data sent by the master
	3	PKW3	RW	2 bytes	Command data sent by the master
	4	PKW4	RW	2 bytes	Command data sent by the master
	5	CW	RW	2 bytes	Command data sent by the master
	6	PZD2	RW	2 bytes	Command data sent by the master
	7	PZD3	RW	2 bytes	Command data sent by the master
	8	PZD4	RW	2 bytes	Command data sent by the master
	9	PZD5	RW	2 bytes	Command data sent by the master
	A	PZD6	RW	2 bytes	Command data sent by the master
	B	PZD7	RW	2 bytes	Command data sent by the master
	C	PZD8	RW	2 bytes	Command data sent by the master
	D	PZD9	RW	2 bytes	Command data sent by the master
	E	PZD10	RW	2 bytes	Command data sent by the master
	F	PZD11	RW	2 bytes	Command data sent by the master
	10	PZD12	RW	2 bytes	Command data sent by the master

Table 6-24 Objects with the monitoring function in the manufacturer-defined object dictionary

Index (hexadecimal)	Subindex (hexadecimal)	Function	Access permission	Data length	Description
2000	0	Number of sub-indices of 2000	RO	1 bytes	-
	1	PKW1	RO	2 bytes	Response data sent by the slave
	2	PKW2	RO	2 bytes	Response data sent by the slave
	3	PKW3	RO	2 bytes	Response data sent by the slave
	4	PKW4	RO	2 bytes	Response data sent by the slave
	5	SW	RO	2 bytes	Response data sent by the slave
	6	PZD2	RO	2 bytes	Response data sent by the slave
	7	PZD3	RO	2 bytes	Response data sent by the slave
	8	PZD4	RO	2 bytes	Response data sent by the slave
	9	PZD5	RO	2 bytes	Response data sent by the slave
	A	PZD6	RO	2 bytes	Response data sent by the slave
	B	PZD7	RO	2 bytes	Response data sent by the slave
	C	PZD8	RO	2 bytes	Response data sent by the slave
	D	PZD9	RO	2 bytes	Response data sent by the slave
	E	PZD10	RO	2 bytes	Response data sent by the slave
	F	PZD11	RO	2 bytes	Response data sent by the slave
	10	PZD12	RO	2 bytes	Response data sent by the slave

■ Example

Example 1: To instruct the VFD whose address is 3 to run forwardly, the master transmits the following SDO command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x01	0x21	0x00	0x01	0x00	0x00	0x00

Example 2: Assume that the address of the VFD slave is 3, and the function of setting 1 is defined as "Set frequency". To set the frequency to 50.00 Hz (that is, setting 1=0x1388), the master transmits the following SDO command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x2B	0x00	0x21	0x03	0x88	0x13	0x00	0x00

Example 3: To read the running state of the VFD whose address is 3, the master transmits the following SDO command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x01	0x20	0x00	0x00	0x00	0x00	0x00

If the VFD is running forward, the following SDO command is returned to the master.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x4B	0x01	0x20	0x00	0x01	0x01	0x00	0x00

Example 4: Assume that the address of the VFD slave is 3, and the function of returned value 1 is defined as "Running frequency". To read the VFD running frequency, the master transmits the following SDO command.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x603	0x40	0x00	0x20	0x03	0x00	0x00	0x00	0x00

If the running frequency of the VFD is 50.00Hz, the following SDO command is returned to the master.

COB-ID	Request code	Object index		Sub-index	Requested data			
	Byte0	Byte1	Byte2	Byte3	Byte4	Byte5	Byte6	Byte7
0x583	0x4B	0x00	0x20	0x03	0x88	0x13	0x00	0x00

6.4.14 Related parameters

Table 6-25 Rectifier unit related parameters

Rectifier function code	Name	Description	Recommended value
P21.01	CANopen module address	Setting range: 1–32	/
P21.13–P21.23	PZD2 transmit–PZD12 transmit	Setting range: 0–20 For details, see Group P21—CANopen	/

Rectifier function code	Name	Description	Recommended value
		communication in the gateway-type rectifier function parameter section.	
P21.29	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500Kbps 5: 800kbps 6: 1Mbps	Consistent with that on the PLC or other host controller.
P21.30	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–100.0s	1.5s
P21.34	CANopen master/slave selection	0: Slave 1: Master	0
P21.51	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable) Bit0: PDO1	0xF
P21.52	PDO transmit enable	Bit1: PDO2 Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF
P22.28	Inverter unit PKW area compatibility	0: 8 bytes (PKW1–4) 1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of inverter function parameter P14.42.	0

Table 6-26 Inverter unit related parameters

Inverter function code	Name	Description	Recommended value
P14.07	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	1.5
P14.08	CANopen communication address	Setting range: 1–32	/
P14.09	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500Kbps 5: 800kbps 6: 1Mbps	Consistent with that on the PLC or other host controller.
P14.10–P14.20	PZD2 receive–PZD12 receive	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section.	/
P14.21–P14.31	PZD2 transmit–PZD12 transmit	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section.	/
P14.42	PKW byte length selection	0: 8 bytes (PKW1–4)	0

Inverter function code	Name	Description	Recommended value
		1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of the rectifier function parameter P22.28.	
P14.43	PDO control command mode selection	0: Simplified CANopen mode (CW sent via broadcast message) 1: Standard CANopen mode (CW sent via CANopen message)	1
P14.88	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable)	0xF
P14.89	PDO transmit enable	Bit0: PDO1 Bit1: PDO2 Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF

6.5 PROFIBUS-DP-to-CANopen networking

6.5.1 PROFIBUS-DP communication protocol overview

PROFIBUS is an international, open fieldbus standard. It enables data exchange among various automation devices. It is widely applicable to automation in various industries, such as the manufacturing, process, building, transportation, and power industries. It provides effective solutions for implementing integrated automation and intelligentization of field devices.

PROFIBUS consists of three mutually compatible components, namely PROFIBUS-Decentralised Peripherals (DP), PROFIBUS-Process Automation (PA), and PROFIBUS-Fieldbus Message Specification (FMS). It adopts the master/slave mode and is generally used for periodic data exchange between VFD devices. PRNV PROFIBUS-DP adapter modules support only the PROFIBUS-DP protocol.

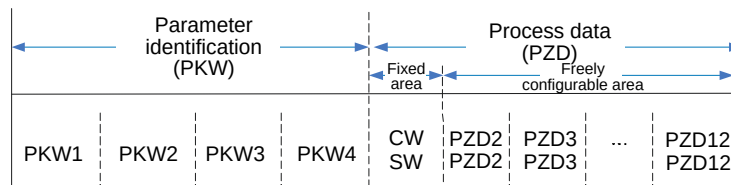
The transmission media of a PROFIBUS field bus are twisted pairs (complying with the RS-485 standard), paired cables, or optical cables. The baud rate ranges from 9.6kbit/s to 12Mbit/s. The maximum bus cable length ranges from 100 m to 1200 m, depending on the selected transmission rate (see Appendix C Technical data). A maximum of 31 nodes can be connected to one PROFIBUS network segment when no repeater is used. If repeaters are used, a maximum of 127 nodes (including the repeaters and master nodes) can be connected.

In PROFIBUS communication, tokens are transmitted between master nodes or by master nodes to slave nodes. Single-master or multi-master systems are supported. The node to respond to the command of a master is selected by the master node, generally a programmable logic controller (PLC). For cyclic master/slave user data transmission and non-cyclic master-master data transmission, a master can also transmit commands to multiple nodes in broadcast mode. When the broadcast mode is adopted, the nodes do not need to transmit feedback signals to the master. On PROFIBUS networks, nodes cannot communicate with each other.

The PROFIBUS protocol is described in details in the EN50170 standard. For details, refer to the EN50170 standard.

6.5.2 Communication packet structure

The communication data frame structure (PKW + PZD) of PROFIBUS-DP is identical to that of PROFINET. Refer to section 6.6.2 Communication packet structure.



6.5.3 Baud rate and communication distance

The maximum length of a cable depends on the transmission rate. The following table lists the relationship between transmission rate and transmission distance.

Table 6-27 Relationship between transmission rate and transmission distance

Transmission rate (kbps)	Type A cable (m)	Type B cable (m)
9.6	1200	1200
19.2	1200	1200
93.75	1200	1200
187.5	1000	600
500	400	200
1500	200	/
12000	100	/

Table 6-28 Cable parameters

Item	Type A cable	Type B cable
Impedance (Ω)	135–165	100–130
Capacitance per unit length (pF/m)	<30	< 60
Loop resistance (Ω /km)	110	/
Conductor diameter (mm)	0.64	>0.53
Conductor cross-sectional area (mm ²)	>0.34	>0.22

In addition to the shielded twisted-pair copper cables, you can also use optical fibers for transmission in a PROFIBUS system. When a PROFIBUS system is applied in an environment with strong electromagnetic interference, you can use optical fiber conductors to increase the high-speed transmission distance. Two types of optical fiber can be used. One is low-cost plastic optical fiber (POF), suitable for transmission distances of less than 50 m. The other is glass optical fiber, suitable for transmission distances of less than 1 km.

6.5.4 Network topology

When a PROFIBUS-DP communication expansion card is installed in the rectifier unit, the PLC or other master device communicates only with the rectifier unit. The rectifier unit converts the communication bus of the expansion card into a CANopen bus and connects to other units via the RJ45 port.

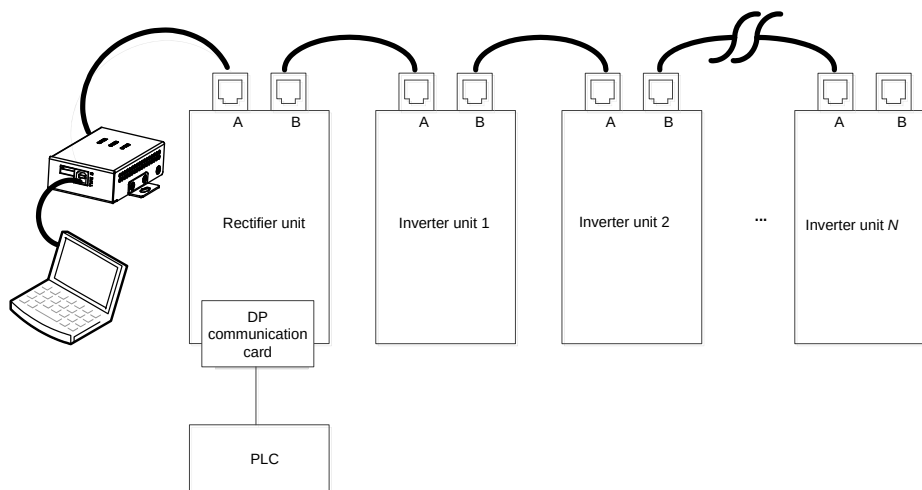


Figure 6-6 PROFIBUS-DP to CANopen network topology

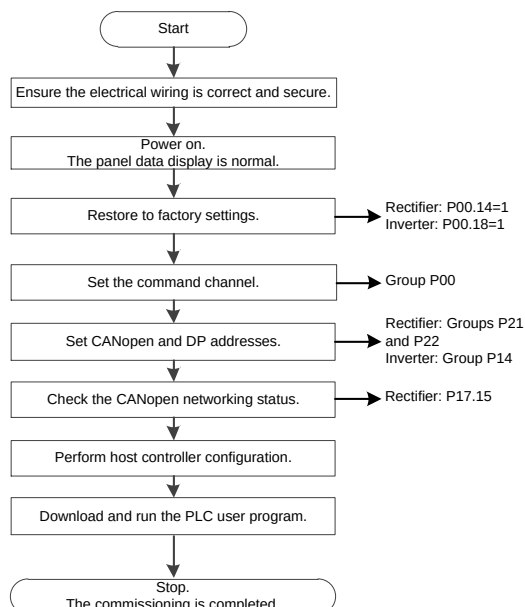
Note: In the networking wiring, the RJ45 ports between units must be cross-connected, that is, port A of a unit can only be connected to port B of another unit. If the connection is incorrect, the communication performance of the entire system will be degraded.

6.5.5 Communication performance

A PROFIBUS-DP-to-CANopen gateway unit (i.e., the rectifier unit with the expansion card installed) can support up to 31 CANopen slave nodes. The gateway unit itself functions as a CANopen master. The maximum data exchanged between one gateway unit and the PLC is 128 bytes for both transmit and receive directions. In addition, the number of supported slave nodes also depends on the limit of the PLC. In general, Siemens PLCs allow more DP nodes than the GD600A's limit of 31 slaves; therefore, only the capacity of the gateway unit itself needs to be considered.

6.5.6 Commissioning procedure

6.5.6.1 Flowchart for commissioning the PROFIBUS-DP to CANopen network



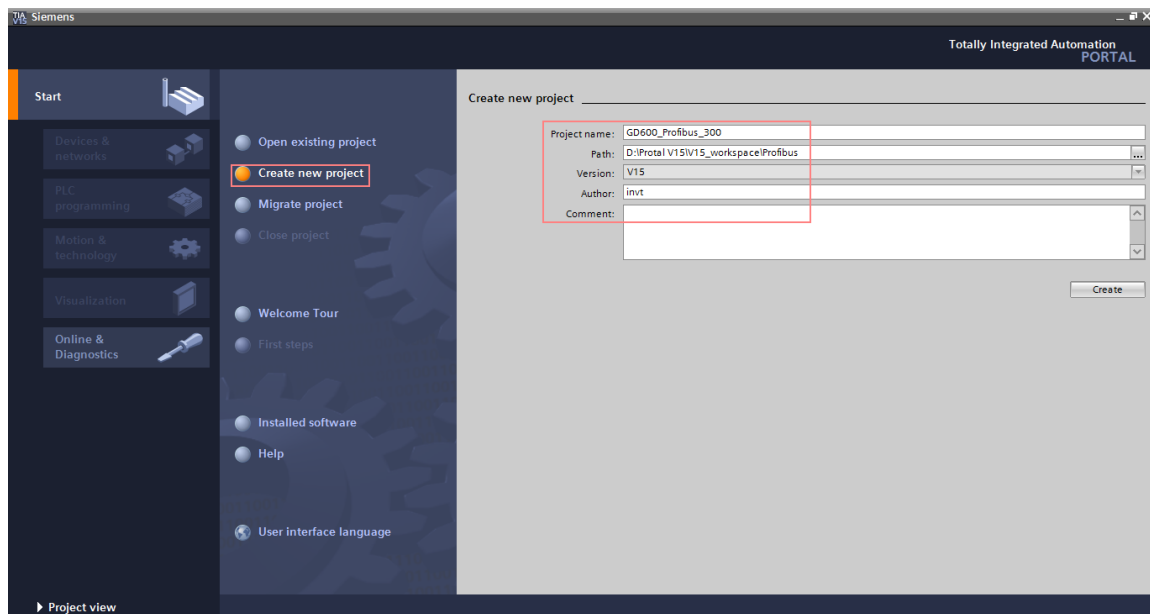
6.5.6.2 TIA portal configuration (S7-300)

The configuration process is illustrated using TIA Portal V15 as an example.

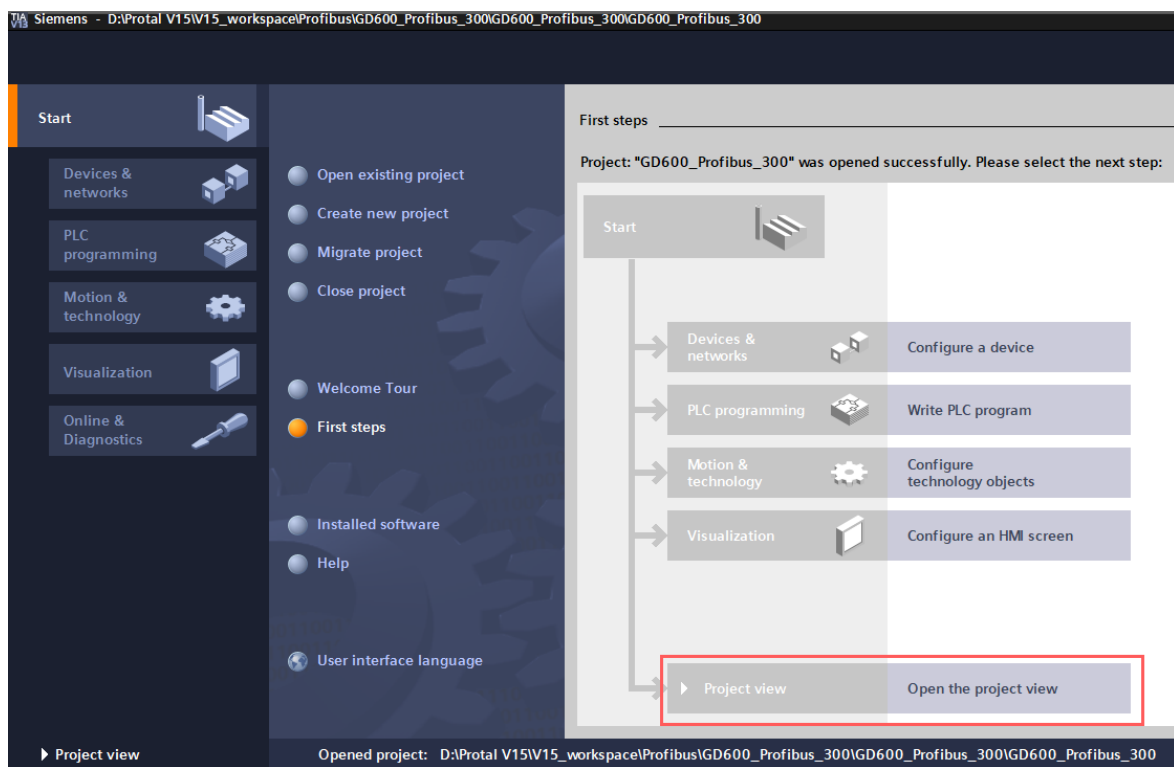
1. Create a project.

Double-click the TIA Portal V15 icon to start the TIA Portal V15 project tool. Then choose **Create new project**. On

the right of the interface, enter **Project name**, **Path**, **Version**, **Author**, and **Comment**, and then click **Create** to generate a new project, as shown in the following figure.



Then double-click to open the project view, as shown in the following figure.

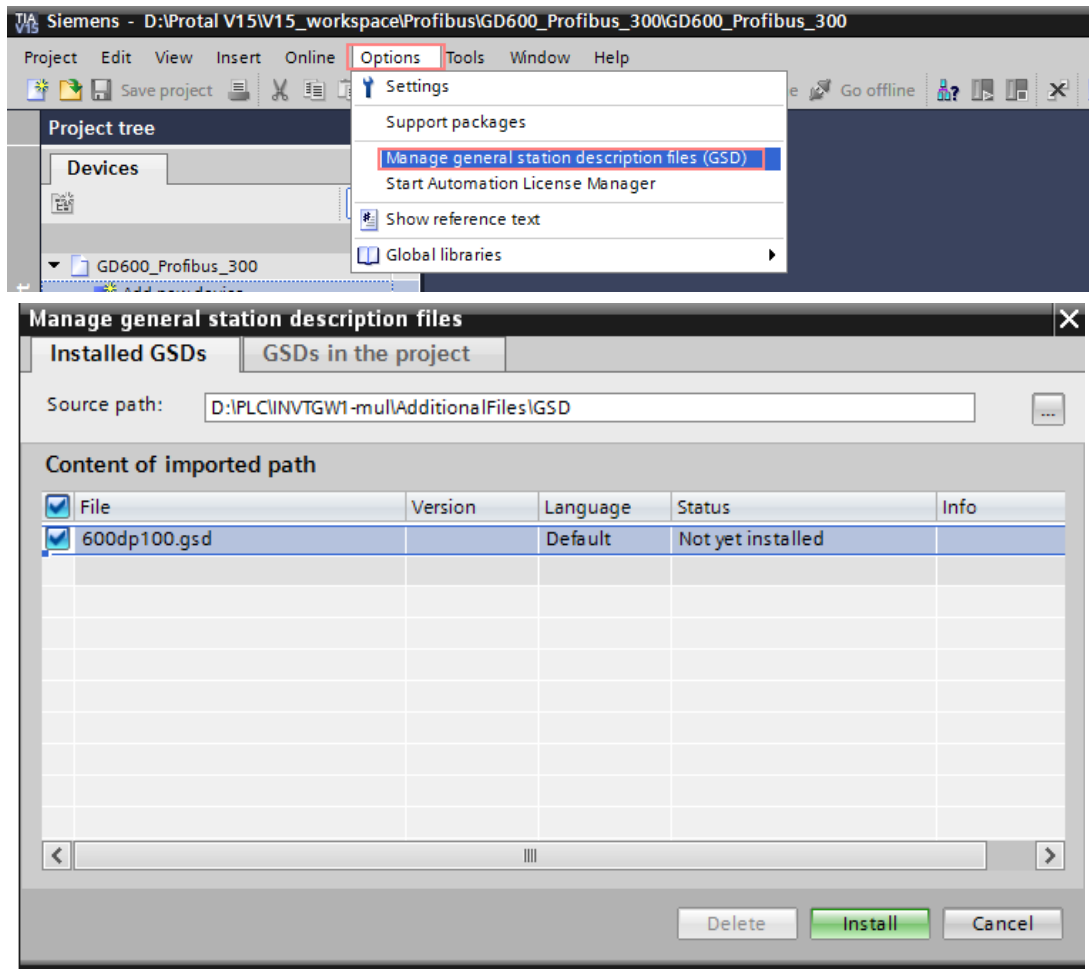


2. Add the GSD file.

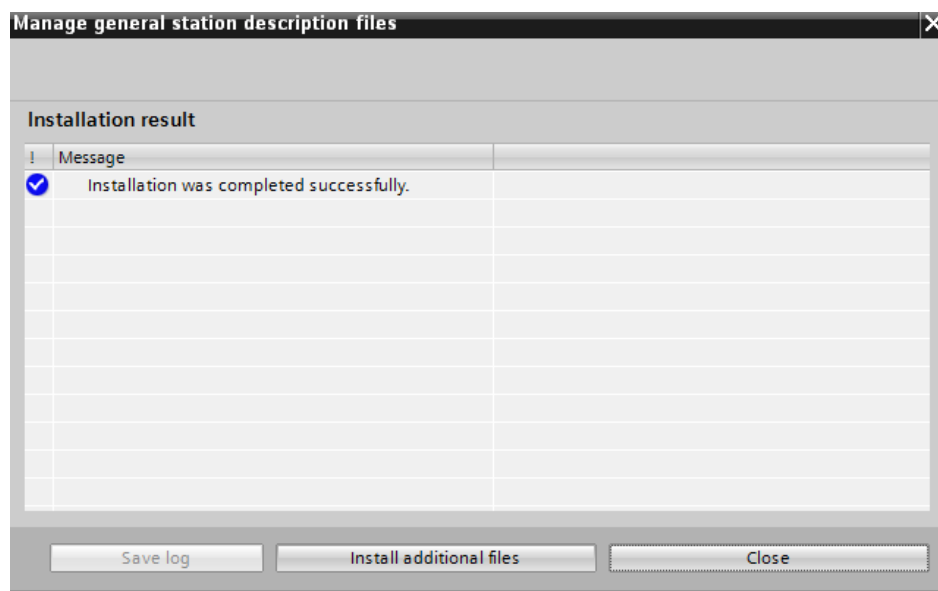
Select the GSD file as shown in the following figure.



Click **Options** on the toolbar, and then choose **Manage general station description files (GSD)**. In the dialog box that appears, enter the source path of the GSD file, select the GSD file, and click **Install**.



After the installation is complete, a dialog box will appear, indicating that the GSD file has been successfully installed.

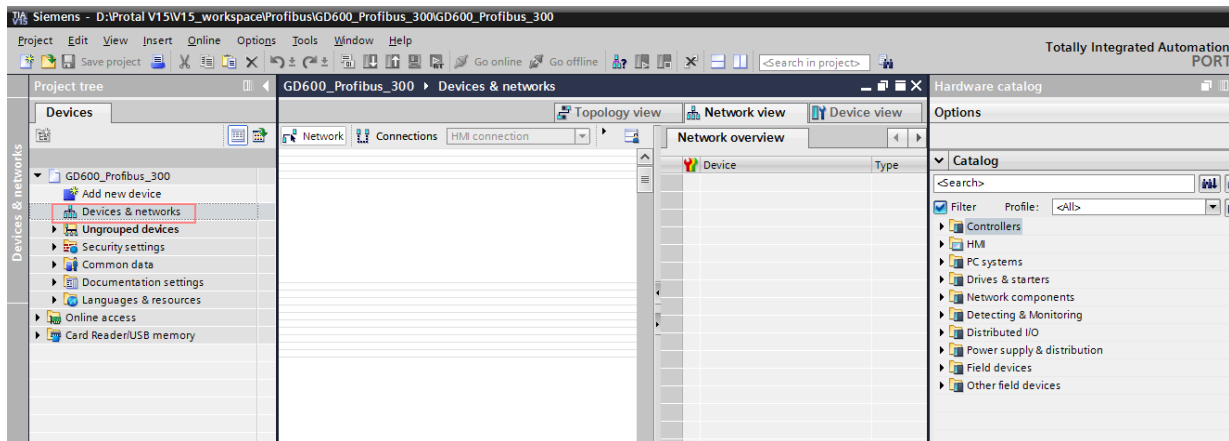


3. Configure project information.

To configure project information, do as follows:

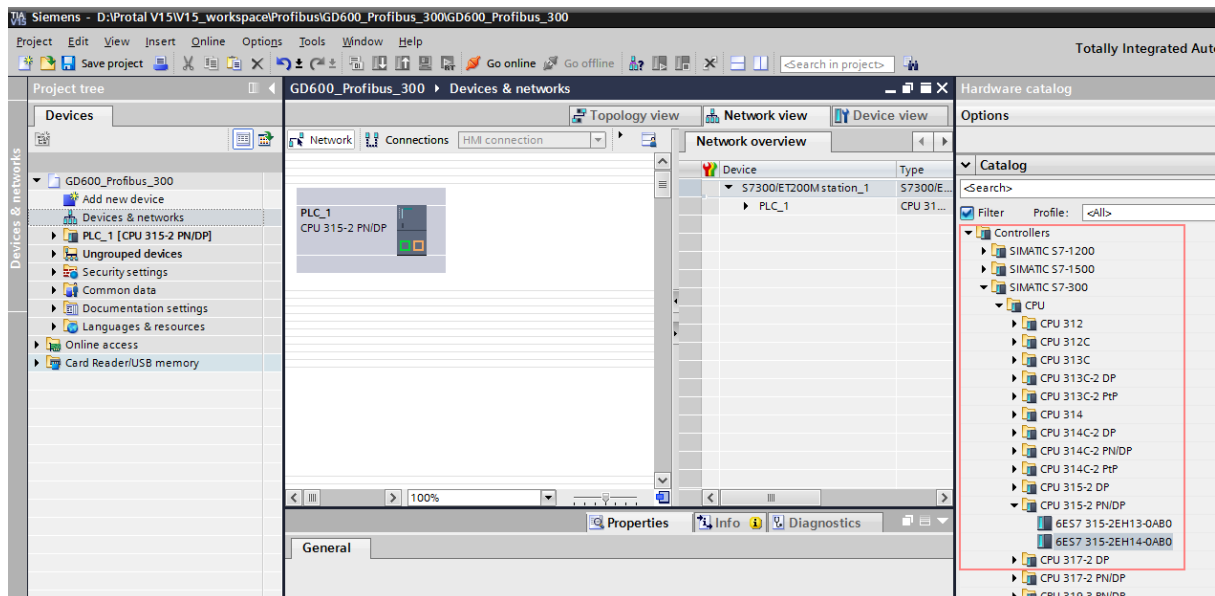
Step 1 Enter the project view.

In the project view for the new project in TIA Portal V15, double-click **Devices & networks** to open the network view.

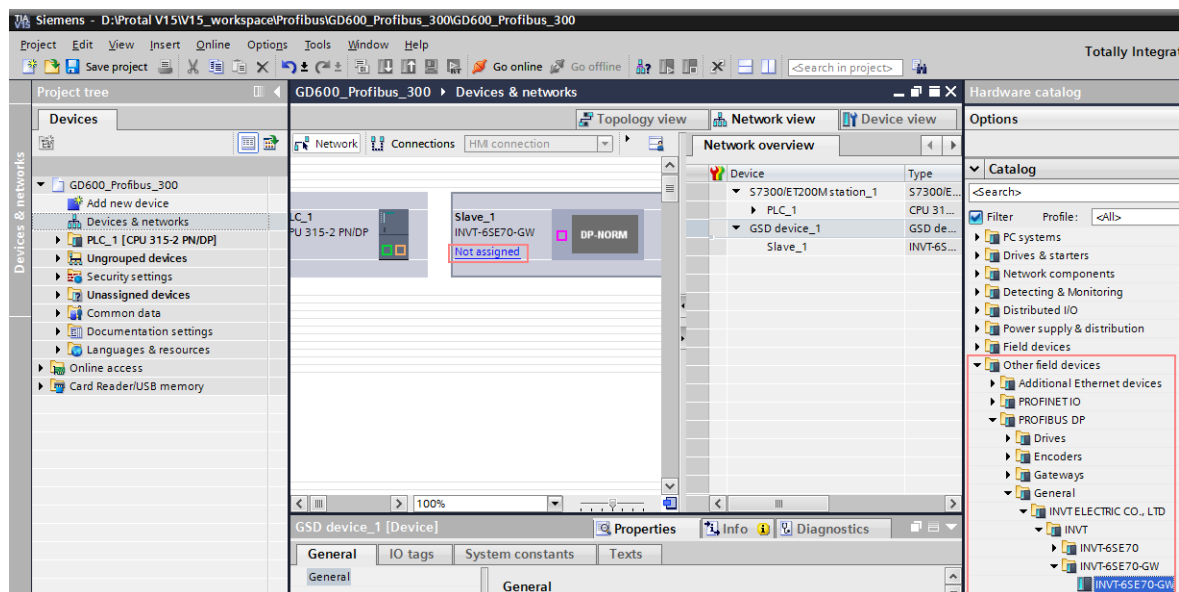


Step 2 Add devices to the project according to the PLC model used.

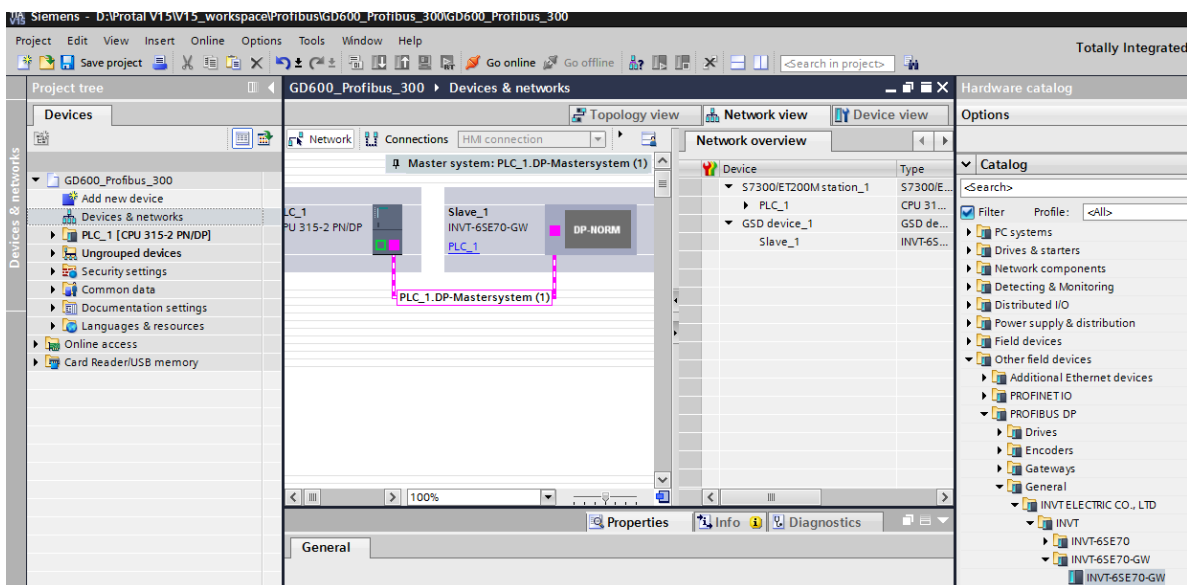
For example, when using a Siemens S7-300 PLC, choose **Controllers** > **SIMATIC S7-300** > **CPU** > **CPU 315-2 PN/DP** > **6ES7 315-2EH14-0AB0** in the **Hardware catalog** panel on the right, and then double-click or drag the **315-2EH14-0AB0** icon into the project to add the S7-300 PLC, as shown in the following figure.



In the **Hardware catalog** panel on the right, choose **Other field devices** > **PROFIBUS DP** > **General** > **INVT ELECTRIC CO., LTD** > **INVT** > **INVT-6SE70-GW**, and then double-click the **INVT-6SE70-GW** icon to add the GSD file to the project, as shown in the following figure.

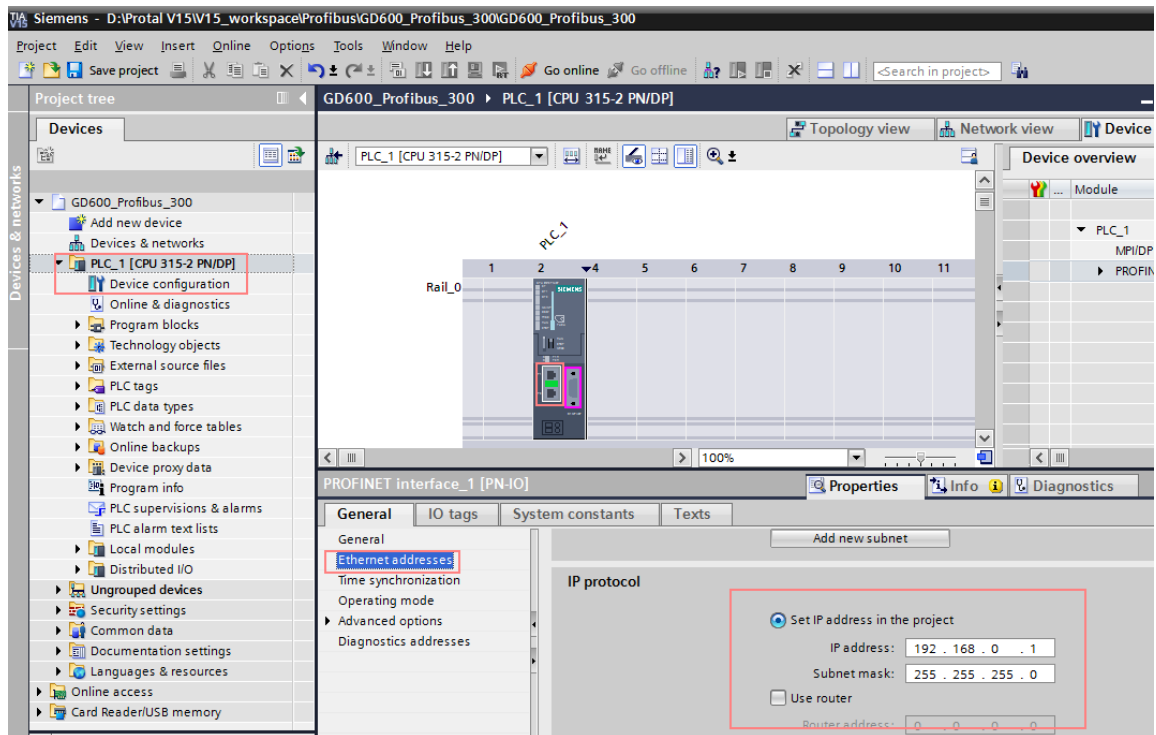


Click the **Not assigned** option of **INVT-6SE70-GW**, and select the IO controller **PLC_1.MPI/DP interface_1**. In the network view, the CPU and INVT-6SE70-GW have been connected to the same PROFIBUS subnet.

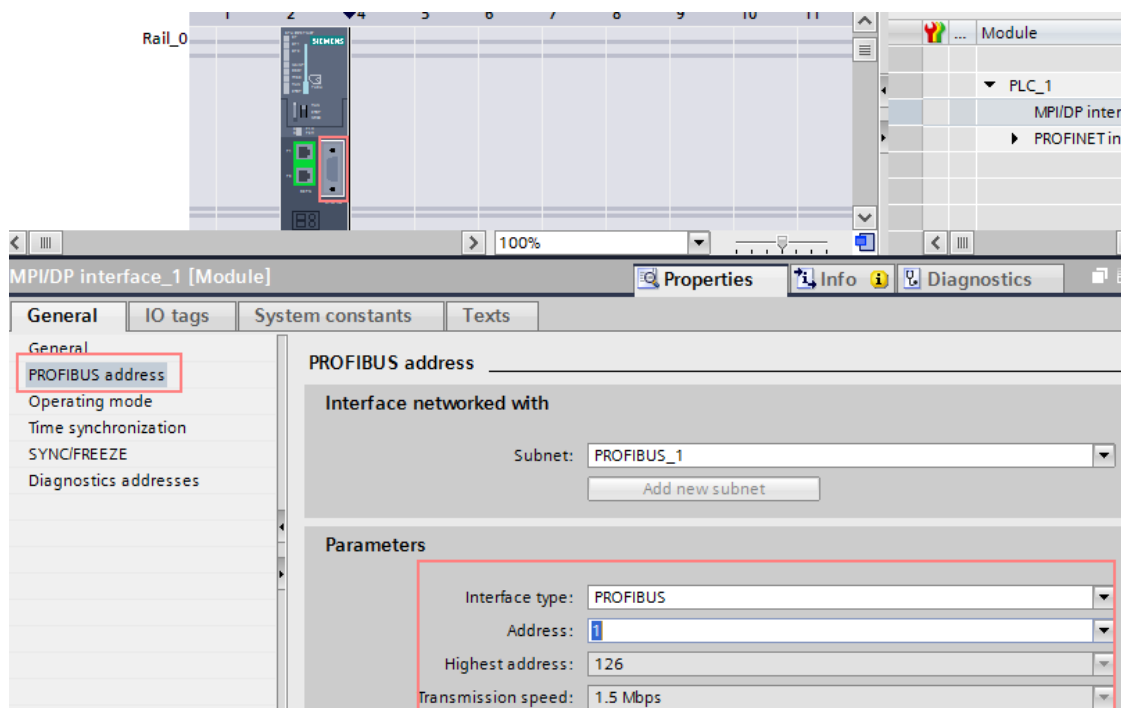


Step 3 Configure the PROFIBUS master.

Double-click **Devices & networks** to open the network view editor. In the network view, double-click **PLC_1 CPU 315-2 PN/DP** to enter the device view. Double-click the network interface of the S7-300 device to open the **PROFINET interface_1** configuration view. Click the **General** tab, choose **Ethernet addresses**, and set the S7-300 parameters (PLC IP address and device name) shown in the following figure.

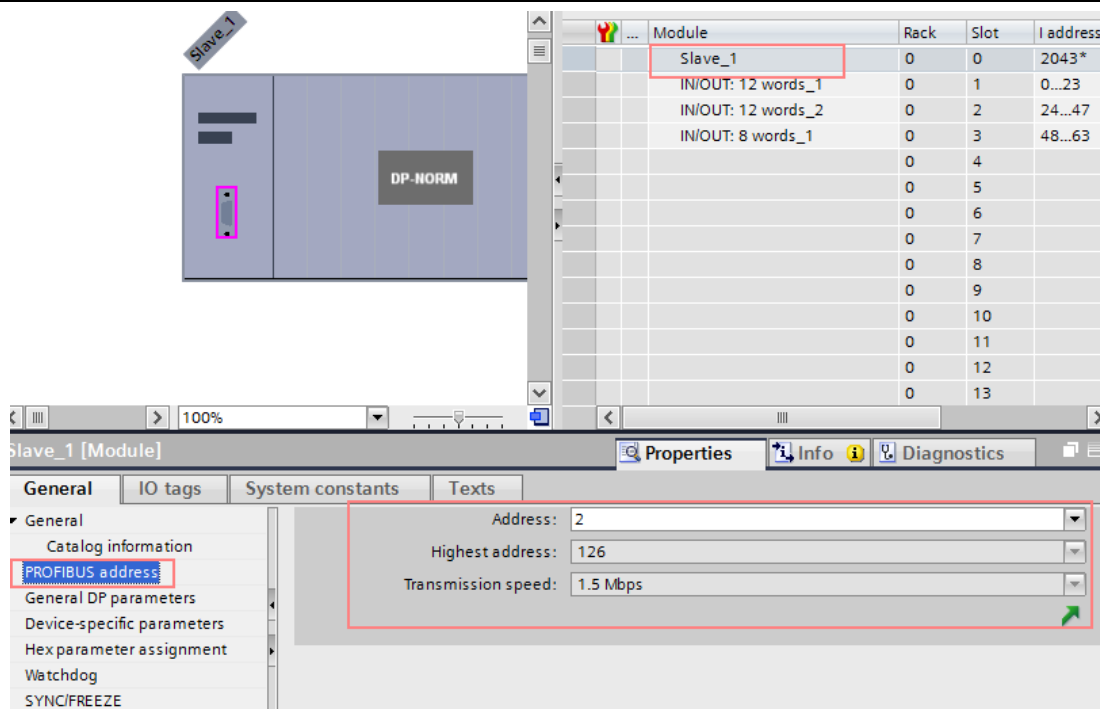


Click **MPI/DP interface_1** to enter the MPI/DP interface_1 editing interface. Click the **General** tab, choose **PROFIBUS address**, and set parameters.

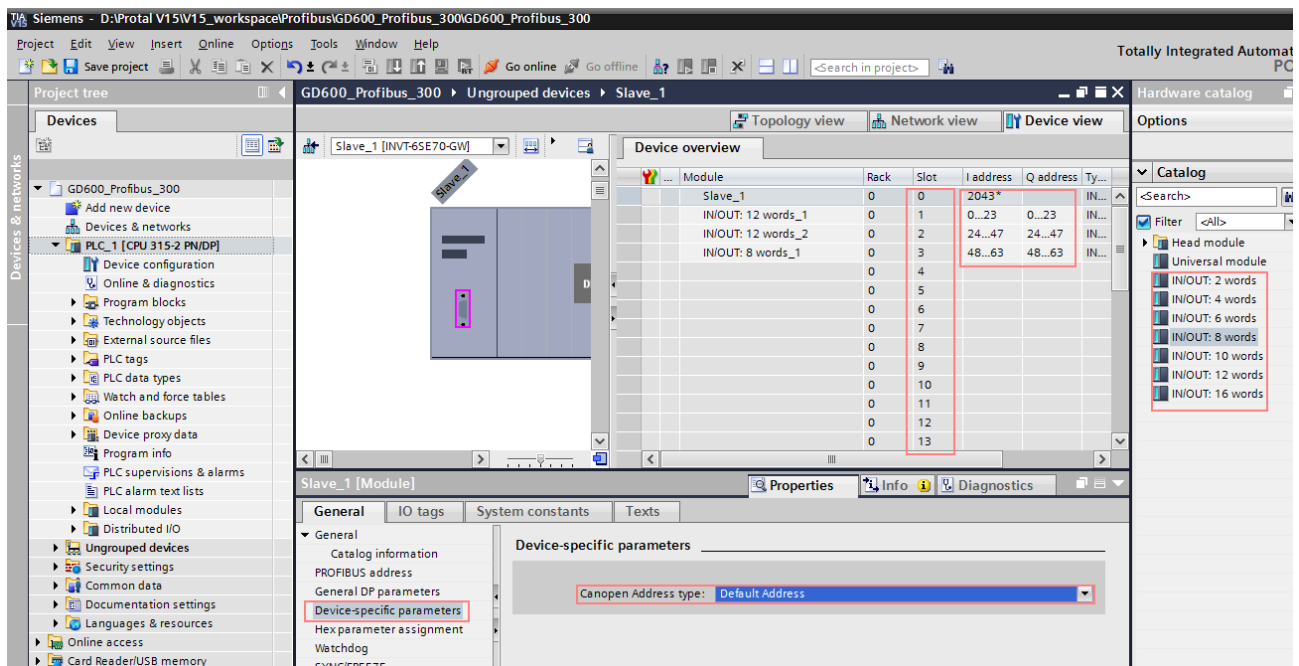


Step 4 Configure the slave.

Double-click the **INVT-6SE70-GW** icon in the project to enter the slave parameter configuration view. Click **Slave_1** to open the PROFIBUS slave configuration interface. Click the **General** tab, choose **PROFIBUS address**, and set parameters.



The I/O module address type can be set to either default address or user-defined address. The configuration for the default address type is shown in the following figure. Click **Device-specific parameters**, select CANopen Address type, and select **Default Address** from **CANopen Address type**. The I/O module address type is then set to the default type. In the default address mode, the I/O module addresses are assigned sequentially in ascending order. Specifically, the data of I/O module 1 corresponds to CANopen node ID 1, the data of I/O module 2 to node ID 2, and so on. The **I address** and **Q address** represent the input and out addresses of the node, respectively. Slot 1 corresponds to the rectifier master unit, while slots 2 to 32 correspond to inverter slave units, supporting up to 32 slave nodes. Click **Hardware catalog**, then double-click a module or drag it into the device view to assign the input data length for the station, as shown in the following figure.



Note:

- The IN/OUT module data of the node can be customized according to user requirements. The process data varies depending on the selected IN/OUT modules. Refer to section 6.5.6.3 IN/OUT module mapping description

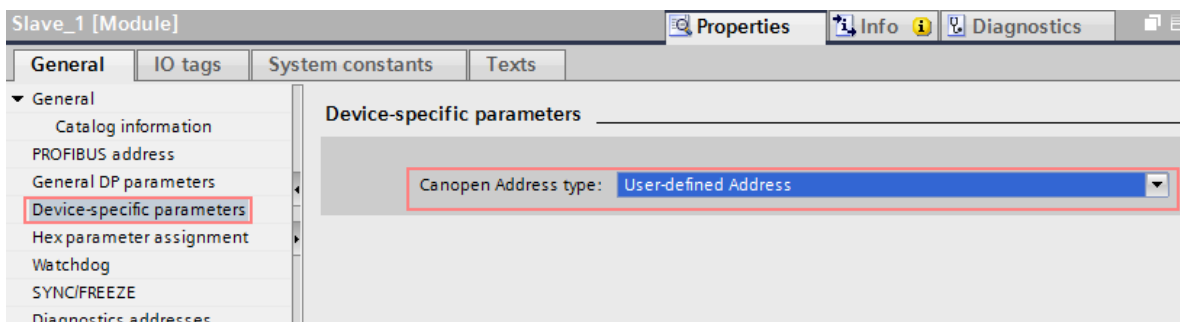
for details.

- The addresses in the variable monitoring table must correspond to those shown in the preceding figure, as follows:
 - ✧ QW0–QW23 correspond to the PLC output addresses of the rectifier unit (node 1, CANopen master).
 - ✧ IW0–IW23 correspond to the PLC input addresses of the rectifier unit (node 1, CANopen master).
 - ✧ QW24–QW47 correspond to the PLC output addresses of the inverter unit (node 2, CANopen slave).
 - ✧ IW24–IW47 correspond to the PLC input addresses of the inverter unit node 2, CANopen slave).
 - ✧ QW48–QW63 correspond to the PLC output addresses of the inverter unit (node 3, CANopen slave).
 - ✧ IW48–IW63 correspond to the PLC input addresses of the inverter unit (node 3, CANopen slave).

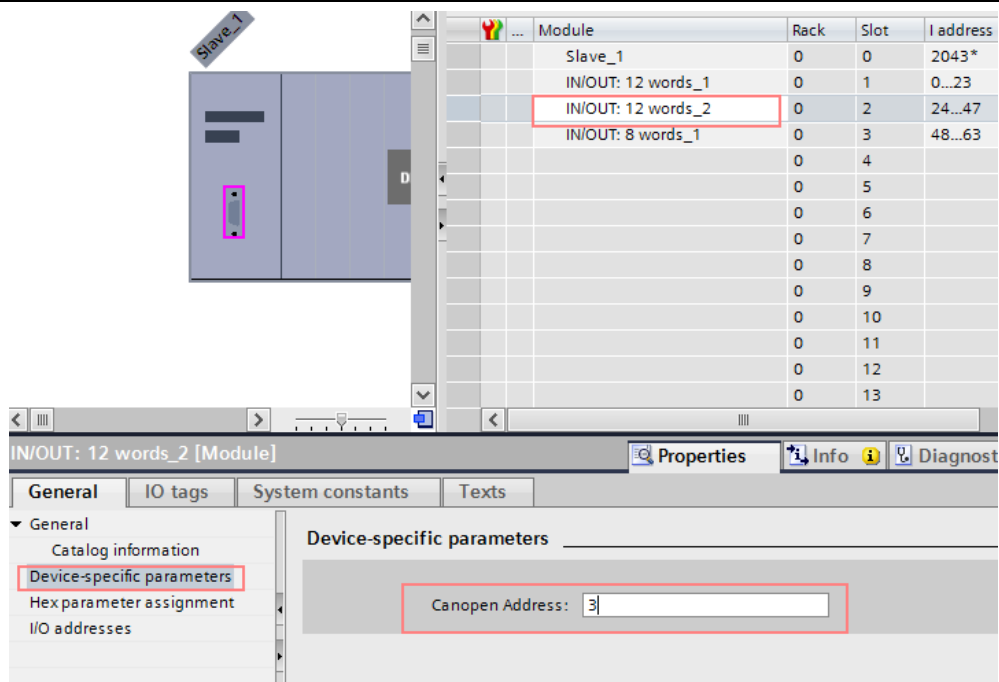
The same applies to subsequent nodes. To ensure consistency of the system mapping, it is recommended to set the starting address of the rectifier unit to 1.

- Due to the limitations of TIA Portal, the I addresses and Q addresses of the I/O modules must start from 0 and increase sequentially, and must not exceed 31. If the value exceeds 31, the data cannot be transmitted.

To facilitate user operation, the I/O module address type also supports a user-defined address type. Click **Device-specific parameters**, select **CANopen Address type**, and select **User-defined Address** from **CANopen Address type**. The I/O module address type is then set to the user-defined type.



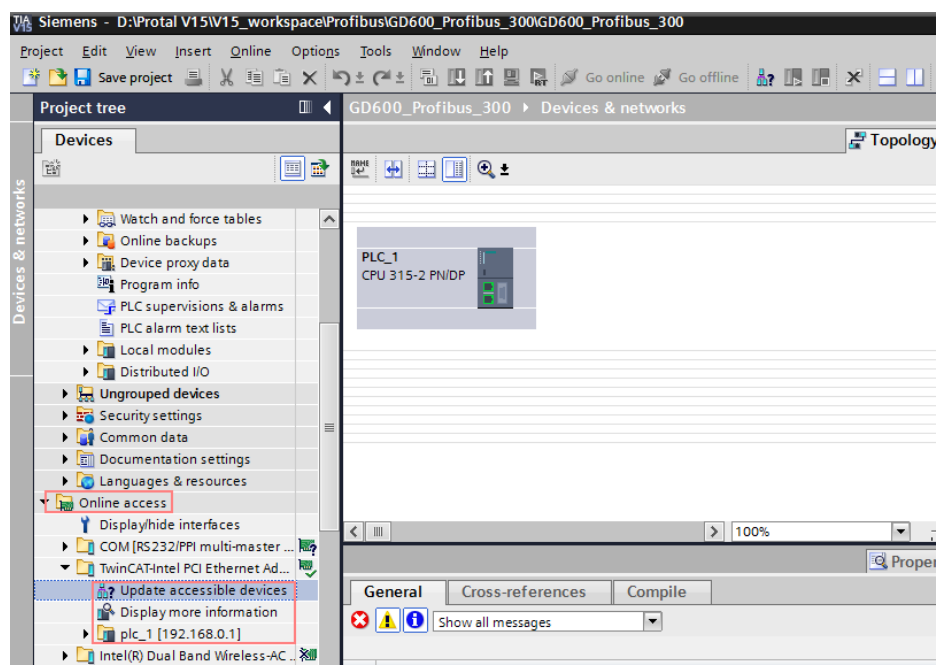
After selecting the user-defined address type, click the I/O module to enter the I/O module view. In the I/O module view, click **Device-specific parameters**, and enter the corresponding CANopen node ID of the rectifier or inverter in **CANopen Address**. The data of this I/O module will then correspond to the selected rectifier or inverter, as shown in the following figure. For example, if the data of the second I/O module needs to correspond to CANopen node ID 3, click **IN/OUT: 12words_2** in the device view, then click **Device-specific parameters**, and change the value of **CANopen Address** to **3**. In this way, the data of the second I/O module will correspond to CANopen node ID 3.



Note: To ensure that the data of different I/O modules is not sent to the same rectifier or inverter, if duplicate values exist for the **CANopen Address** parameter, the data of all I/O modules will not be transmitted.

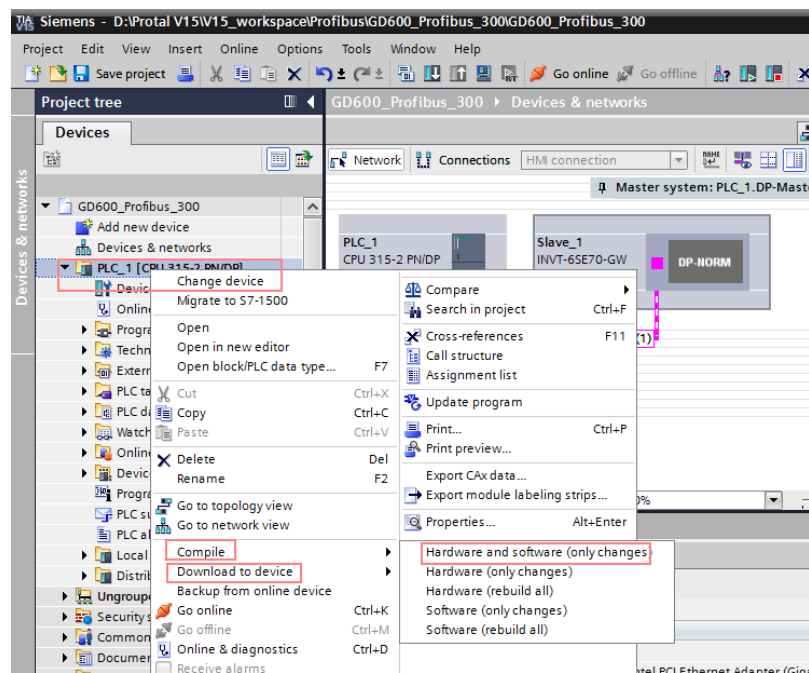
Step 5 Assign IO devices.

First, ensure that the PLC is connected to the computer via an Ethernet cable. Then set the computer Ethernet IP address to the same subnet as the IP address configured for the PROFIBUS master. In the project tree, choose **Online access > TwinCAT-Intel PCI Ethernet Adapter > Update accessible devices**. The device IP address will then be displayed.

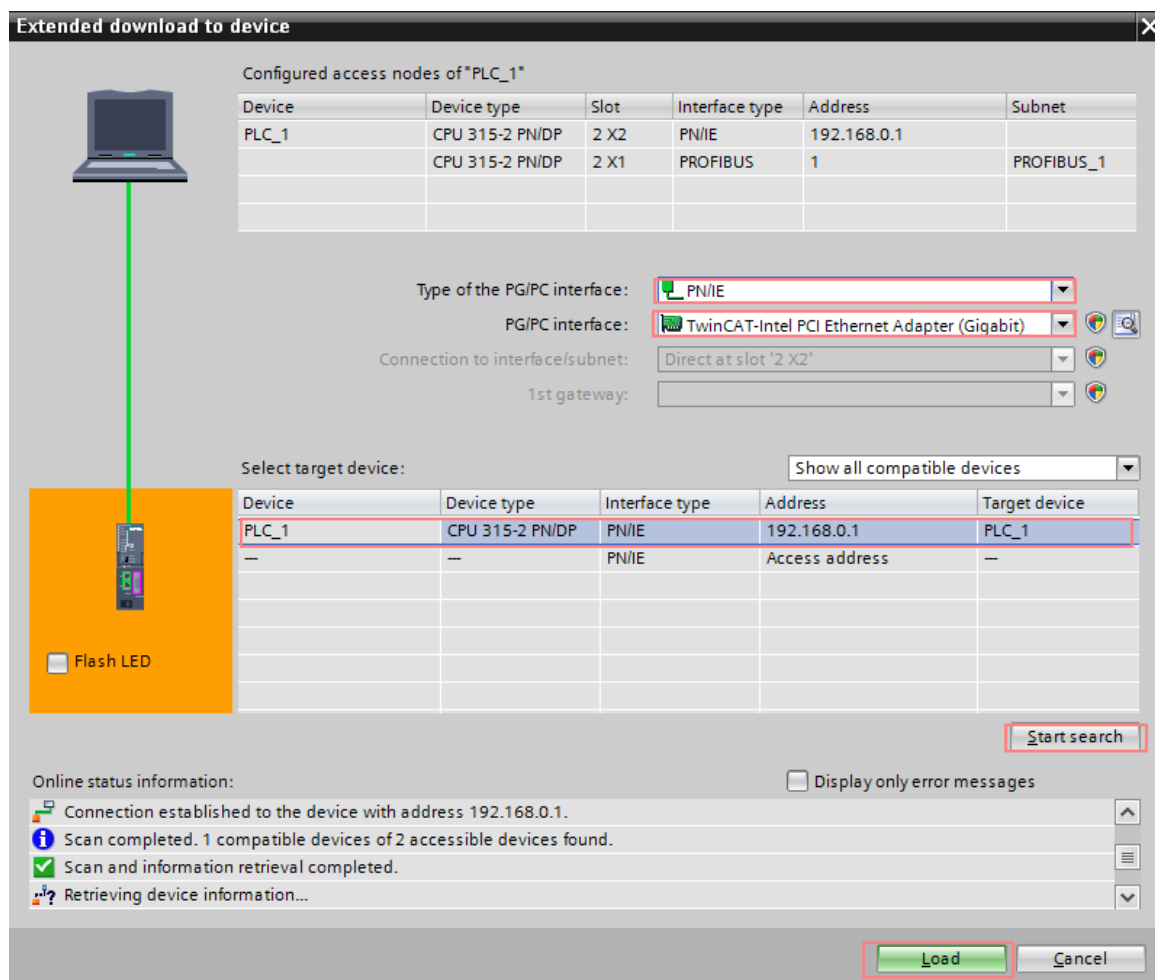


Step 6 Compile and download.

After completing the entire project configuration, download the project configuration data to the CPU, as shown in the following figure. Click **Save project** to save the entire project. Right-click **PLC_1 [CPU 315-2 PN/DP]**, and then choose **Compile > Hardware and software (change only)** to compile the project. Finally, click the icon of download to device icon to download the project configuration to the PLC.

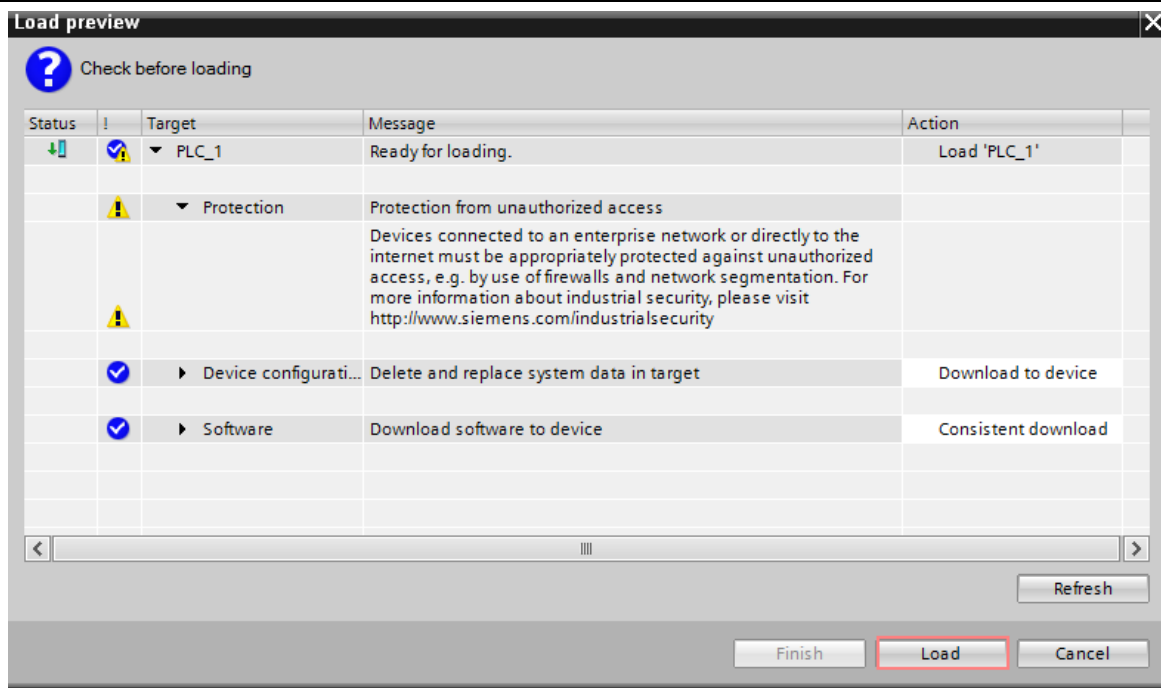


After the download is complete, the following interface will appear. In the drop-down list of **PG/PC interface type**, choose **PN/IE**. Click **Start search** in the lower right corner to scan for PLC devices on the network.



Select the PLC to download (there is only one PLC in the example), and click **Download**.

After downloading the configuration data and program to the PLC, continue to choose **Load** in the download interface.



Step 7 Configure the variable monitoring table. Choose **Watch and force tables > Add new watch table** in the project tree on the left.

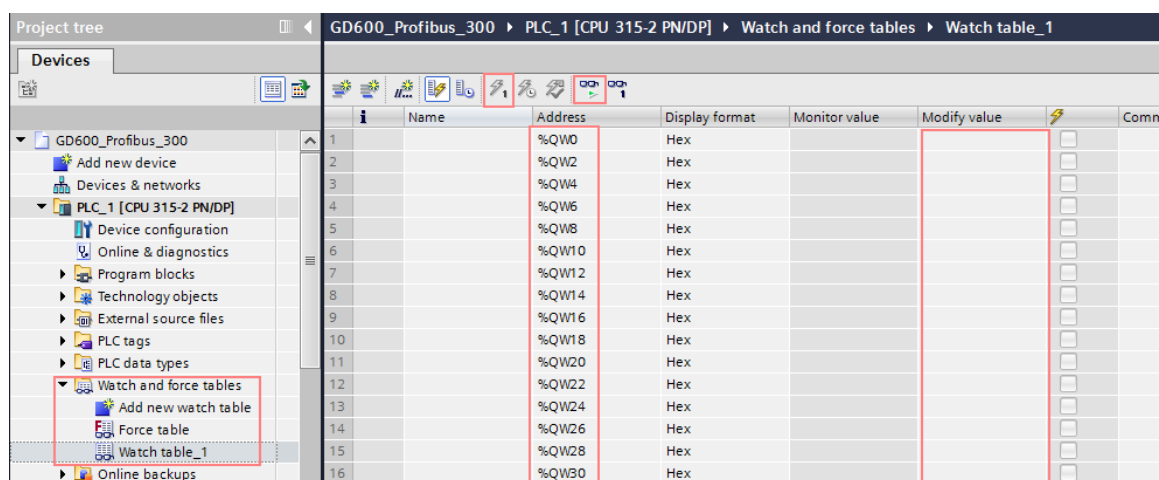
The addresses in the table must be consistent with those assigned during the IN/OUT module configuration.

QW0–QW23 correspond to the PLC output addresses of the rectifier unit (node 1), consistent with the Q addresses configured previously, while IW0–IW23 correspond to the PLC input addresses, consistent with the I addresses configured previously.

QW24–QW47 correspond to the PLC output addresses of the inverter unit (node 2), consistent with the Q addresses configured previously, while IW24–IW47 correspond to the PLC input addresses, consistent with the I addresses configured previously.

QW48–QW63 correspond to the PLC output addresses of the inverter unit (node 3), consistent with the Q addresses configured previously, while IW48–IW63 correspond to the PLC input addresses, consistent with the I addresses configured previously.

Monitor and modify the values as required. Refer to the following figure.



Finally, perform PLC programming as required.

6.5.6.3 IN/OUT module mapping description

In the configuration of PROFIBUS-DP to CANopen communication, to ensure efficient CANopen communication, the IN/OUT modules support selectable data lengths of 2, 4, 8, 10, and 12 words, but do not support 16 words. Selecting

different word types causes data mapping difference.

- When the IN/OUT module is configured for more than 8 words, function code read/write operations are supported. Mapping starts from PKW, and up to 7 PZD data items (PZD2–PZD8) can be read and written.
- When the IN/OUT module selects 8 words or less, the mapping starts from CW/SW and it supports data reading and writing of up to 7 PZDs, but it does not support reading and writing of PKW function codes.

6.5.7 Related parameters

Table 6-29 Rectifier unit parameters

Rectifier function code	Name	Description	Recommended value
P17.15	Actual online slave nodes	Number of actual online slave nodes. Range: 0–31	0
P17.16	Expansion card type of card slot 1 (Near relay terminals)	P17.16 setting range: 0–18 (Slot 1 expansion card type) P17.17 setting range: 0–18 (Slot 2 expansion card type)	/
P17.17	Slot 2 expansion card type (Near AC input cables)	0: No card 6: DP communication card	/
P17.18	Slot 1 expansion card software version	Displays the software version of the expansion card in slot 1. Range: 0.00–655.35	0.00
P17.19	Slot 2 expansion card software version	Displays the software version of the expansion card in slot 2. Range: 0.00–655.35	0.00
P17.20	Status of slaves 02–17	Displays the online status of slave nodes 02–17. Range: 0x0000–0xFFFF 0: Offline 1: Online	0x0000
P17.21	Status of slaves 18–32	Displays the online status of slave nodes 18–32. Setting range: 0x0000–0x7FFF 0: Offline 1: Online	0x0000
P21.01	CANopen module address	Setting range: 1–32	1
P21.29	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4
P21.30	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–100.0s	0.0s
P21.33	Number of CANopen slave nodes	Setting range: 0–31 (Set this parameter only when the master is active.)	Depends on the number of slave nodes

Rectifier function code	Name	Description	Recommended value
P21.34	CANopen master/slave selection	0: Slave 1: Master	1
P21.51	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable)	0xF
P21.52	PDO transmit enable	Bit0: PDO1 Bit1: PDO2 Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF
P21.53	PN/ECAT/DP card PZD configuration selection	0: PKW1–PZD8 1: PKW1–PZD12	1
P22.13–P22.23	PZD2–PZD12 transmit	Setting range: 0–20 For details, see Group P22—Communication expansion function group 1 (PROFIBUS-DP) in the gateway-type rectifier function parameter section.	/
P22.25	PROFIBUS-DP communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s
P22.28	Inverter unit PKW area compatibility	0: 8 bytes (PKW1–4) 1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of inverter function parameter P14.42.	1

Table 6-30 Inverter unit related parameters

Inverter function code	Name	Description	Recommended value
P14.07	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	1.5s
P14.08	CANopen communication address	Setting range: 1–32	2
P14.09	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4
P14.10–P14.20	PZD2–PZD12 receive	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section.	/
P14.21–P14.31	PZD2–PZD12 transmit	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section.	/
P14.33	Communication card control and status word format selection	0: Decimal system 1: Binary system	0

Inverter function code	Name	Description	Recommended value
P14.42	PKW byte length selection	Setting range: 0–1 0: 8 bytes (PKW1–4) 1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of the rectifier function parameter P22.28.	1
P14.88	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable) Bit0: PDO1 Bit1: PDO2	0xF
P14.89	PDO transmit enable	Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF
P19.00	Slot 1 expansion card type (Near relay terminals)	0: No card 6: DP communication card	0
P19.01	Slot 2 expansion card type (Near AC output cable)		0
P19.03	Slot 1 expansion card software version	Range: 0.00–655.35	0.00
P19.04	Slot 2 expansion card software version	Range: 0.00–655.35	0.00

6.6 PROFINET-to-CANopen networking

6.6.1 PROFINET communication protocol overview

■ Supported functions

Supports the PROFINET protocol and PROFINET IO devices.

Equipped with two PROFINET IO ports, supporting 100M full duplex operating.

Supports line and star network topologies.

■ Supported communication types

Standard Ethernet channel:

Standardized channels are non-real-time communication channels using the TCP/IP protocol, mainly used for device parameterization, configuration, and reading diagnostic data.

Real-Time Communication Channel (RT):

The RT channel uses an optimized communication path for real-time data exchange. It has a higher priority than TCP/UDP/IP, ensuring deterministic data transmission between different nodes within a defined time interval. The bus cycle time can reach the millisecond range. It is used for transmitting process data, alarm data, and other cyclic data.

Isochronous Real-Time Communication Channel (IRT):

The IRT channel is hardware-based and implemented by an integrated switch ASIC for synchronized real-time communication. IRT further reduces protocol stack processing time and enables synchronization of applications, data transmission, and devices. It achieves transmission latency of less than 1 ms and jitter of less than 1 μs, and is typically used in motion control applications.

6.6.2 Communication packet structure

6.6.2.1 PROFINET telegram format

Table 6-31 shows the RT frame (non-synchronous) structure.

Table 6-31 RT frame structure

Frame header	EtherType	VLAN tag	EtherType	Frame ID	RT user data	Cycle counter	Data status	Transfer status	FCS
/	2 bytes	2 bytes	2 bytes	2 bytes	36–1440 bytes	2 bytes	1 bytes	1 bytes	4 bytes
	0x8100	/	0x8892	/	/	/	/	/	/
	VLAN flag		/	/	/	APDU status			/
Data header									
7-byte preamble		1-byte SFD		6-byte source MAC address			6-byte destination MAC address		

Table 6-32 shows the IRT communication protocol and IRT frame (non-synchronous) structure.

Table 6-32 IRT frame structure

Frame header				EtherType	VLAN tag	EtherType	Frame ID	IRT user data	FCS
Preamble: 7 bytes	SFD: 1 byte	Source MAC address: 6 bytes	Destination MAC address: 6 bytes	2 bytes	2 bytes	2 bytes	2 bytes	36–1440 bytes	4 bytes

6.6.2.2 PROFINET telegram structure

The PROFINET communication card supports 16 words of input and output data. The telegram structure for data exchange with the VFD is shown in Figure 6-7.

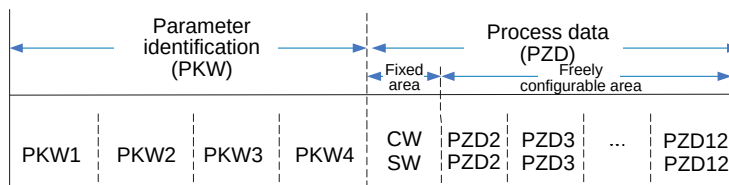


Figure 6-7 Telegram structure

Through the above 32 I/Os, parameters can be set for the rectifier or inverter units, status values can be monitored, control commands can be issued, and operating status can be monitored. In addition, VFD function code parameters can be read and written. For detailed operations, refer to the following sections.

Parameter zone:

PKW1 – Parameter identifier PKW2 – Index PKW3 – Parameter value 1 PKW4 – Parameter value 2

Process data:

CW – Control word (from master to slave; refer to Table 6-36, Table 6-37, Table 6-40 and Table 6-41.)

SW – Status word (from slave to master; refer to Table 6-38, Table 6-49, Table 6-42, and Table 6-43.)

PZD – Process data (user specified)

PZD zone: The PZD zone in communication messages is designed for controlling and monitoring VFDs. The master and slave always process the received PZD with the highest priority. The processing of PZD takes priority over that of PKW, and the master and slave always transmit the latest valid data on the interfaces. Control word (CW) and status word (SW)

Using CWs is the basic method of the fieldbus system to control the VFD. A CW is sent from the fieldbus master to a VFD device. In this case, the adapter module functions as a gateway. The VFD device responds to the bit code information of the CW and feeds status information back to the master through an SW.

Reference value: The VFD device may receive control information through multiple channels, including analog and digital input terminals, VFD control panel, and communication modules (such as RS485 and CH-PA01 adapter modules). To enable the control over VFD devices through PROFINET, you need to set communication cards as the controllers of the VFD devices.

Actual value: An actual value is a 16-bit word that includes information about VFD device operation. The monitoring function is defined through VFD parameters. The conversion scale of the integer transmitted to the master as the actual value depends on the selected function. For details, see the related VFD user manual.

Note: A VFD device always checks the bytes of a CW and reference value.

■ PKW description

In cyclic communication, the PKW area consists of four 16-bit words. The definition of each word is shown in the following table.

Table 6-33 Each word in the PKW area

First word PKW 1 (16 bits)		
Bit 15–Bit 00	Task or response ID flag	0–7
Second word PKW 2 (16 bits)		
Bit 15–Bit 00	Basic parameter address	0–65535
Third word PKW 3 (16 bits)		
Bit 15–Bit 00	Value (most significant word) of a parameter or error code of the returned value	00
Fourth word PKW 4 (16 bits)		
Bit 15–Bit 00	Value (least significant word) of a parameter	0–65535

Note: If the master requests the value of a parameter, the values in PKW3 and PKW4 of the message that the master transmits to the VFD are no longer valid.

Task request and response: When transmitting data to a slave, the master uses a request number, and the slave uses a response number to accept or reject the request. The following table describes the request and response functions.

Table 6-34 Task identification flag PKW1

Request No. (from the master to a slave)		Response signal	
Request	Function	Acceptance	Rejection
0	No task	0	/
1	Requesting the value of a parameter	1, 2	3
2	Modifying a parameter value (one word) [modifying the value only on RAM]	1	3 or 4
3	Modifying a parameter value (two words) [modifying the value only on RAM]	2	3 or 4
4	Modifying a parameter value (one word) [modifying the value on both RAM and EEPROM]	1	3 or 4
5	Modifying a parameter value (two words) [modifying the value on both RAM and EEPROM]	2	3 or 4

Note: Request 2 "Modifying a parameter value (one word) [modifying the value only on RAM]", request 3 "Modifying a parameter value (two words) [modifying the value only on RAM]", and request 5 "Modifying a parameter value (two words) [modifying the value on both RAM and EEPROM]" are not supported currently.

Table 6-35 Response identification flag PKW1

Response No. (from slave to master)	
Response No.	Function
0	No response
1	Transmitting the value of a parameter (one word)
2	Transmitting the value of a parameter (two words)
3	The task cannot be executed and one of the following error code is returned: 1: Invalid command 2: Invalid data address

Response No. (from slave to master)	
Response No.	Function
	3: Invalid data value 4: Operation failure 5: Incorrect password 6: Incorrect data frame 7: Parameter read-only 8: Parameter cannot be modified in running 9: Password protection

PKW examples:

Example 1: Reading the value of a parameter

Set PKW1 to 01 and PKW2 to 10 to read a frequency set through keypad (the address of the frequency set through keypad is 10), and the value is returned in PKW4.

Request (Master → VFD)

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Request	00	01	00	10	00	00	00	00	xx	xx	xx	xx	xx	xx	...	xx	xx

0010: Parameter address
 0001: Request for parameter value reading

Response (VFD → Master)

	PKW1		PKW2		PKW3		PKW4		SW		PZD2		PZD3		...	PZD12	
Response	00	01	00	10	00	00	50	00	xx	xx	xx	xx	xx	xx	...	xx	xx

5000: Parameter value in address 10
 0001: Response (parameter value updated)

Example 2: Modify a parameter value (both RAM and EEPROM).

To modify the keypad frequency setting (parameter address: 10), set PKW1 to 04 and PKW2 to 10.

The value to be written (50.00) is placed in PKW4.

Request (Master → VFD)

	PKW1		PKW2		PKW3		PKW4		CW		PZD2		PZD3		...	PZD12	
Request	00	04	00	10	00	00	50	00	xx	xx	xx	xx	xx	xx	...	xx	xx

5000: Parameter address in address 10
 0004: Request for parameter value modifying

Response (VFD → Master)

	PKW1		PKW2		PKW3		PKW4		SW		PZD2		PZD3		...	PZD12	
Response	00	01	00	10	00	00	50	00	xx	xx	xx	xx	xx	xx	...	xx	xx

0001: Response (parameter value updated)

■ Rectifier unit PZD description

In the Goodrive600A rectifier unit, the first word of the transmitted and received telegrams is the control word (CW) or the status word (SW). Two data formats are available. You can select binary or decimal format via parameter P01.16. Refer to Table 6-36 and Table 6-37 for definitions.

Table 6-36 Rectifier unit control word (CW) in decimal

Bit	Name	Value	Description
0–7	Communication-based control command	1	Run
		2	/
		3	/
		4	/
		5	Stop
		6	/
		7	Fault reset
		8	/
8	Write enable	1	Function code write enable (PKW1–PKW4)
		0	Function code write disable (PKW1–PKW4)

Table 6-37 Rectifier unit control word (CW) in binary

Bit	Name	State/Description	Priority
0	Communication-based control command	0: Stop; 1: Run	1
1		Reserved	Reserved
2		0: Inactive; 1: Fault reset	3
3–7		Reserved	Reserved
8	Write enable	1	Function code write enable (PKW1–PKW4)
		0	Function code write disable (PKW1–PKW4)

Table 6-38 Rectifier unit status word (SW) in decimal

Bit	Name	Value	Description
0–7	Run status byte	1	Running, no fault
		2	Running, fault present
		3	Stopped, no fault
		4	Stopped, fault present
		5	POFF, no fault
		6–7	POFF, fault present

Table 6-39 Rectifier unit status word (SW) in binary

Bit	Name	State/Description	Priority
0	Run status byte	0: Inactive; 1: Running	0

Bit	Name	State/Description	Priority
1		0: Inactive; 1: Stopped	1
2		0: Inactive; 1: Fault	2
3		0: Inactive; 1: In POFF state	3
4–7		Reserved	/

Note: The binary status word may represent a combination of multiple status bits. For example, 0x101 indicates that the drive is running with a fault.

Reference value (REF): For the rectifier unit, received PZD data is not valid.

Actual value (ACT): The rectifier unit sends actual values (ACT) in the PZD response telegram (PZD2–PZD12).

1. Inverter unit PZD description

In the inverter unit, the first word of the transmitted and received telegrams is the control word (CW) or the status word (SW). Two data formats are available. You can select binary or decimal format via parameter P14.33. Refer to Table 6-40 and Table 6-41 for definitions.

Table 6-40 Inverter unit control word (CW) in decimal

Bit	Name	Value	Description
0–7	Communication-based control command	1	Run forward
		2	Run reverse
		3	Jog forward
		4	Jog reverse
		5	Stop
		6	Coast to stop
		7	Fault reset
		8	Jog stop
		9	Emergency stop
8	Write enable	1	Function code write enable (PKW1–PKW4)
		0	Function code write disable (PKW1–PKW4)

Table 6-41 Inverter unit control word (CW) in binary

Bit	Name	State/Description	Priority
0–7	Communication-based control command	0: Decelerate to stop 1: Run forward	1
		0: Decelerate to stop 1: Run reverse	2
		0: Inactive; 1: Fault reset	3
		0: None 1: Coast to stop	4
		0: None 1: Jog forward	5
		0: None 1: Jog reverse	6
		0: None 1: Jog stop	7
		0: Inactive; 1: Pre-excitation	8
8	Write enable	1	Function code write enable (PKW1–PKW4)
		0	Function code write disable (PKW1–PKW4)
9	Reserved	Reserved	Reserved
10	Emergency stop selection	0: Inactive 1: Emergency deceleration stop	0: Top priority

Table 6-42 Inverter unit status word (SW) in decimal

Bit	Name	Value	Description
0–7	Run status byte	1	Forward run
		2	Reverse run
		3	Stopped
		4	Fault
		5	POFF
		6	Pre-exciting
8	Bus voltage established	1	Ready to run
		0	Not ready to run
9–10	Motor group setting	00	Select motor 1
		01	Select motor 2
11	Motor type feedback	1	Synchronous motor (SM)
		0	Asynchronous motor (AM)
12	Overload indication	1	Overload alarm
		0	No overload alarm
13–14	Running mode selection	00	Keypad-based control
		01	Terminal-based control
		10	Communication-based control
		11	Reserved
15	Heartbeat feedback	1	Heartbeat feedback
		0	No heartbeat feedback

Table 6-43 Inverter unit status word (SW) in binary

Bit	Name	State/Description	Priority
0–7	Run status byte	0: Inactive; 1: Forward running	0 (Top priority)
		0: Inactive; 1: Reverse running	1
		0: None 1: VFD in stopped state	2
		0: None 1: VFD in fault	3
		0: None 1: VFD in POFF state	4
		0: Inactive; 1: Pre-exciting	5
		Reserved	6–7
8	Bus voltage established	1	Ready to run
		0	Not ready to run
9–10	Motor group feedback	1	Feedback from motor 1
		0	Feedback from motor 2
11	Motor type feedback	1	Synchronous motor (SM)
		0	Asynchronous motor (AM)
12	Overload alarm feedback	1	Overload alarm
		0	No overload alarm
13–14	Running mode selection	00	Keypad-based control
		01	Terminal-based control
		10	Communication-based control
		11	Reserved
15	Heartbeat reference	1	Enable heartbeat
		0	Disable heartbeat

Reference value (REF): For the inverter unit, words 2 to 12 of the received PZD request telegram represent the main reference value (REF).

Actual value (ACT): For the inverter unit, words 2 to 12 of the transmitted PZD response telegram represent the actual value (ACT).

6.6.3 Network topology

When a PN communication card is installed in the rectifier unit, the PLC or other master device communicates only with the rectifier unit. The rectifier unit converts the communication bus of the expansion card into a CANopen bus and connects to other units via the RJ45 port.

Note: In the networking wiring, the RJ45 ports between units must be cross-connected, that is, port A of a unit can only be connected to port B of another unit. If the connection is incorrect, the communication performance of the entire system will be degraded.

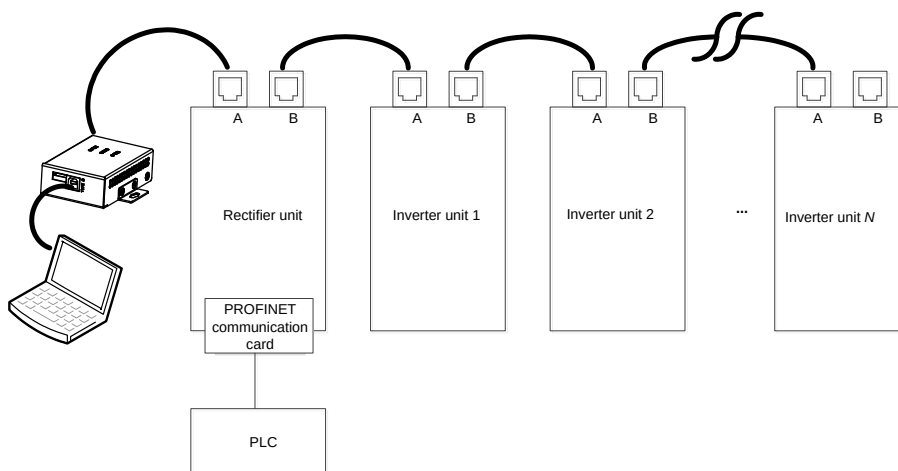


Figure 6-8 PROFINET to CANopen network topology

6.6.4 Communication performance

When the Goodrive600A series VFDs are networked for communication, a single PROFINET-to-CANopen gateway unit can support up to 32 nodes. Since the gateway itself occupies one node, up to 31 CANopen slave nodes can be connected.

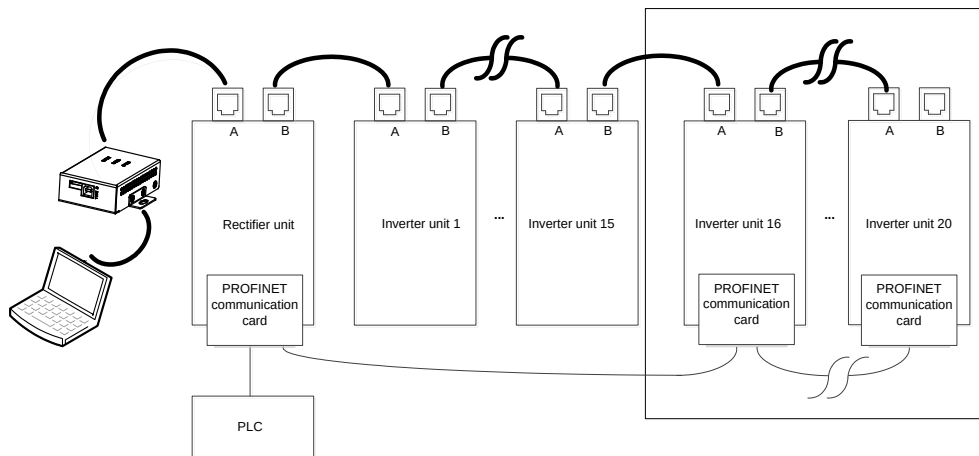
For the S7-1200 series, a single PROFINET-to-CANopen gateway unit supports up to 15 nodes. Since the gateway itself occupies one node, up to 14 CANopen slave nodes can be connected.

In PROFINET-to-CANopen networking applications, each CANopen slave (typically an inverter unit) can be configured as an I/O node. The number of I/O submodules is also limited by the PLC connection resources, taking Siemens PLC as an example.

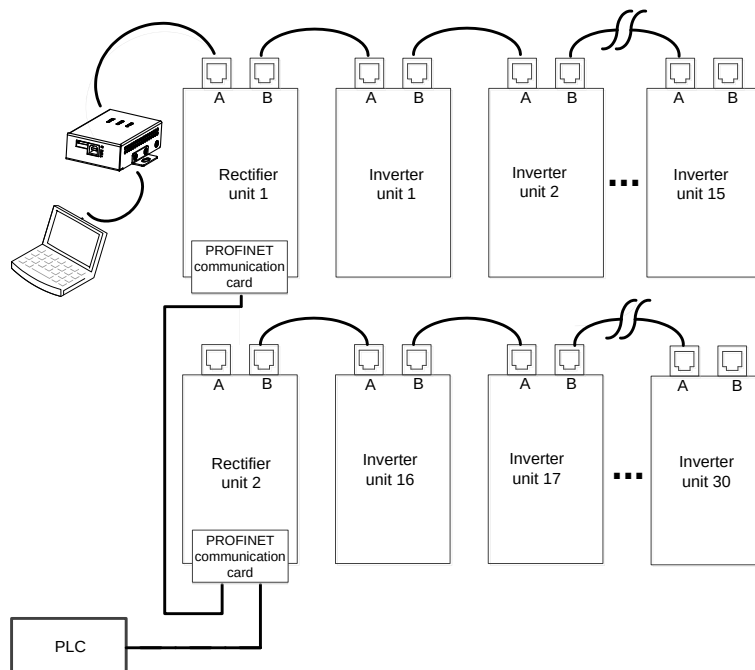
PLC model	PROFINET		PROFIBUS-DP		
	I/O nodes	Submodules	Masters	Slaves	Submodules
S7-1200 series	16	16*16	3	32*3	32*16

Since the gateway is treated as one I/O node (one I/O node can contain up to 16 submodules), it occupies one I/O submodule resource. Therefore, in the S7-1200 system, a maximum of 15 I/O submodules are available, corresponding to 15 CANopen slave nodes (rectifier or inverter units). The number of slave nodes can be increased as follows:

1. To support additional slave nodes, PROFINET communication cards can be added. The system adopts a hybrid architecture combining direct PROFINET networking and PROFINET-to-CANopen gateways for data exchange. The topology is as follows.



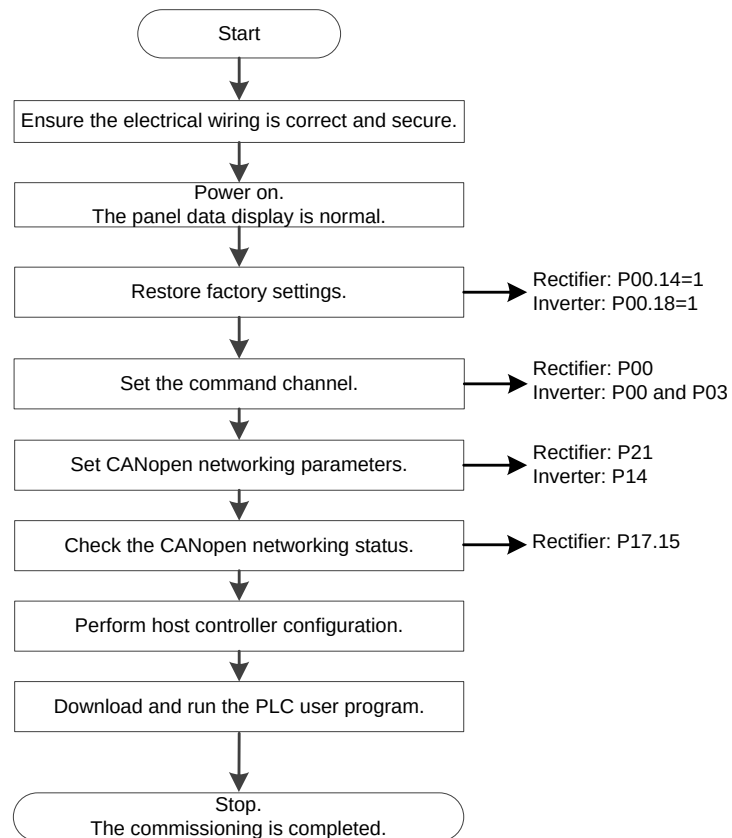
2. When multiple rectifier units are used, additional PROFINET communication cards can be configured for the other rectifier units. The system can then adopt multiple PROFINET-to-CANopen gateways to enable data exchange and increase the number of slave nodes. The topology is as follows.



Note: The PROFINET-to-CANopen gateway networks corresponding to different rectifier units must remain independent; otherwise, CANopen address conflicts may occur.

6.6.5 Commissioning procedure

6.6.5.1 Flowchart for commissioning the PROFIBUS-to-CANopen network

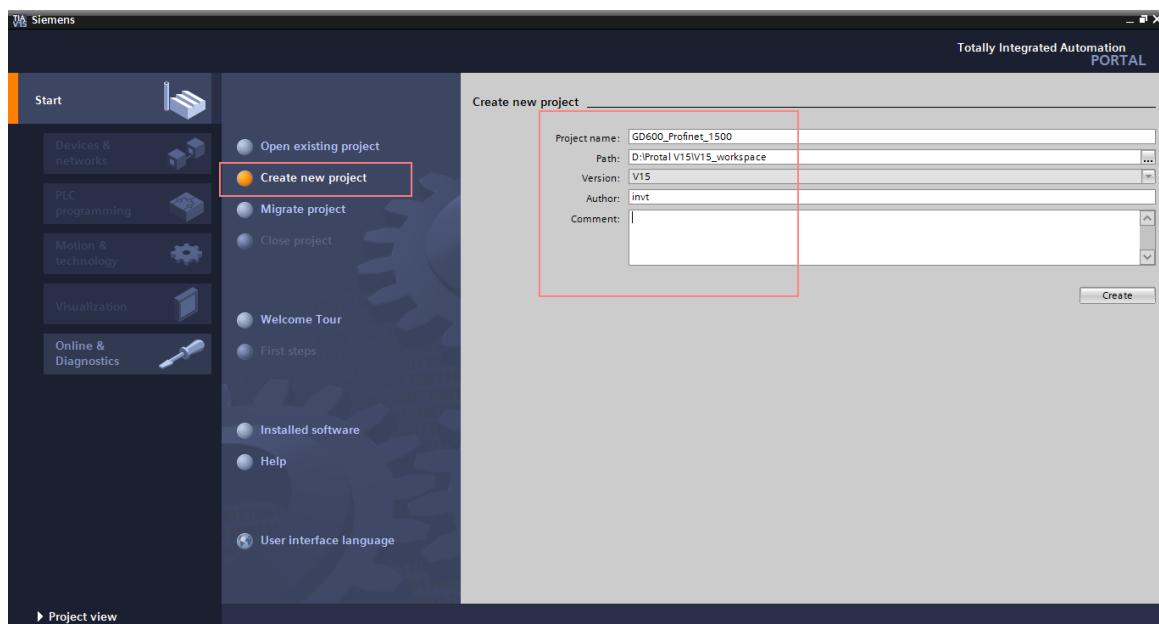


6.6.5.2 TIA portal configuration (S7-1500)

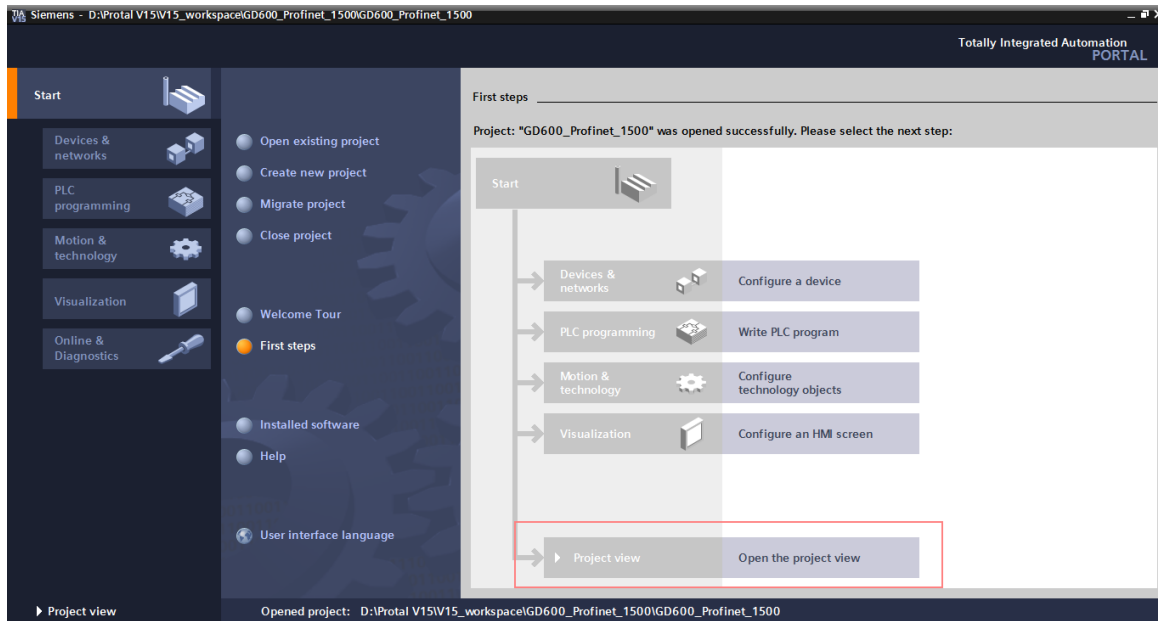
The configuration procedure is illustrated using a Siemens S7-1500 PLC as an example.

1. Create a project.

Double-click the **TIA Portal V15** icon to start the TIA Portal V15 project tool. Then choose **Create new project**. On the right of the interface, enter **Project name**, **Path**, **Version**, **Author**, and **Comment**, and then click **Create** to generate a new project, as shown in the following figure.



Then double-click to open the project view, as shown in the following figure.

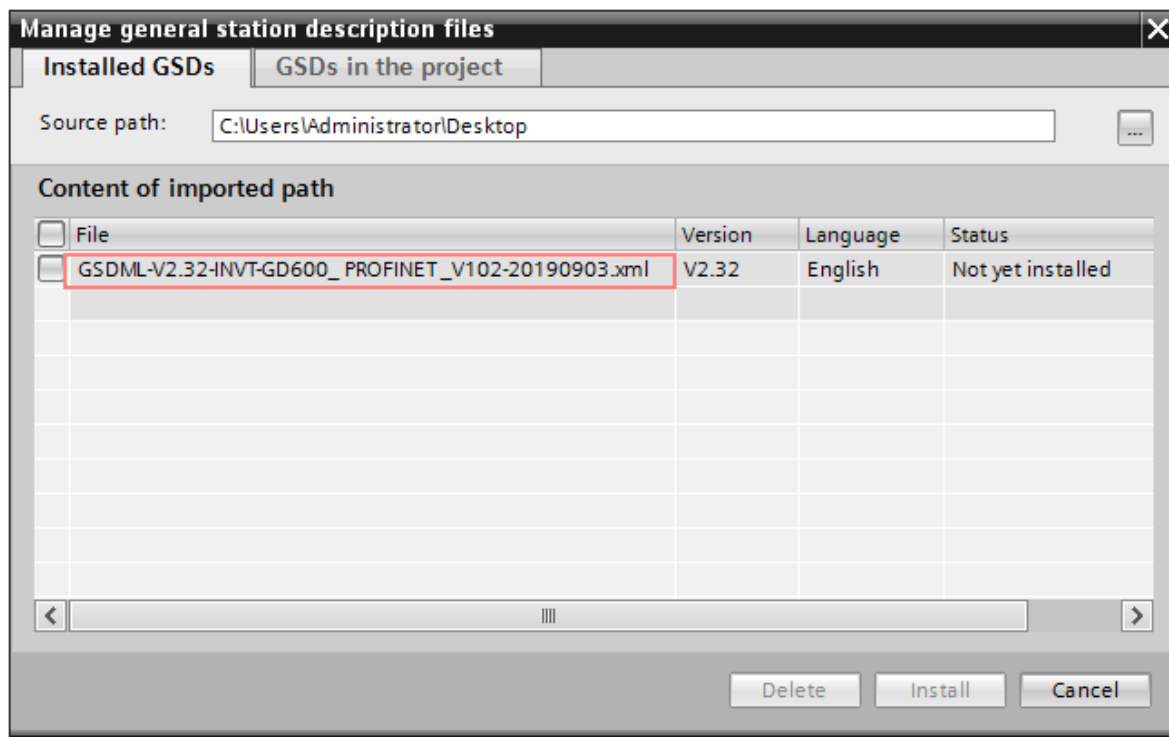


2. Add the GSD file.

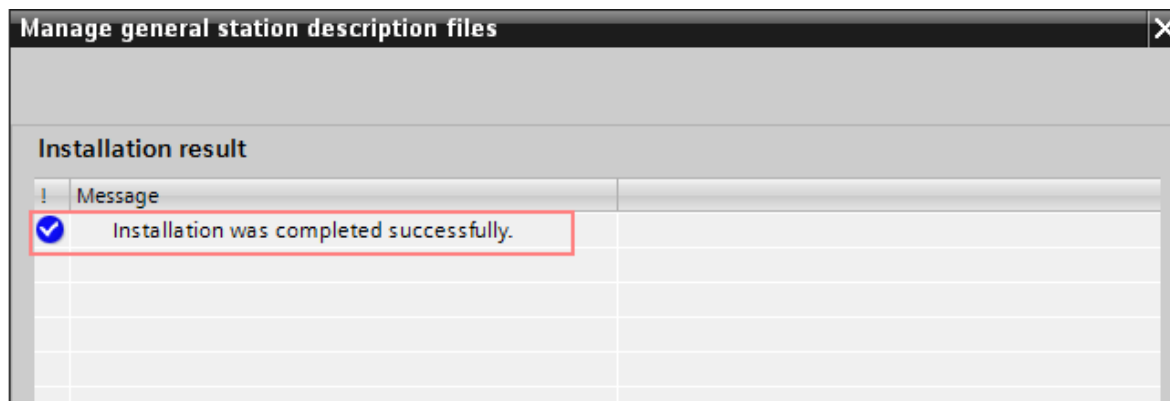
Select the GSD file as shown in the following figure.

 GSDML-V2.32-INV-T-GD600_ PROFINET _V102-20190903.xml

Click **Options** on the toolbar, and then choose **Manage general station description files (GSD)**. In the dialog box that appears, enter the source path of the GSD file, select the GSD file, and click **Install**.



After the installation is complete, a dialog box will appear, indicating that the GSDML file has been successfully installed.

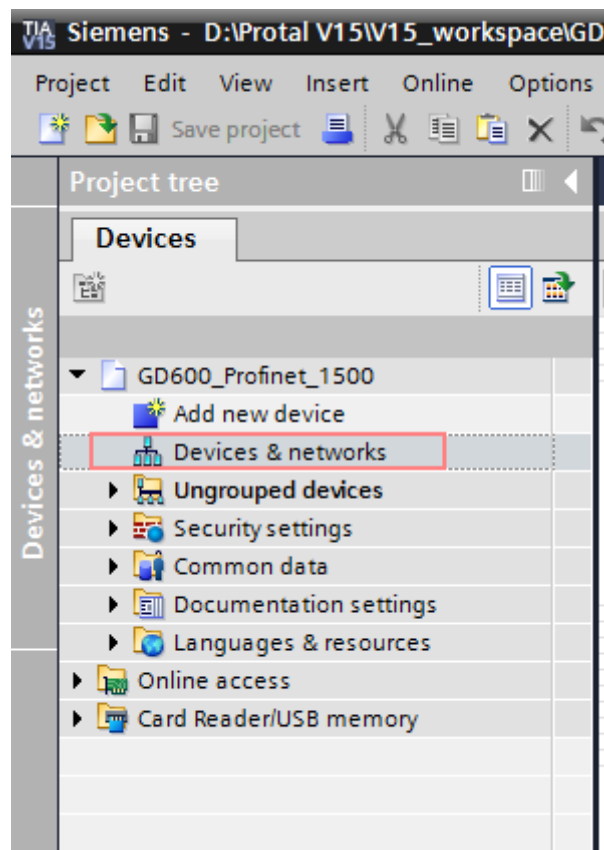


3. Configure project information.

To configure project information, do as follows:

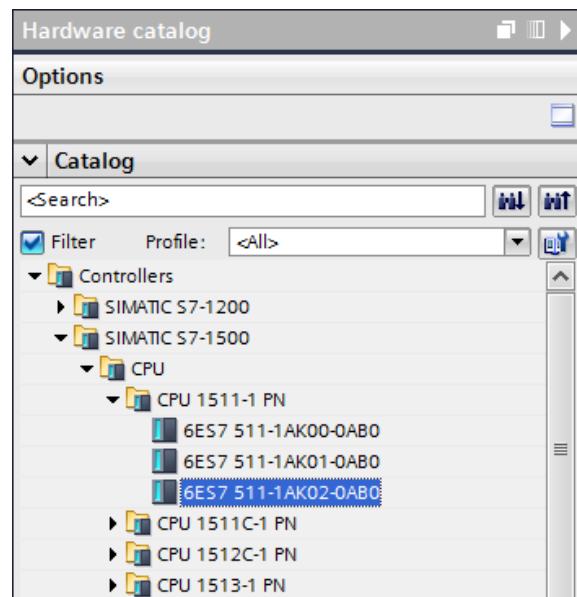
Step 1 Enter the project view.

In the project view for the new project in TIA Portal V15, double-click **Devices & networks** to open the network view.

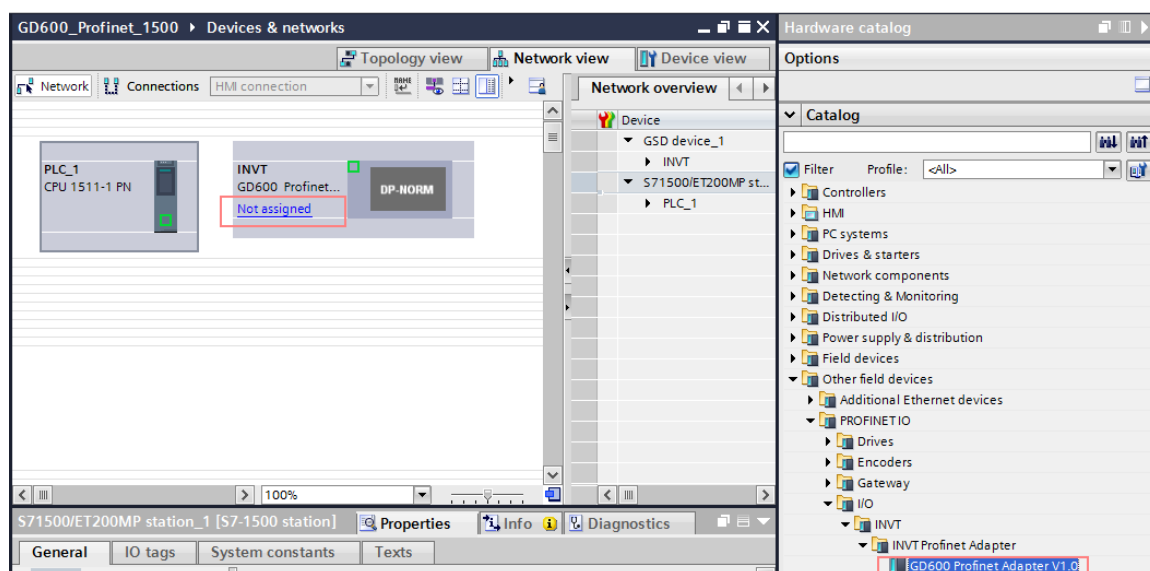


Step 2 Add devices to the project according to the PLC model used.

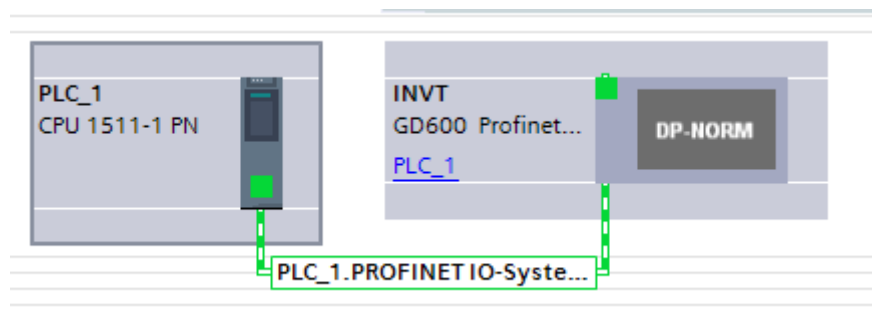
For example, when using a Siemens S7-1500 PLC, choose **Controllers > SIMATIC S7-1500 > CPU > CPU 1511-1 PN > 6ES7 511-1AK02-0AB0** in the **Hardware catalog** panel on the right, and then double-click or drag the **6ES7 511-1AK02-0AB0** icon into the project to add the S7-1511 PLC, as shown in the following figure.



In the **Hardware catalog** panel on the right, choose **Other field devices** > **PROFINET IO** > **I/O** > **INVT** > **INVT PROFINET Adapter** > **GD600 PROFINET Adapter V1.0**, and then double-click the **GD600 PROFINET Adapter V1.0** icon to add the GSDML file to the project, as shown in the following figure.



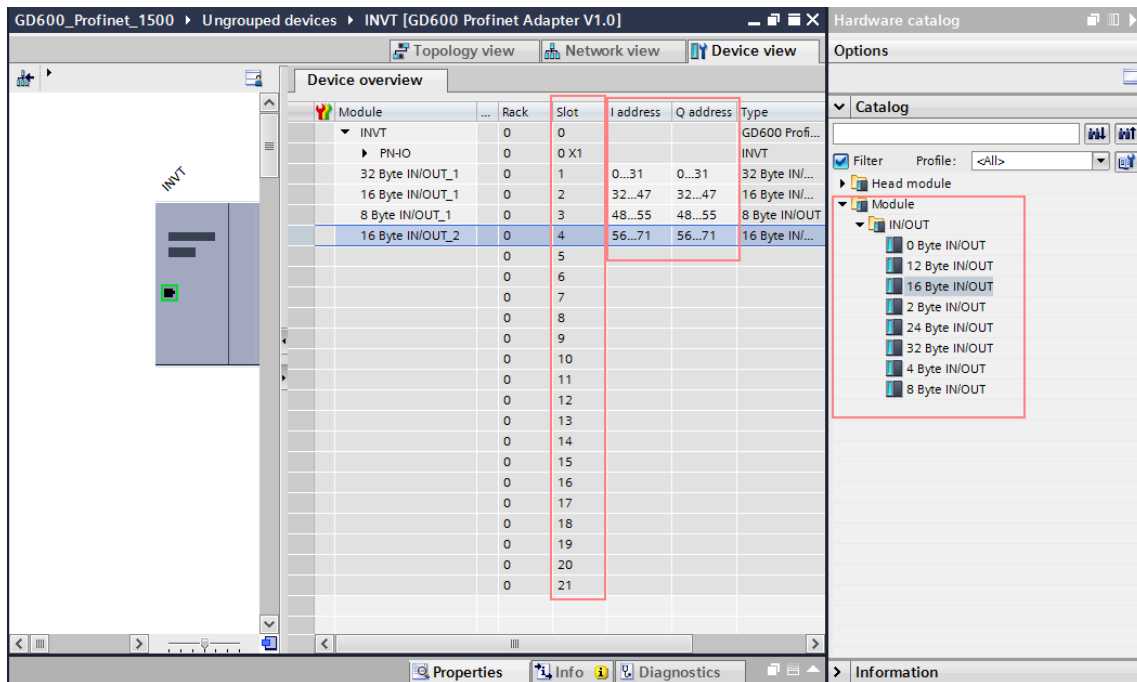
Click the **Not assigned** option of **GD600A PROFINET Adapter V1.0**, and select the IO controller **PLC_1.PROFINET interface_1**. In the network view, the CPU and INVT PROFINET have been connected to the same PROFINET subnet.



Step 3 Configure PROFINET slave nodes depending on the number of nodes on the network.

Double-click the **GD600 PROFINET Adapter V1.0** icon in the project to enter the slave parameter configuration view. Each slot number corresponds to a CANopen node ID. The **I address** and **Q address** represent the input and out

addresses of the node, respectively. Slot 1 corresponds to the rectifier master unit, while slots 2 to 32 correspond to inverter slave units, supporting up to 31 slave nodes. Click **Hardware catalog**, choose **Module > IN/OUT**, then double-click a module or drag it into the device overview to assign the input data length for the node, as shown in the following figure.

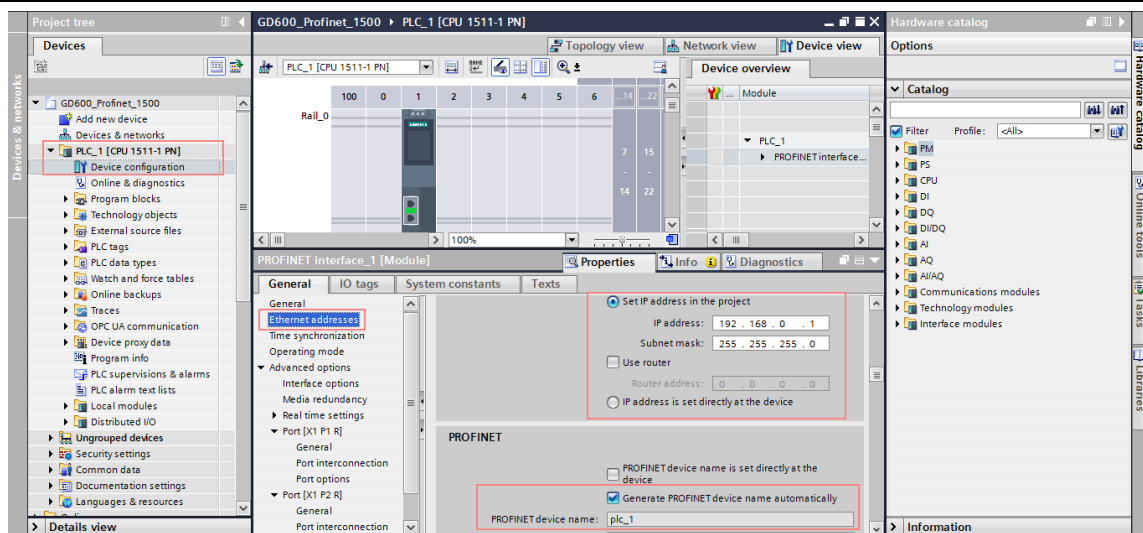


Note:

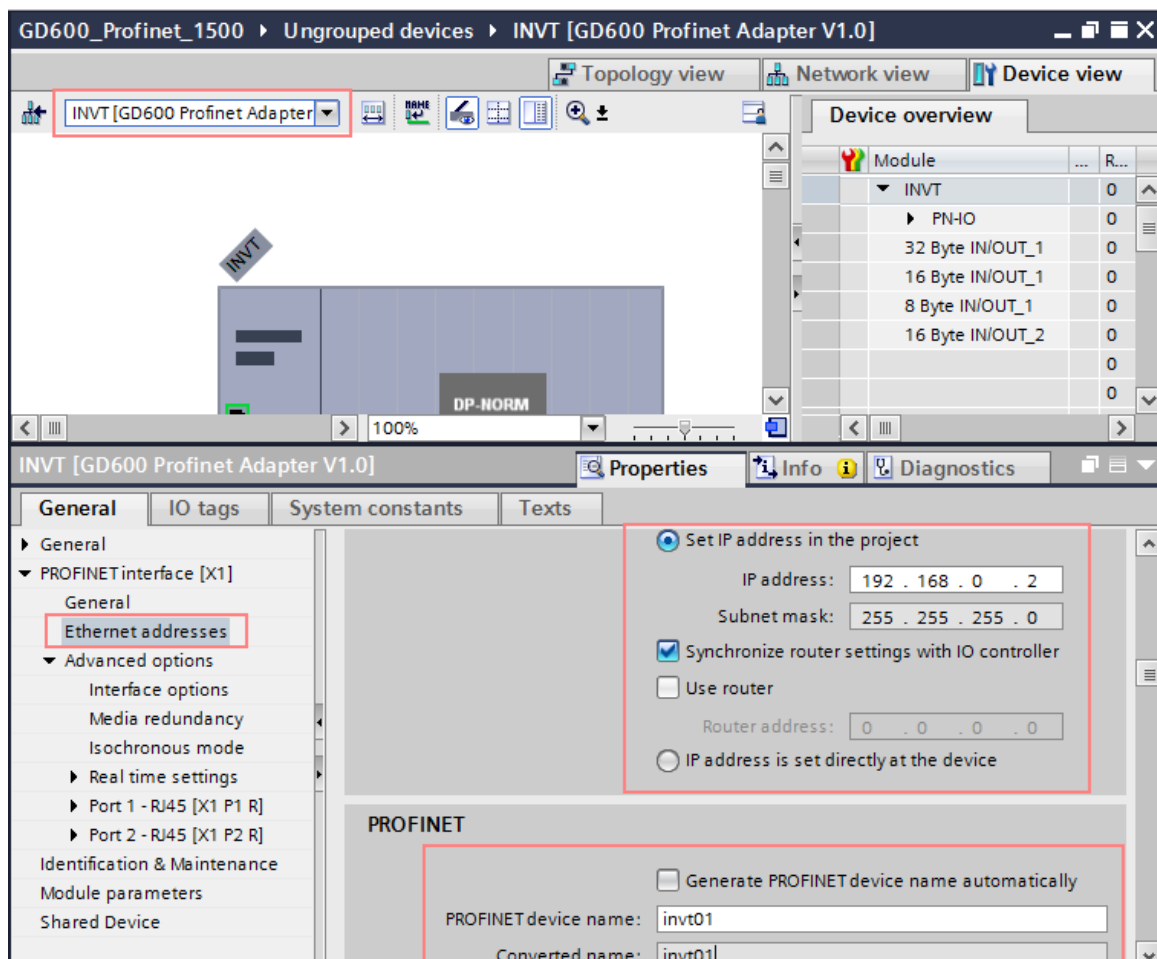
- The IN/OUT data length of each node can be configured according to user requirements, and may vary between units. Selecting different I/O modules results in different gateway data mappings. For details, refer to section 6.6.5.3 IN/OUT module mapping description
- The addresses in the variable monitoring table must correspond to those shown in the preceding figure, as follows:
 - ✧ QW0–QW31 correspond to the PLC output addresses of the rectifier unit (station 1, CANopen master).
 - ✧ IW0–IW31 correspond to the PLC input addresses of the rectifier unit (node 1, CANopen master).
 - ✧ QW32–QW47 correspond to the PLC output addresses of the inverter unit (node 2, CANopen slave).
 - ✧ IW32–IW47 correspond to the PLC input addresses of the inverter unit (node 2, CANopen slave).
 - ✧ QW48–QW55 correspond to the PLC output addresses of the inverter unit (node 3, CANopen slave).
 - ✧ IW48–IW55 correspond to the PLC input addresses of the inverter unit (node 3, CANopen slave).

The same applies to subsequent nodes. To ensure consistency of the system mapping, it is recommended to set the starting address of the rectifier unit to 1.

Double-click **Devices & networks** to enter the editing interface in the network view. Double-click the **PLC_1 CPU 1511-1PN** module to enter the device view. Double-click the network interface of the S7-1511 device to open the **PROFINET interface_1** configuration view. Click the **General** tab, choose **Ethernet addresses**, and set the S7-1511C parameters (PLC IP address and device name) shown in the following figure.

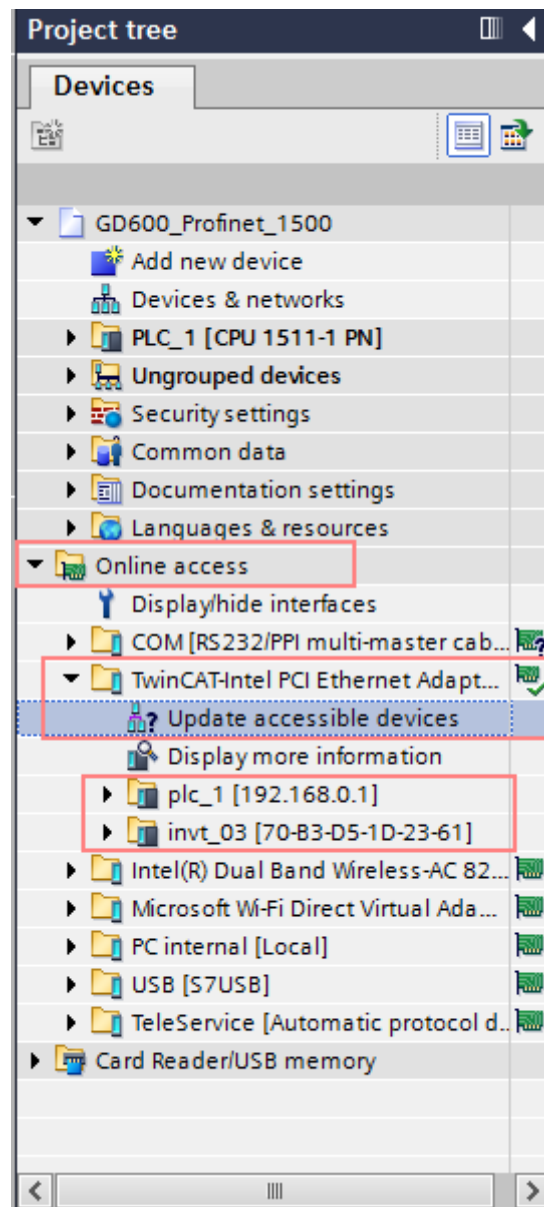


Double-click **Devices & networks** to enter the editing interface in the network view. Double-click the **INVT GD600A PROFINET...** module to enter the device view. Double-click the network interface position of the INVT PROFINET communication card to enter the PROFINET interface configuration view. Click the **General** tab, choose **PROFINET interface [X1] > Ethernet addresses**, and set PROFINET parameters.



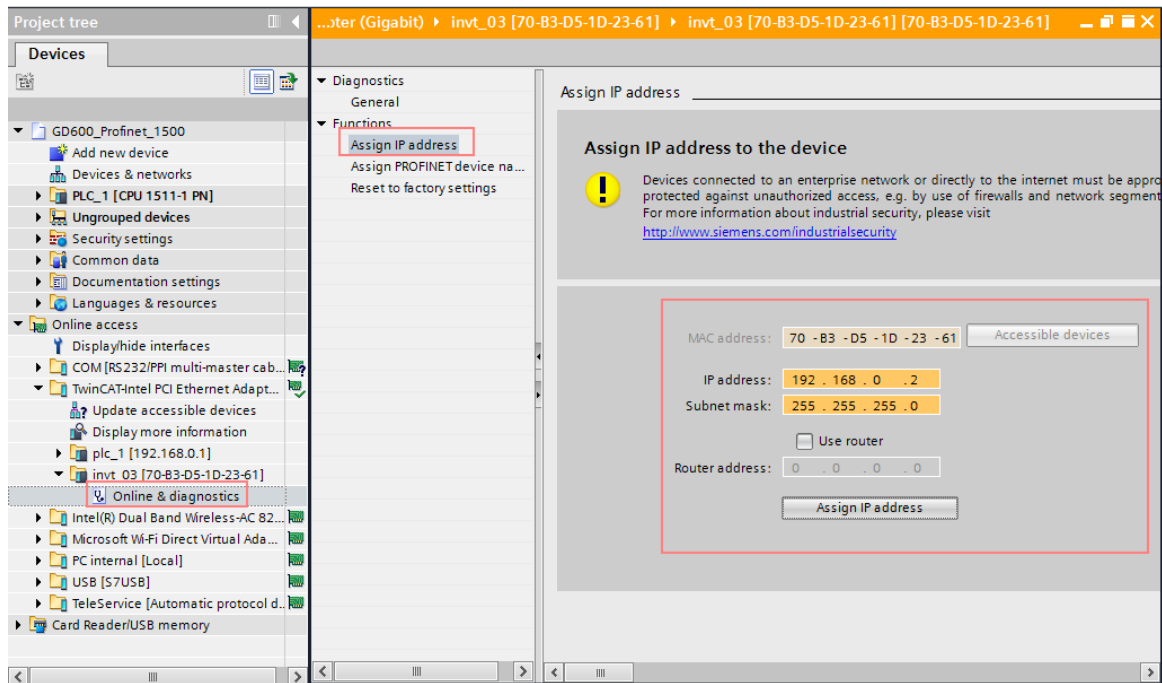
Step 4 Assign IO devices.

First of all, ensure that the CPU and INVT PROFINET communication card have been connected to your computer through a network cable.

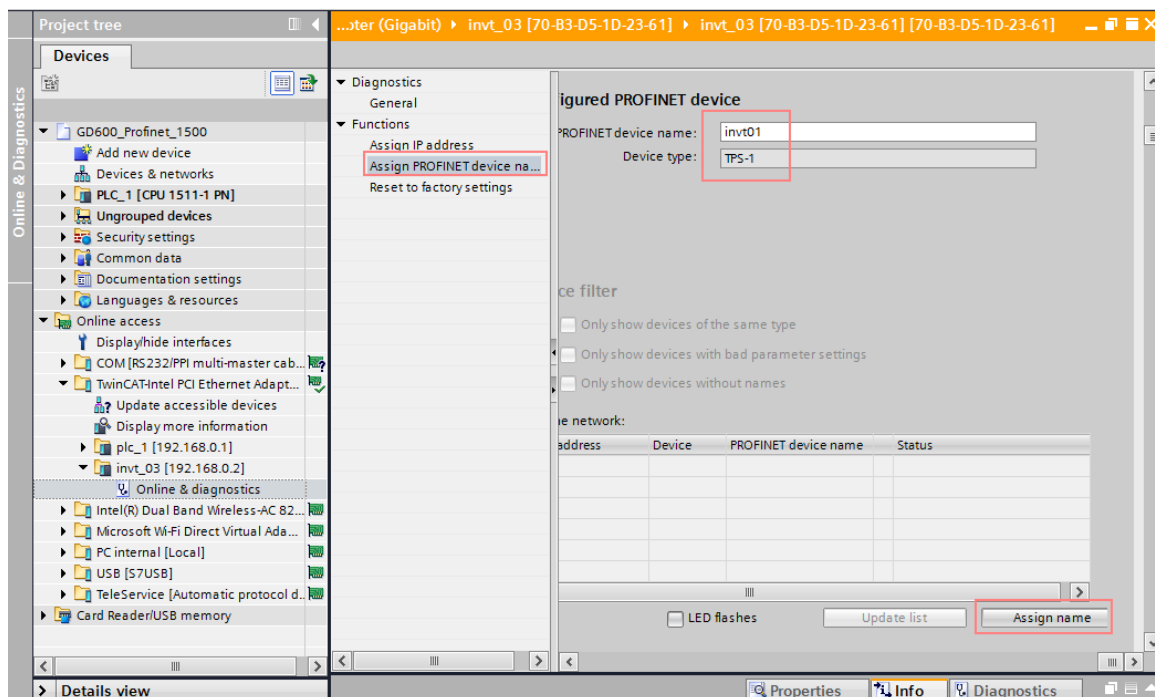


In the project tree, choose **Online access**, find the network adapter corresponding to your computer. Double-click **Update accessible devices** and wait for a period of time. All the devices scanned in the network are displayed. Find the INVT communication card device and click it, for example, **emc[192.168.0.2]**. Double-click **Online & diagnostics** to enter the online commissioning state.

Note: If the communication card is used for the first time, the device name cannot be found, and only the default IP address can be found.



Choose **Functions** > **Assign PROFINET device name** to enter the name assignment interface. Set the device name and type, and click **Assign name**.



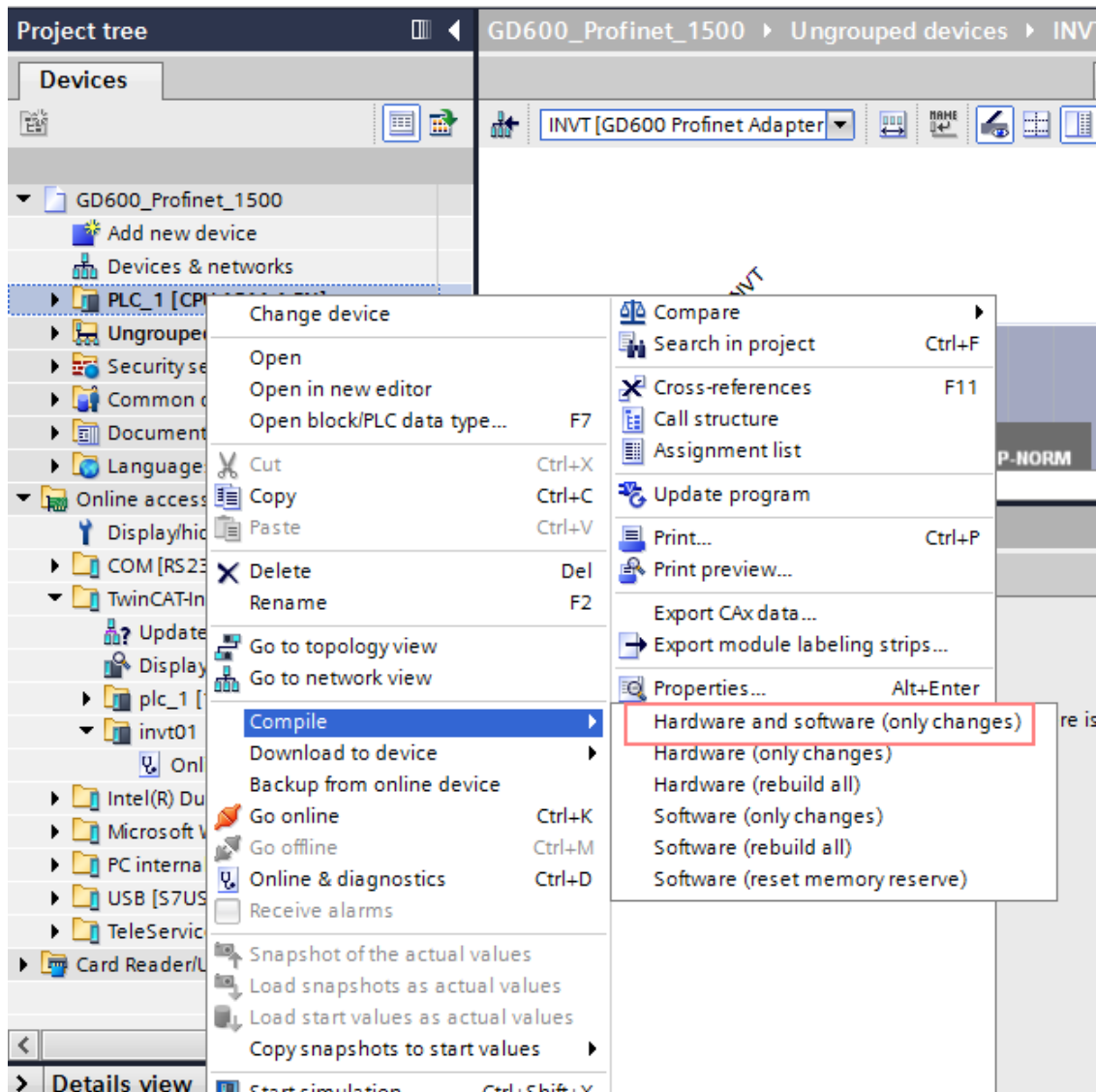
Note: The PROFINET communication card name that is set online must be the same as the PROFINET communication card name that is set during project configuration. Otherwise, devices cannot communicate through PROFINET. In addition, your computer Ethernet IP address must be in the same network segment, such as 192.168.0.55.

Note: The device name **invnt01** is used for example, which must be the same as the device name configured for the PROFINET communication card in the project.

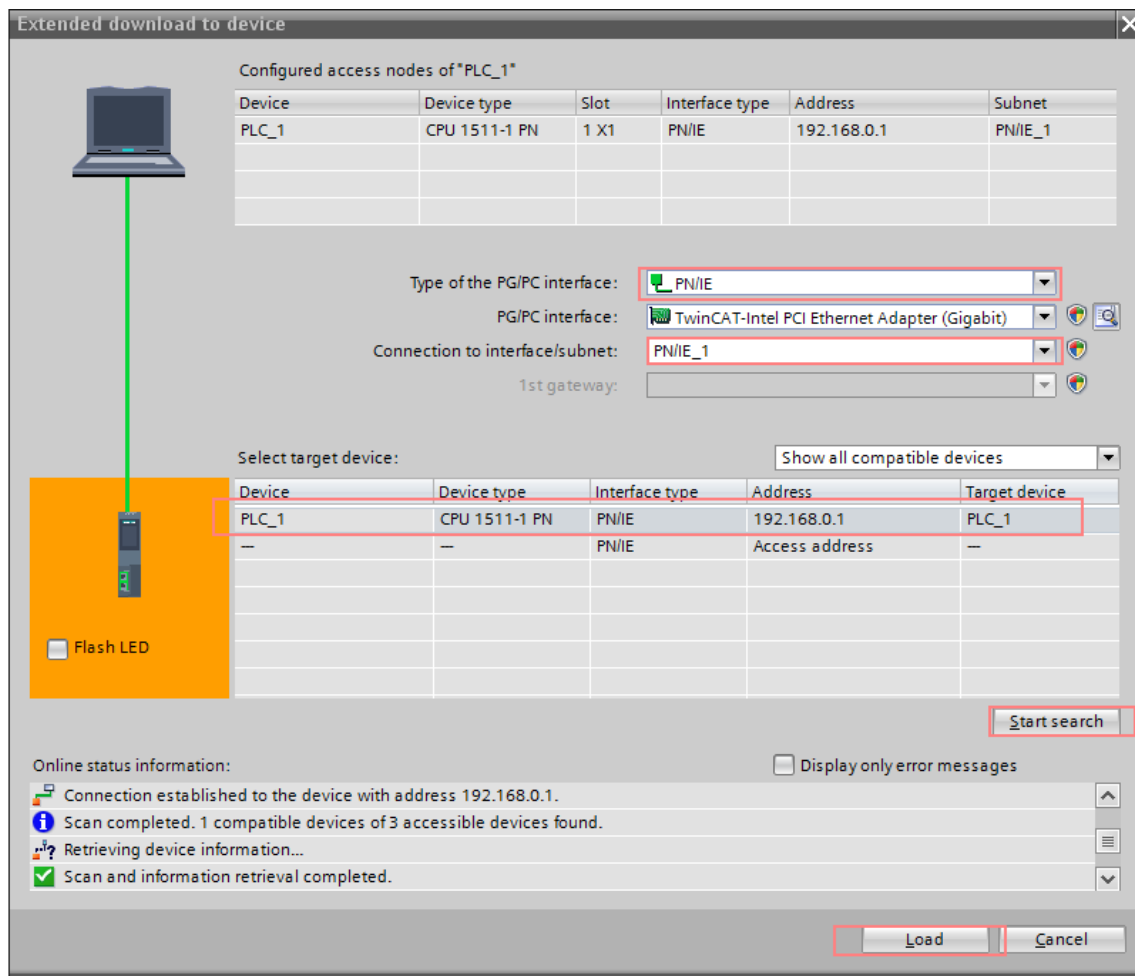
Step 5 Save, compile, and download the project.

After completing the entire project configuration, download the project configuration data to the CPU, as shown in the following figure

Choose **Save project** to save the project. Right-click **PLC_1[CPU 1511-1 PN]** and choose **Compile > Hardware and software (only changes)**. Click the **Download to device** icon to download the project configuration to the PLC. See the following figure.

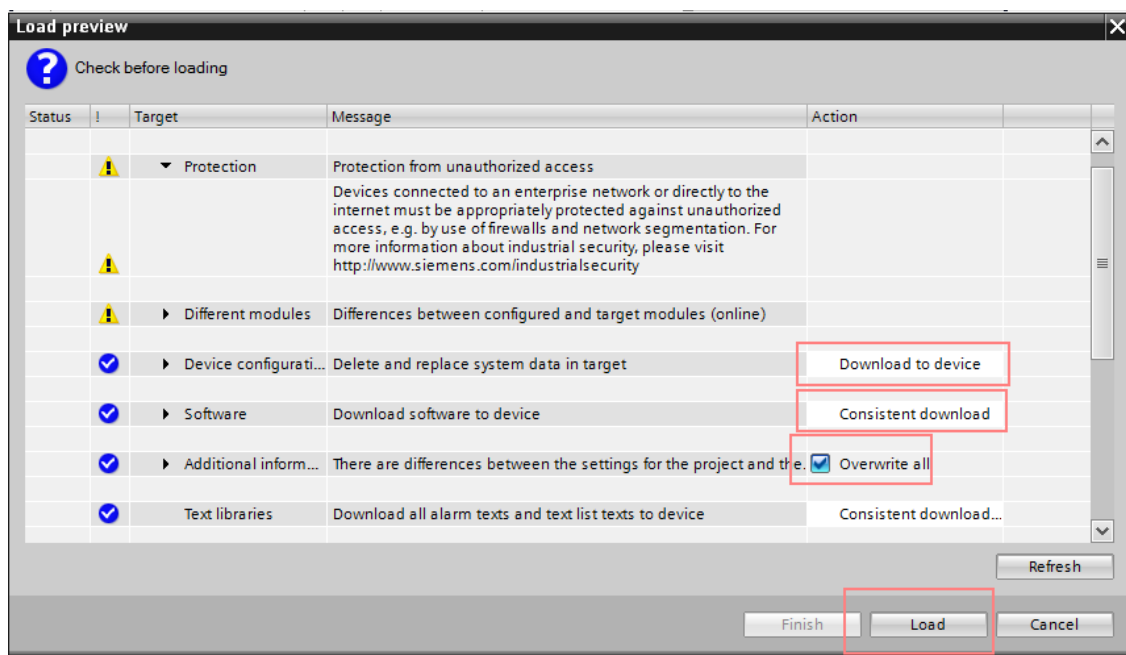


After the download is complete, the following interface appears. Select **PN/IE_1** from the **Connection to interface/subnet** drop-down list box. Click **Start search** in the lower right corner to scan for PLC devices in the network.



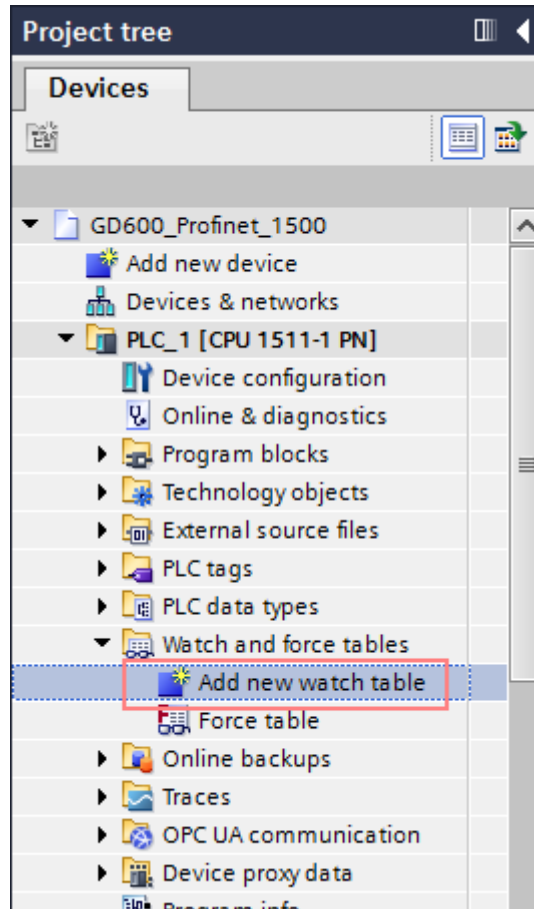
Select the PLC to download (there is only one PLC in the example), and click **Download**.

After downloading the configuration data and program to the PLC, continue to click **Load** and then **Finish** in the download interface.



Step 6 Configure the variable monitoring table.

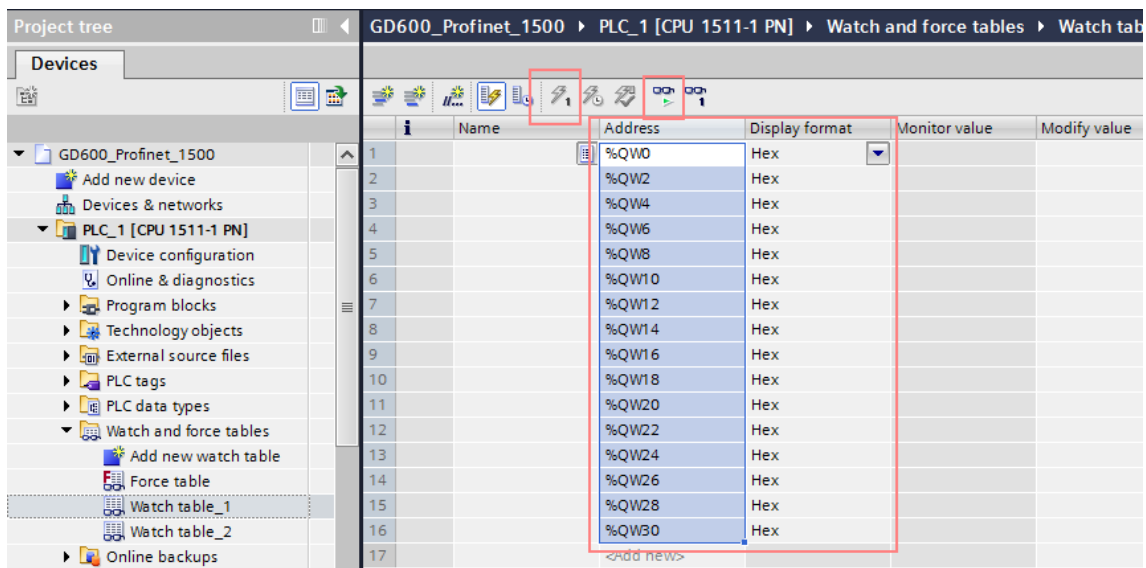
Choose **Watch and force tables > Add new watch table** in the project tree on the left.

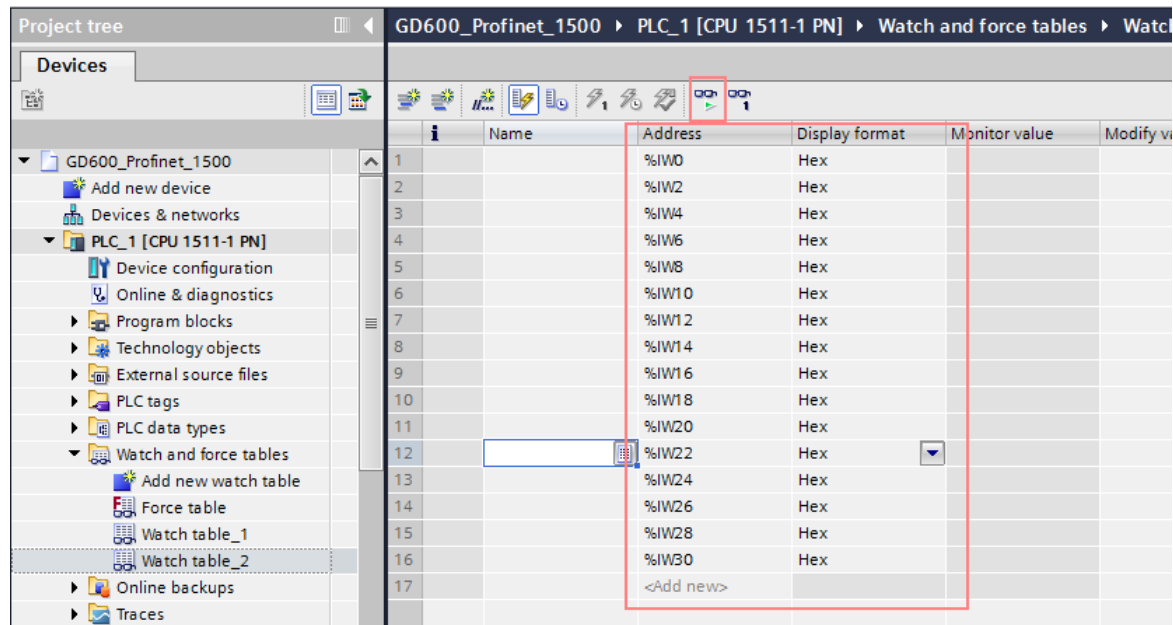


The addresses in the table must be consistent with those assigned during the IN/OUT module configuration.

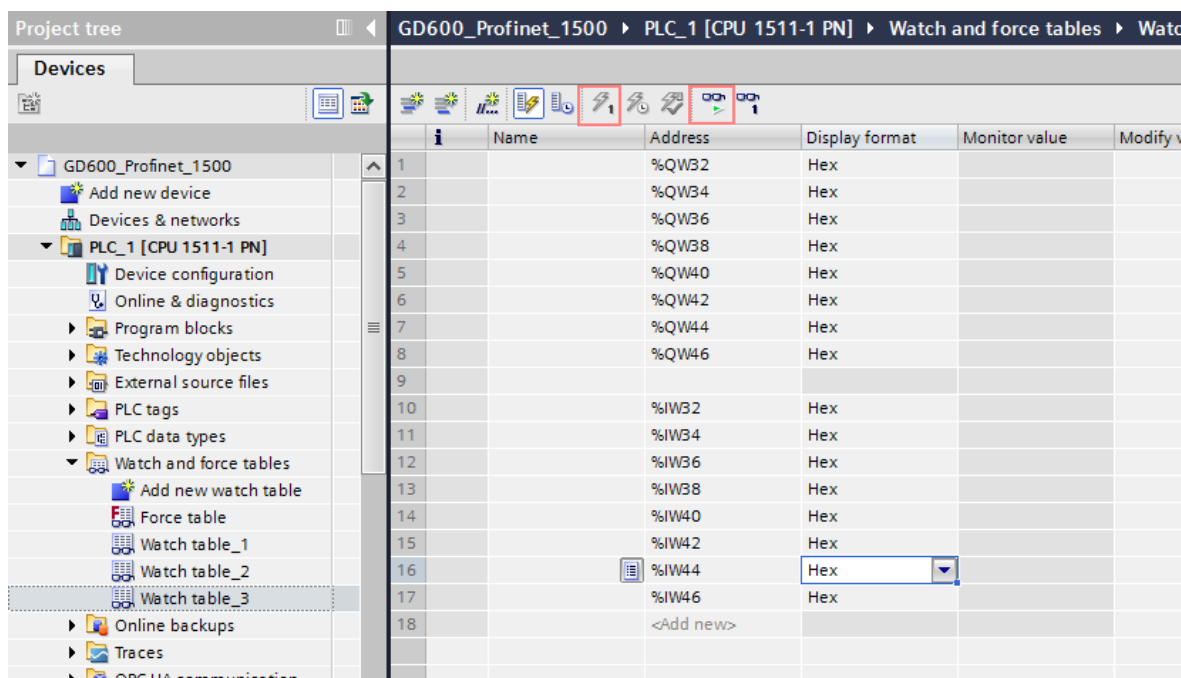
- QW0–QW31 correspond to the PLC output addresses of the rectifier unit (node 1), consistent with the Q addresses configured previously, while IW0–IW31 correspond to the PLC input addresses, consistent with the I addresses configured previously.

Monitor and modify the values as required. Refer to the following figure.





- QW32–QW47 correspond to the PLC output addresses of the inverter unit (node 2), consistent with the Q addresses configured previously, while IW32–IW47 correspond to the PLC input addresses, consistent with the I addresses configured previously.
Monitor and modify the values as required. Refer to the following figure.



Step 7 Finally, perform PLC programming as required.

6.6.5.3 IN/OUT module mapping description

In the configuration of PROFINET-to-CANopen communication, different IN/OUT modules can be selected according to the application requirements. The IN/OUT modules support data lengths of 2, 4, 6, 8, 10, 12, and 16 words. The data mapping varies with the selected data length, as described in the following:

- When the IN/OUT module is configured for more than 8 words, function code read/write operations are supported. Mapping starts from PKW, and up to 7 PZD data items (PZD2–PZD8) can be read and written.
- When the IN/OUT module selects 8 words or less, the mapping starts from CW/SW and it supports data reading and writing of up to 7 PZDs, but it does not support reading and writing of PKW function codes.

6.6.6 Related parameters

Table 6-44 Rectifier unit parameters

Rectifier function code	Name	Description	Recommended value
P17.15	Actual online slave nodes	Number of actual online slave nodes. Setting range: 0–31	0
P17.16	Slot 1 expansion card type (Near relay terminals)	0: No card 15: PROFINET communication card	0
P17.17	Slot 2 expansion card type (Near AC input cables)		0
P17.18	Slot 1 expansion card software version	Displays the software version of the expansion card in slot 1. Range: 0.00–655.35	0.00
P17.19	Slot 2 expansion card software version	Displays the software version of the expansion card in slot 2. Range: 0.00–655.35	0.00
P17.20	Status of slaves 02–17	Displays the online status of slave nodes 02–17. Range: 0x0000–0xFFFF 0: Offline 1: Online	0x0000
P17.21	Status of slaves 18–32	Displays the online status of slave nodes 18–31. Range: 0x0000–0x7FFF 0: Offline 1: Online	0x0000
P21.01	CANopen module address	Setting range: 1–32	1
P21.29	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4
P21.30	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–100.0s	0.0s
P21.33	Number of CANopen slave nodes	Setting range: 0–31 (Set this parameter only when the master is active.)	Depends on the number of slave nodes
P21.34	CANopen master/slave selection	0: Slave 1: Master	1
P21.51	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable) Bit0: PDO1	0xF

Rectifier function code	Name	Description	Recommended value
P21.52	PDO transmit enable	Bit1: PDO2 Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF
P21.53	PN/ECAT/DP card PZD configuration selection	0: PKW1–PZD8 1: PKW1–PZD12	1
P22.26	PROFINET communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s
P23.28–P23.38	PZD2 transmit–PZD12 transmit	Setting range: 0–20 For details, see Group P23—Communication expansion function group 2 (EtherNet/PROFINET/EtherCAT) in the gateway-type rectifier function parameter section.	/

Table 6-45 Inverter unit parameters

Inverter function code	Name	Description	Recommended value
P14.07	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	1.5s
P14.08	CANopen communication address	Setting range: 0–95	2
P14.09	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4
P14.10–P14.20	PZD2 receive–PZD12 receive	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section.	/
P14.21–P14.31	PZD2–PZD12 transmit	Setting range: 0–47 For details, see Group P14—Communication in the inverter function parameter section. Note: After networking with a communication expansion card, PZD12 transmit is not available.	/
P14.33	Communication card control and status word format selection	0: Decimal system 1: Binary system Note: This parameter must be set identically for both the rectifier unit and the inverter unit.	0
P14.43	PDO control command mode selection	0: Simplified CANopen mode (CW sent via broadcast message) 1: Standard CANopen mode (CW sent via CANopen message)	1
P14.42	PKW byte length selection	Setting range: 0–1 0: 8 bytes (PKW1–4)	1

Inverter function code	Name	Description	Recommended value
		1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of the rectifier function parameter P22.28.	
P14.88	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable) Bit0: PDO1 Bit1: PDO2	0xF
P14.89	PDO transmit enable	Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0xF
P19.00	Slot 1 expansion card type (Near relay terminals)	0: No card	0
P19.01	Slot 2 expansion card type (Near AC output cable)	11: PROFINET communication card	0
P19.03	Slot 1 expansion card software version	Setting range: 0–655.35	0.00
P19.04	Slot 2 expansion card software version	Setting range: 0–655.35	0.00

Note: When a communication expansion card is used for networking, PZD12 receive/transmit is fixed to the CANopen communication address.

6.6.6.1 PDO count configuration parameters

By setting P21.33 (Number of slave nodes) and P21.51, P21.52, the maximum number of supported PDOs can be configured. See Table 6-46 for details.

Table 6-46 GD600A PROFINET expansion card PDO count configuration

PDO receive/transmit enable (P21.51/P21.52)	Number of CANopen slave nodes (P21.33)
0x0F: Max. support (PDO1, 2, 3, 4)	<16
0x07: Max. support (PDO1, 2, 3)	≥16, ≤31

6.6.6.2 CANopen master PDO transmission period parameters

When P21.32 = 0, the transmission periods of all inverter RXPDO1–RXPDO4 are uniformly set by rectifier parameters P21.35, P21.36, P21.37, and P21.38.

The transmission period of inverter receive PDO control commands can be configured via inverter parameter P14.43. When P14.43 = 0, the CANopen control word broadcast mode is used; otherwise, standard CANopen mode is used.

6.7 EtherCAT-to-CANopen networking

6.7.1 EtherCAT communication protocol introduction

Ethernet for Control Automation Technology (EtherCAT) is a real-time industrial field bus communication protocol of Ethernet-based development architecture. It was introduced in 2003 and has been an international standard since 2007. EtherCAT sets new standards for real-time performance and topology flexibility.

- EtherCAT is one of the fastest industrial Ethernet technology, but it also synchronizes with nanosecond accuracy. Compared with other bus systems with the same cycle time, the EtherCAT system architecture typically reduces CPU load by 25% to 30%.
- EtherCAT networks have no practical limitations regarding topology – line, star, tree, redundant ring and all those combined with up to 65535 nodes.

- Compared with traditional fieldbus systems, EtherCAT node addressing is configured automatically, eliminating the need for network configuration. Integrated diagnostics with fault localization enable precise error identification. In addition, there are no switches to configure, and no complicated handling of MAC or IP addresses is required.
- The master device doesn't require a special interface card and the slave devices use highly-integrated, cost-effective chips available from a variety of suppliers.
- Distributed clock synchronization provides an effective synchronization solution for EtherCAT. In EtherCAT, data exchange is fully hardware-based. Because communication uses a logical ring topology and, with full-duplex Fast Ethernet, also a physical ring topology, the master clock can simply and accurately determine the propagation delay compensation for each slave clock, and vice versa. The distributed clocks are adjusted based on this value, providing a highly accurate, low-jitter network-wide time base.

In general, EtherCAT features include high performance, flexible topology, easy to use, low cost, high precision device synchronization, cable redundancy options and a functional safety protocol, and Hot Swap for devices.

6.7.1.1 CANopen over EtherCAT (CoE) model reference

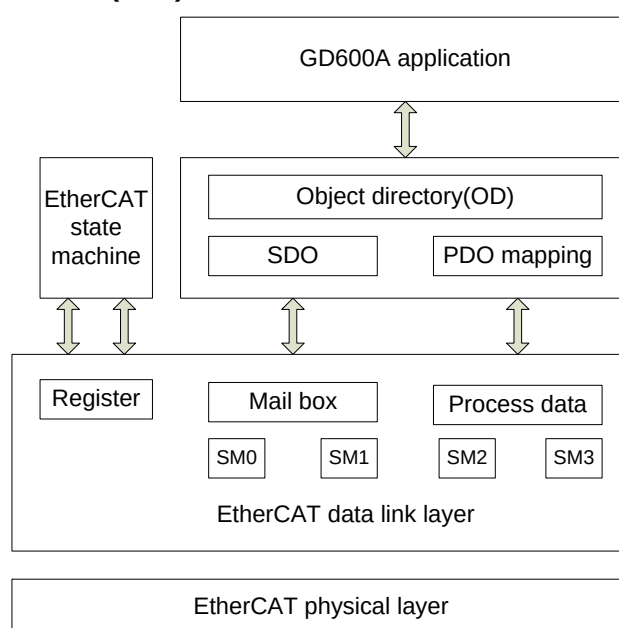


Figure 6-9 CoE reference model

The EtherCAT (CoE) network reference model consists of two parts: the data link layer and the application layer. The data link layer is mainly responsible for the EtherCAT communication protocol, and the application layer embeds the CANopen Drive Profile (DS402) communication protocol. The object dictionary in CoE includes parameters, application data, and PDO mapping configuration information.

Process data object (PDO) is composed of objects in the object dictionary that could operate PDO mapping. The content of PDO data is defined by PDO mapping. PDO data is read and written cyclically and does not require access to the object dictionary. In contrast, mailbox communication (Service Data Object, SDO) is acyclic and requires access to the object dictionary for read/write operations.

Note: To ensure correct parsing of SDO and PDO data at the EtherCAT data link layer, the FMMU and Sync Manager must be configured. Refer to Table 6-47 for details.

Table 6-47 EtherCAT Sync Manager configuration

Sync Manager	Configuration	Size	Start address
Sync Manager 0	Assigned to receive SDO	512 Bytes	0x1000
Sync Manager 1	Assigned to send SDO	512 Bytes	0x1200
Sync Manager 2	Assigned to Receive PDO	1536 Bytes	0x1400
Sync Manager 3	Assigned to send PDO	1536 Bytes	0x1A00

6.7.1.2 EtherCAT slave site information

The EtherCAT slave information file (XML file) is used for the master to read, in order to construct the configuration between the master and slave. The XML file contains the information required for EtherCAT communication configuration. INVT provides an EtherCAT slave information file.

6.7.1.3 EtherCAT state machine

The EtherCAT state machine is used to describe the states of the slave application and state transitions. State change requests are typically initiated by the master, with responses from the slave. The state transition process is shown in Figure 6-10.

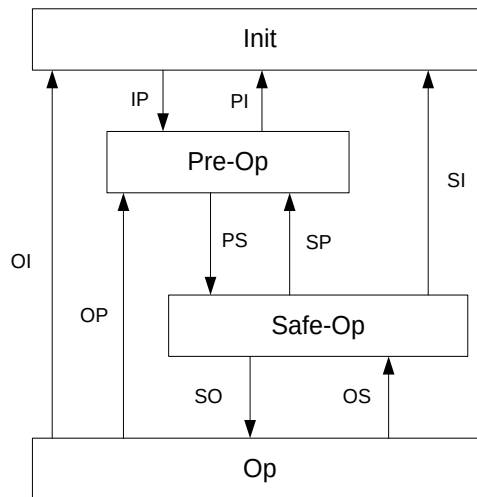


Figure 6-10 EtherCAT state machine flowchart

Table 6-48 EtherCAT state machine description

Status	Description
Init	SDO communication is not available. PDO communication is not available.
Init to Pre-Op	The master configures the data link layer address and SM channel for SDO communication. The master initializes DC synchronization information. The master requests to change into Pre-Op status. The master configures the application layer control register. The slave checks whether the mailbox is initialized properly.
Pre-Op	SDO communication is available; PDO communication is unavailable.
Pre-Op to Safe-Op	The master configures the PDO communication Sync Manager (SM) channels and FMMU channels. The master configures PDO mapping via SDO. The master requests transition to the Safe-Op state. The slave checks whether the PDO configuration and distributed clocks (DC) are correctly configured.
Safe-Op	SDO communication is available. PDO receive communication is available, while PDO transmit communication is not available. The device is in the Safe-Op state.
Safe-Op to Op	The master requests to switch to the Op state.
Op	SDO communication is available. PDO communication is available.

6.7.1.4 PDO process data mapping

The process data of an EtherCAT slave is composed of synchronization manager channel objects. Each synchronization manager channel object describes the consistency area of the EtherCAT process data and contains multiple process data objects. EtherCAT slaves with application control functions should support PDO mapping and the reading of SM PDOs Assign objects.

The master can select the required objects for PDO mapping from the object dictionary. PDO mapping configuration is located in the range of 0x1600 to 0x1614 (RxPDOs: receive PDOs) and range of 0x1A00 to 0x1A14 (TxPDOs: transmit PDOs) in the object dictionary. The PDO mapping method is shown in the following figure.

Index	Sub-index	Object content
0x1600	0	16
	1	0x70010010
	2	0x70020010
	...	...
	16	0x70100010
0x1601	0	12
	1	0x70810010
	...	...
	12	0x708c0010
...	...	...
0x1614	0	12
	1	0x7a010010
	...	...
	12	0x7a0c0010
0x1a00	0	16
	1	0x60010010
	2	0x60020010
	...	...
	16	0x60100010
...	...	...
0x1a14	0	12
	1	0x7a010010
	...	...
	12	0x7a0c0010

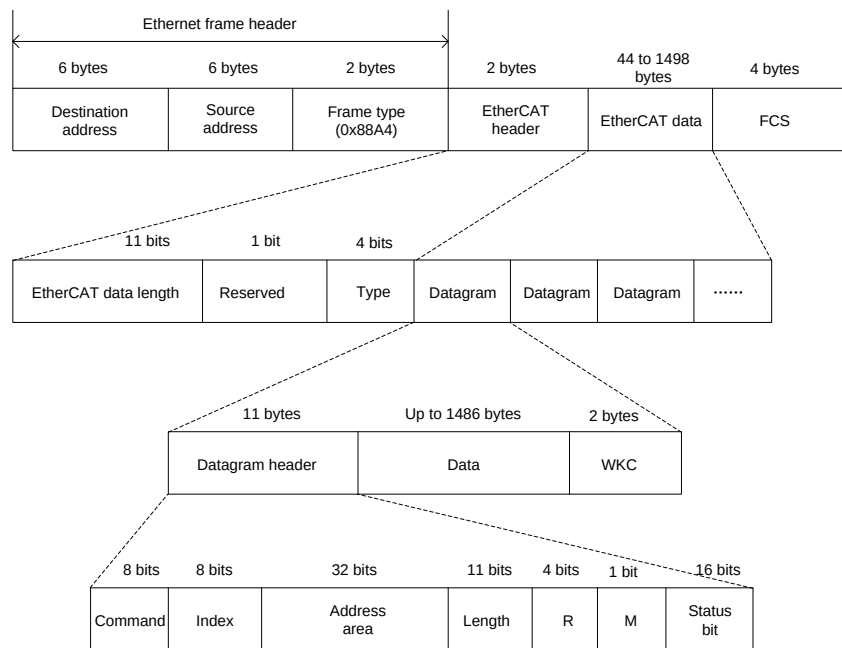
In addition to mapping the PDO objects, the exchange of EtherCAT process data also requires assigning the PDOs to the Sync Manager channels. The relationship between PDOs and SM channels is established through SM PDO assigned objects (1C12h and 1C13h). The method for Sync Manager PDO mapping is as follows.

Index	Sub-index	Object content
1C12h	0	21
	1	0x1600
	2	0x1601
	...	...
	31	0x161E
1C13h	0	21
	1	0x1a00
	2	0x1a01
	...	...
	31	0x1a1E

6.7.2 Communication frame structure

6.7.2.1 EtherCAT frame format

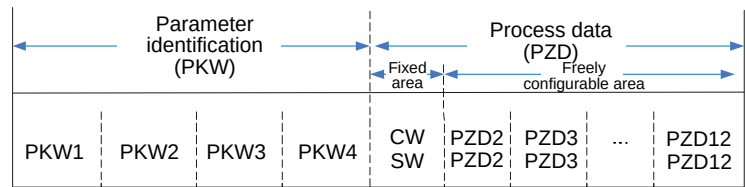
The following figure describes the structure of EtherCAT frame:



Each datagram (subframe) contains data from one EtherCAT slave node. The data within a datagram is a combination of multiple information frames described in section 6.7.2.2 EtherCAT frame structure, depending on the number of CANopen nodes in the CANopen network (including the CANopen master node and all slave nodes).

6.7.2.2 EtherCAT frame structure

The EtherCAT frame structure (PKW + PZD) is identical to the corresponding PROFINET telegram structure. For details, refer to section 6.6.2.2 PROFINET telegram structure.



6.7.3 Network topology

In this network, the PLC or another master device connects only to the rectifier unit that has been inserted with an EtherCAT communication card, and the rectifier unit connects to other units through RJ45 since it converts the communication card bus to CANOpen bus.

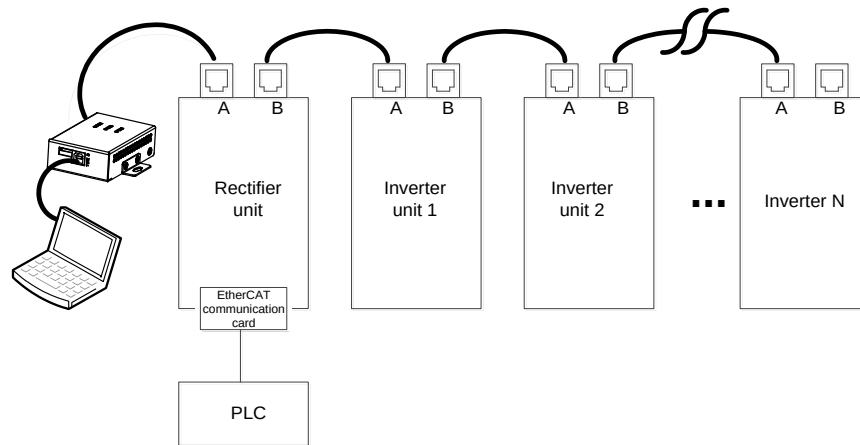


Figure 6-11 EtherCAT-to-CANOpen network topology

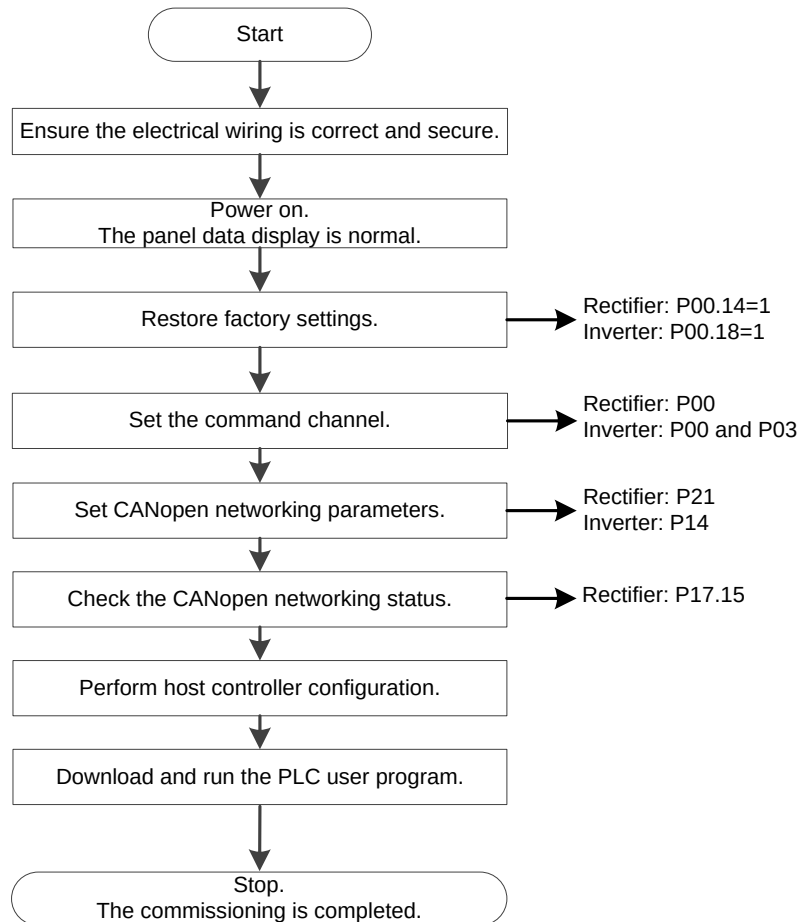
Note: In the networking wiring, the RJ45 ports between units must be cross-connected, that is, port A of a unit can only be connected to port B of another unit. If the connection is incorrect, the communication performance of the entire system will be degraded.

6.7.4 Communication performance

An EtherCAT-to-CANOpen gateway unit supports up to 31 CANOpen slave nodes. The gateway unit itself is counted as one CANOpen node. The maximum data exchanged between a single gateway unit and the PLC is 512 bytes for input and 512 bytes for output. At the same time, the number of slaves supported by the gateway is limited by the number of nodes supported by the PLC. In general, a Beckhoff PLC supports more than 32 EtherCAT nodes, which exceeds the limit of the Goodrive600A series. Therefore, only the gateway limitation needs to be considered.

6.7.5 Commissioning procedure

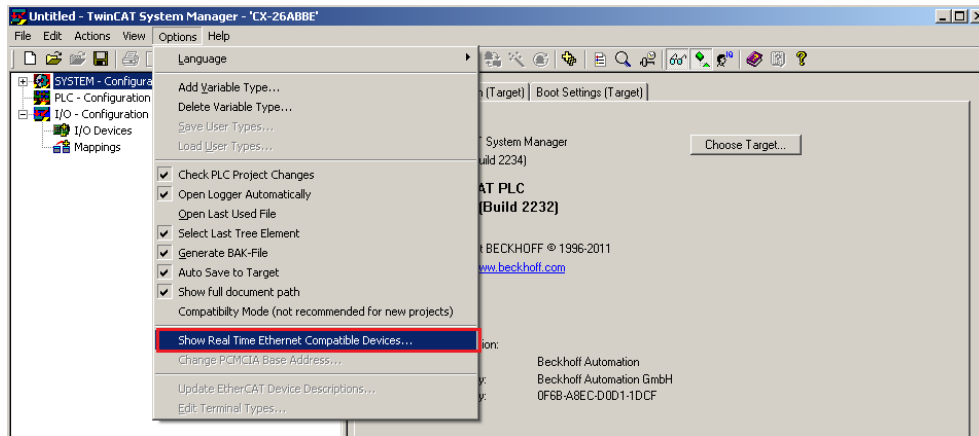
6.7.5.1 Flowchart for commissioning the EtherCAT-to-CANopen network



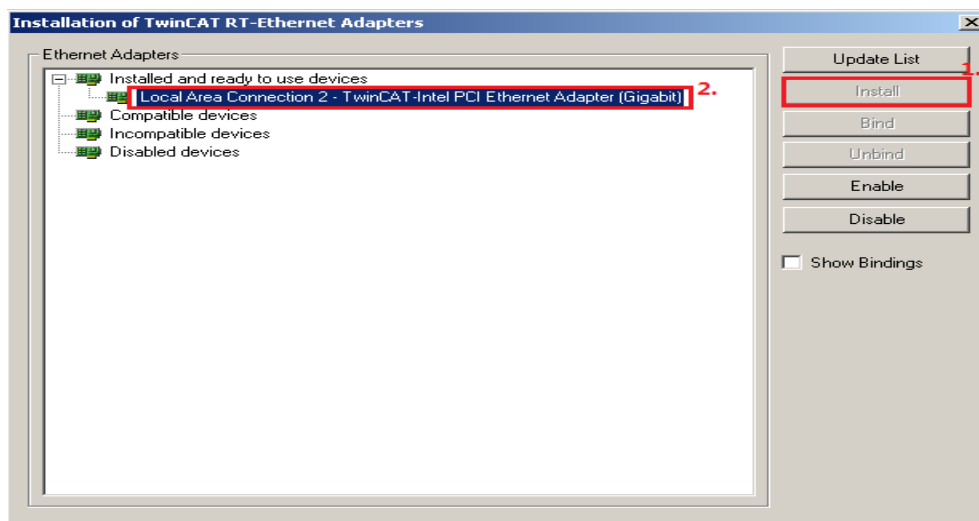
6.7.5.2 TwinCAT portal configuration (PLC model: Beckhoff CX5010)

The following uses TwinCAT 2 software and Beckhoff CX5010 as an example to describe the configuration procedure on TwinCAT portal.

1. Install TwinCAT 2.
2. Copy the GD600A EtherCAT configuration file (**GD600A-EtherCAT_XML_100.xml**) to the TwinCAT 2 installation directory:
C:\TwinCAT\Io\EtherCAT
3. Double-click the **TwinCAT System Manager** icon to open the configuration interface. When using the software for the first time, install the network adapter driver. This step is not required for subsequent use, as shown in the following figure.

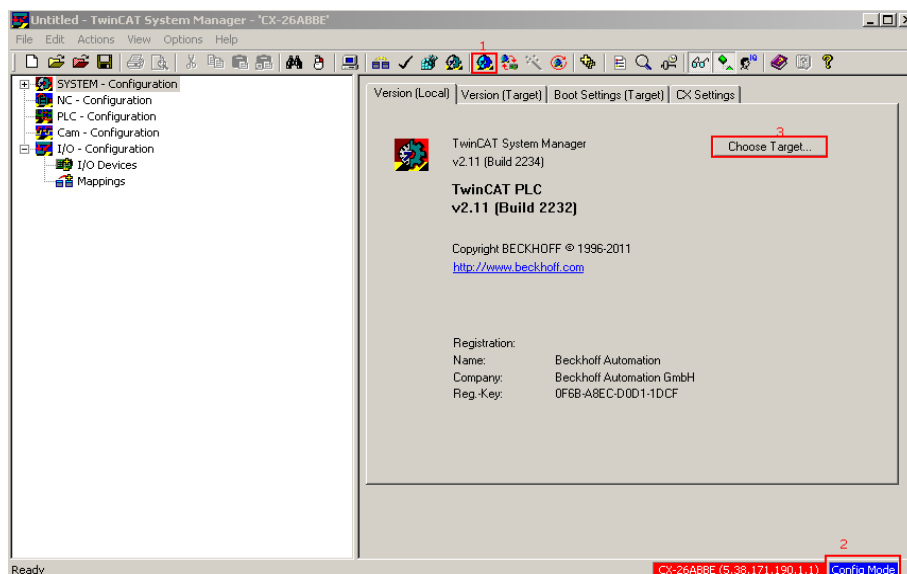


In the top menu bar, choose **Options > Show Realtime Ethernet Compatible Devices....** In the pop-up dialog box, choose the local network adapter, click **Install**. Once the network adapter is installed, it is displayed under **Installed and ready to use devices**. (Note: Use a network adapter with an Intel chipset.)

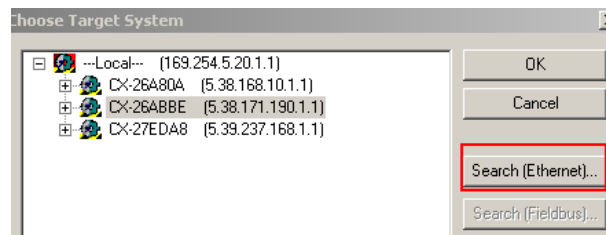


4. Connect the CX5010.

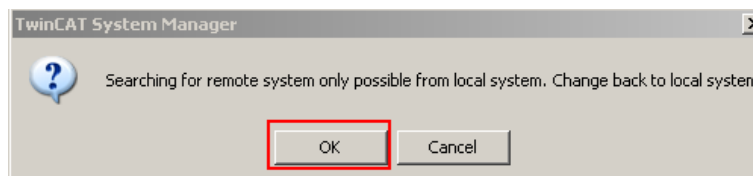
Connect the CX5010 to the PC with TwinCAT2 through a network cable. Meanwhile, connect the CX5010 to the EK1110 module, and then to the GD600A EtherCAT card on the rectifier through the module interface. In the following example, a connection between the rectifier and an inverter is needed. After the network adapter is installed, the interface of TwinCAT2 is displayed as follows:



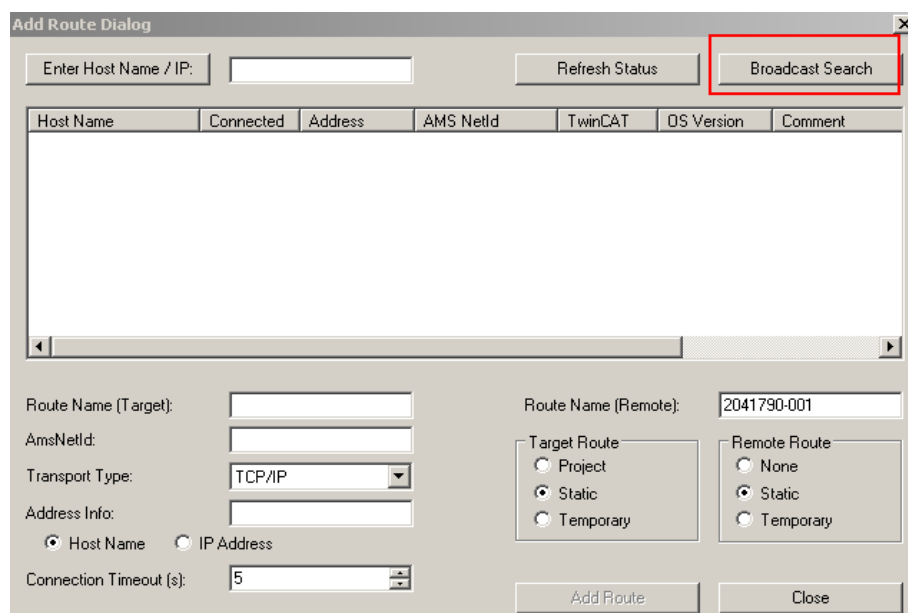
If **Config Mode** (as marked 2) is not displayed in the preceding figure, click **Restart TwinCAT System in Config Mode** (as marked 1), and then click **Choose Target...** (as marked 3). The following dialog box is displayed.



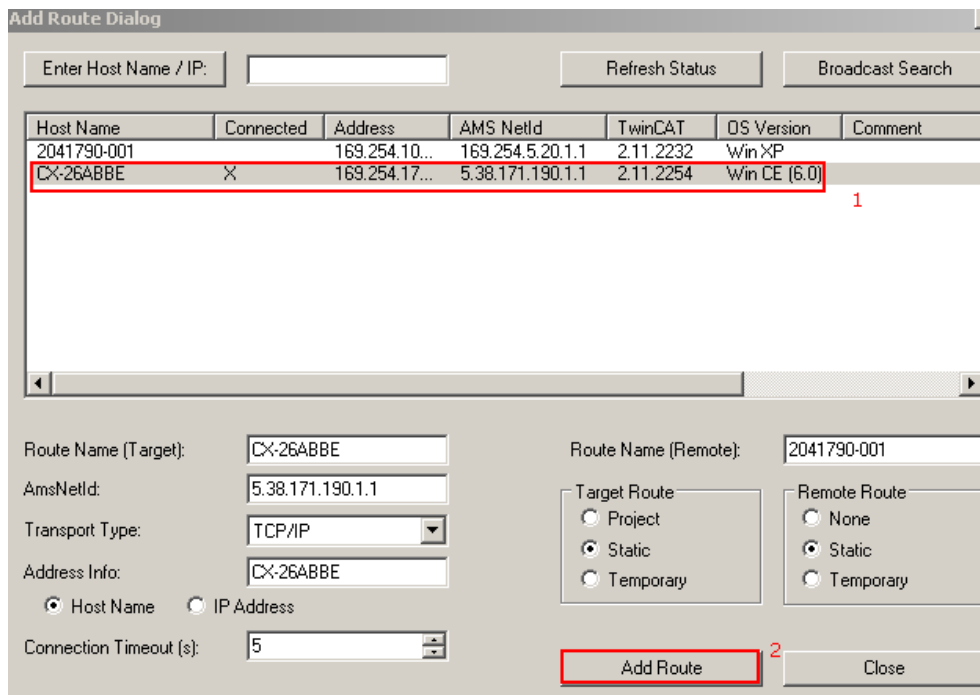
When a new PLC is used for the first time, the corresponding device is not displayed. If the PLC has been connected before, it will appear in the list and does not need to be searched again. As shown in the preceding figure, **CX-26ABBE** is the CX5010 used in this example. Since this section describes the procedure for first-time use, the PLC device must be searched. Click **Search [EtherNet]...** to open the following dialog box.



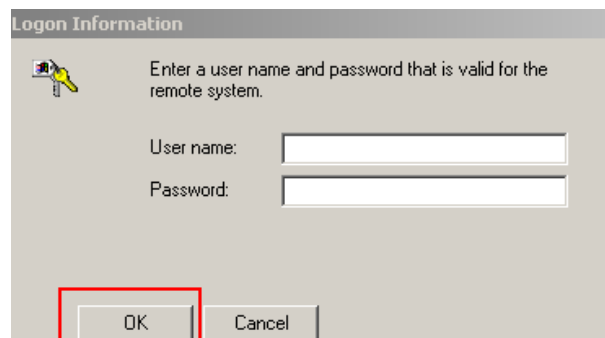
Click **OK**. The following interface appears.



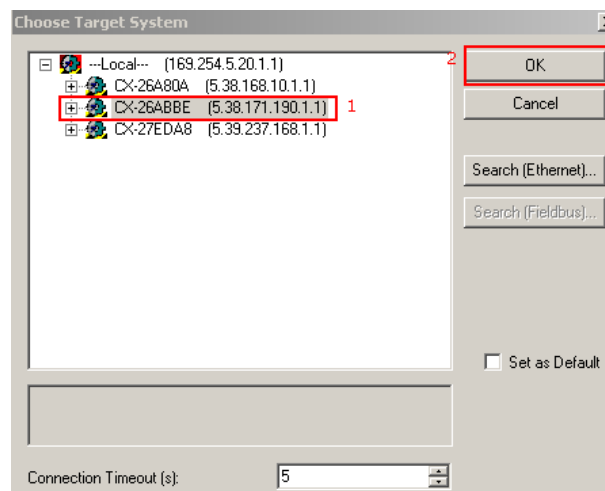
Select **Broadcast Search**. After a short period of searching, the following interface appears.



The **CX-26ABBE** shown in the figure above is the detected device. When connecting to a new device for the first time, the Connected field is empty. For devices that have been connected previously, the connection is established automatically. An X in this field indicates that the device is connected. Select a PLC that you need (for example, **CX-26ABBE**), and click **Add Route** to add the device. The following dialog box appears.



Enter the user name and password, and then click **OK** to add the device. By default, both the user name and password are empty. In the **Add Route Dialog**, an X appears in the **Connected** column for the device **CX-26ABBE**, indicating that the device is connected. Then click **Close**.



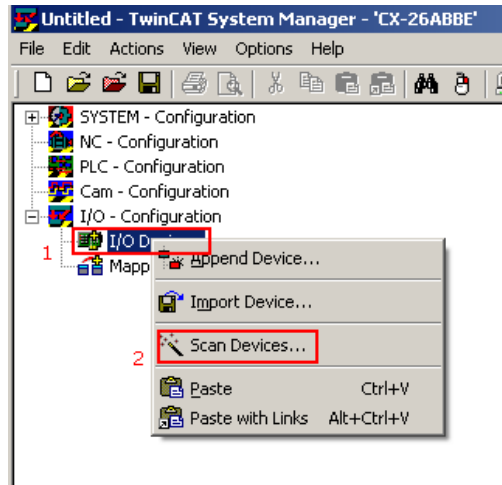
Select the required PLC (for example, **CX-26ABBE**) and click **OK**. If the PLC has been connected previously, skip

the device search step and select it directly at this step. At this point, the PLC has been successfully connected.

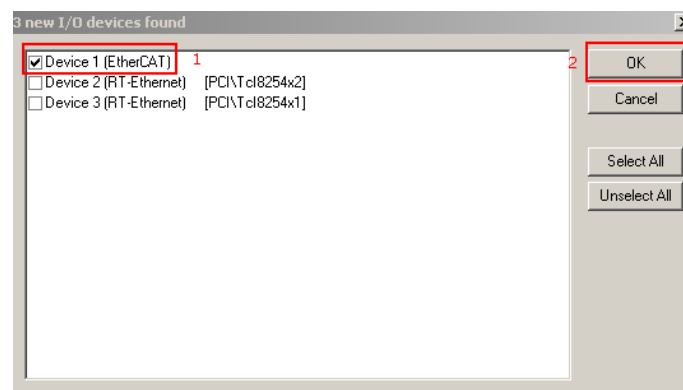
5. Scan and configure the PLC.

Right-click **I/O Devices** and choose **Scan Devices...** from the shortcut menu.

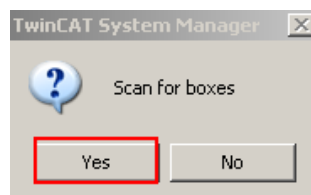
Note: This operation is available only in **Config Mode**. Otherwise, **Scan Devices...** is grayed out and cannot be chosen.



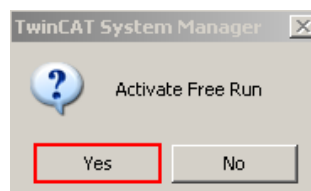
The following dialog box appears.



By default, the connected PLC device is selected (for example, **Device 1 [EtherCAT]**). Click **OK**. The following dialog box appears.



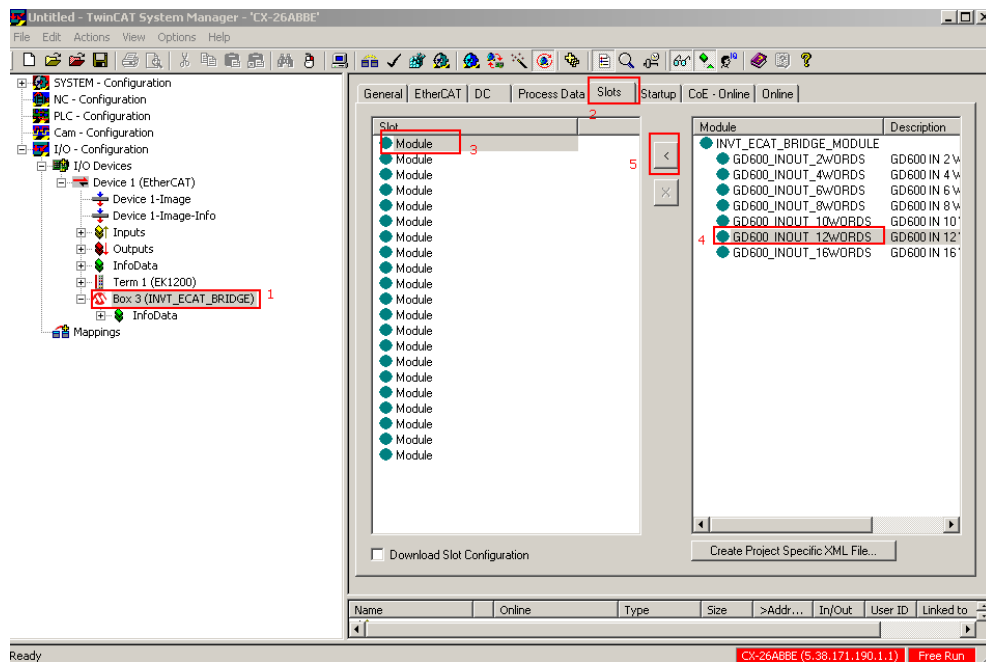
Click **Yes**. The following dialog box appears.



Click **Yes** again. The CX5010 is now configured and connected.

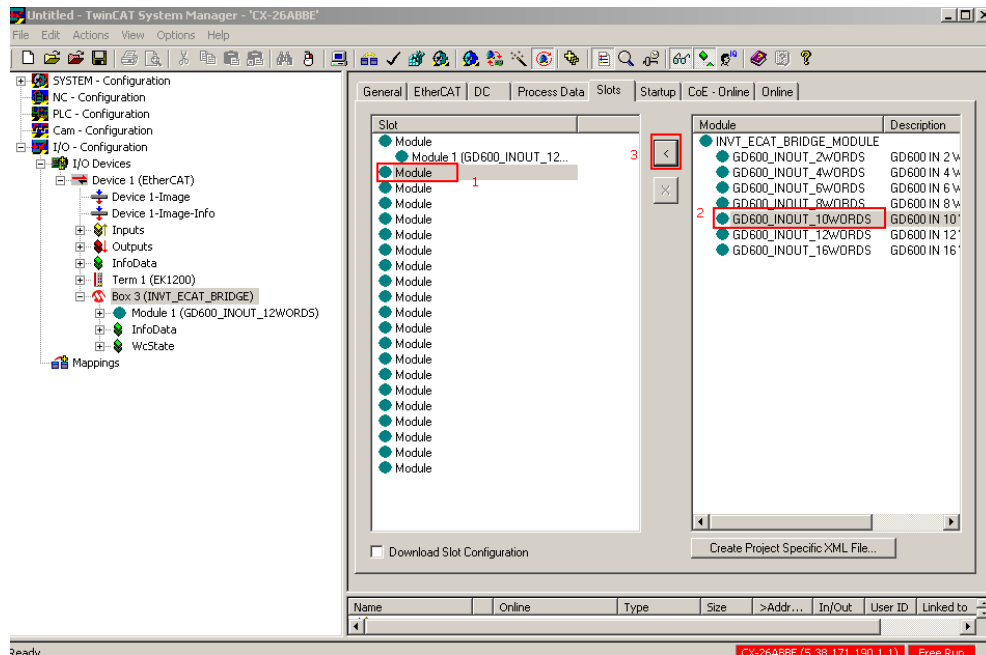
6. Add CANopen node modules.

After the CX5010 is configured and connected, the following interface appears.



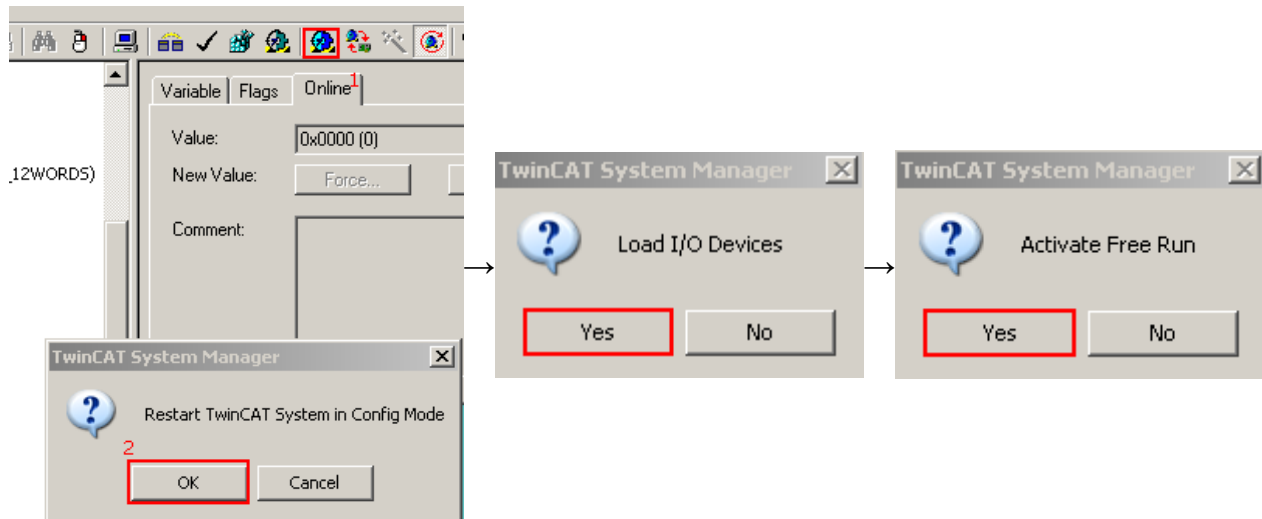
Double-click **Box 3 (INVT_ECAT_BRIDGE)** (note that the box number is not fixed and may vary; however, the description in parentheses is fixed and is defined by the device description file **GD600A-EtherCAT_XML_100.xml**). Select the **Slots** tab on the right, then select the first **Module**. On the right, choose a module, for example, **GD600A_INOUT_12WORDS**.

Note: The **GD600A_INOUT_16WORDS** module is not supported in EtherCAT-to-CANopen gateway applications and must not be selected. This module is intended for EtherCAT bus applications only. Click < to add the selected module.

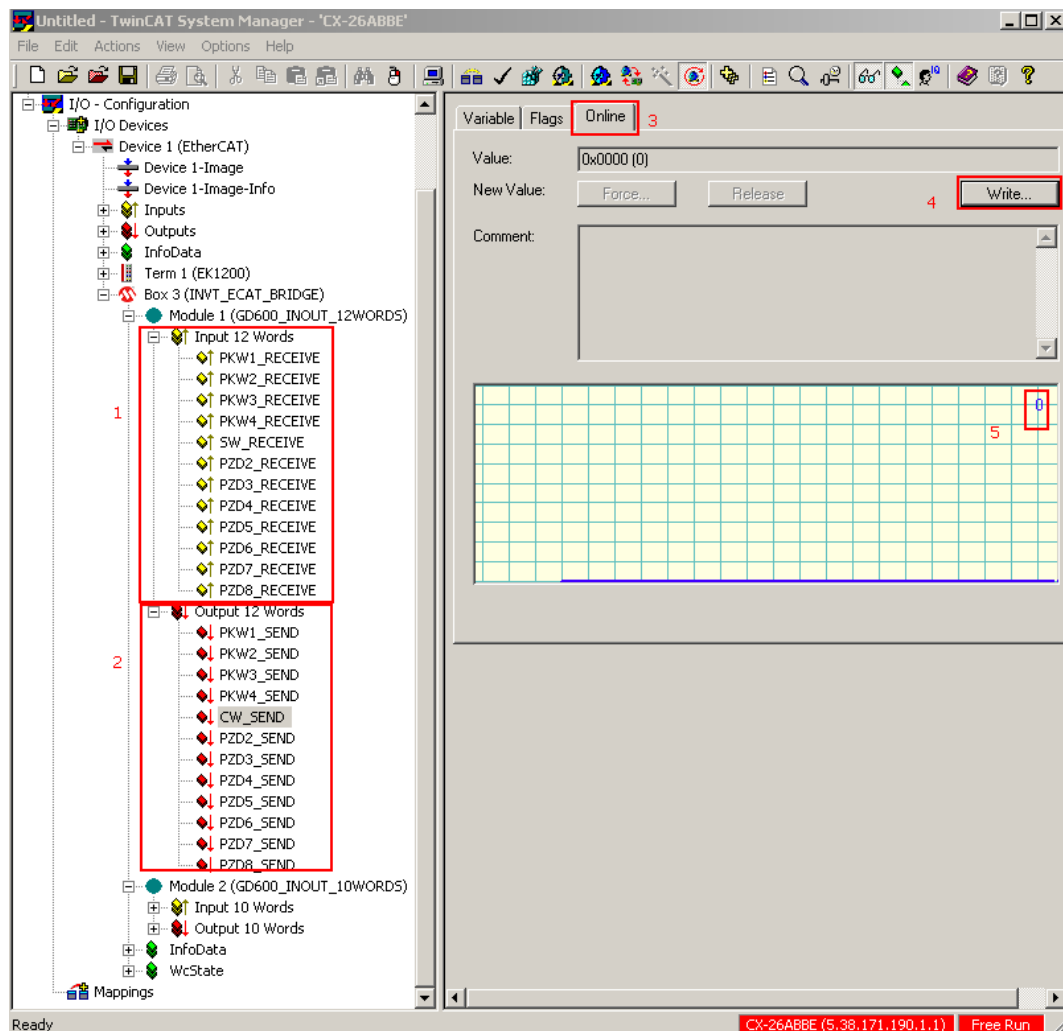


Repeat the same procedure to select the second **Module**. Choose **GD600A_INOUT_10WORDS**, and click < to add the second module.

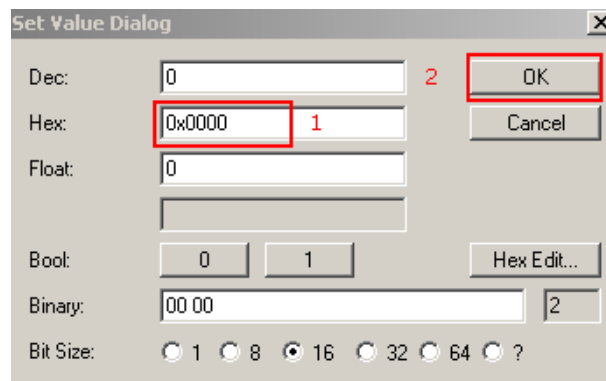
Then click **Restart TwinCAT System in Config Mode** to update the configuration.



After the configuration is completed, the following interface appears. This indicates that TwinCAT 2 has established an EtherCAT-to-CANopen network configuration via the CX5010, connecting one rectifier unit and one inverter unit.



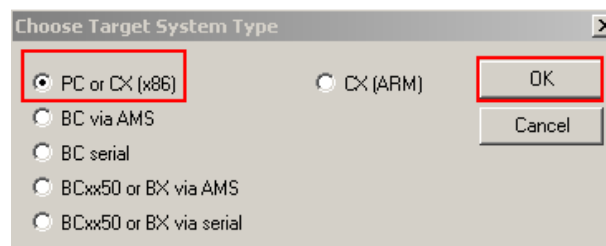
In which, area 1 shows the data received by TwinCAT, area 2 shows the data sent by TwinCAT. You can debug and modify the parameters by selecting a variable from area 1 or area 2 and selecting **Online** on area 3. For example, select **CW_SEND** > **Online** > **Write** to open the **Set Value Dialog** box. The default value is 0. The **Set Value Dialog** box appears.



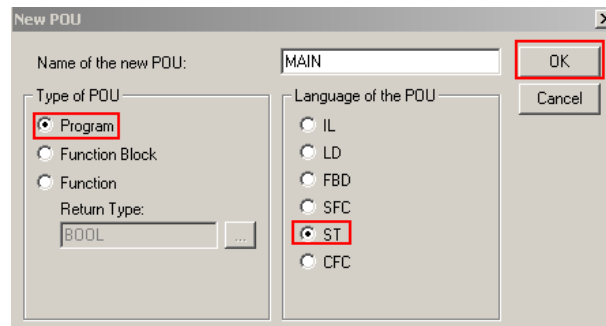
Modify the value in Dec or Hex format and click **OK**.

7. Compile and download the PLC program and link variables.

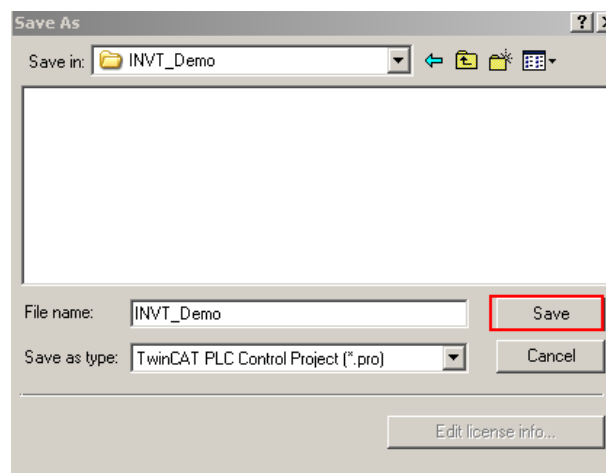
Double-click the **TwinCAT PLC Control** icon and choose **File > New**. In the dialog box that appears, click **OK**.



By default, **Type of POU** is **Program** and **Language of the POU** is **ST**. Select a programming language according to your programming preference and click **OK**.

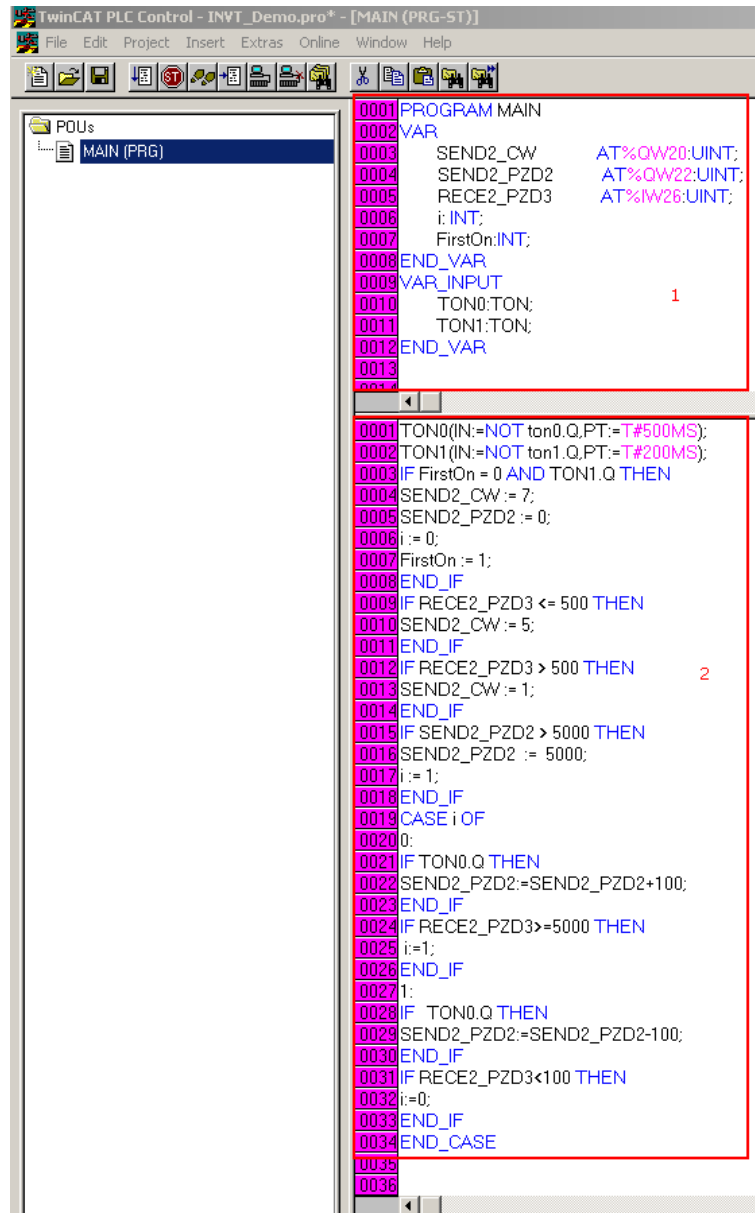


After creating a new project, choose a path to save the project. In this example, the project is saved as **INVT_Demo.pro**, as shown in the following figure.

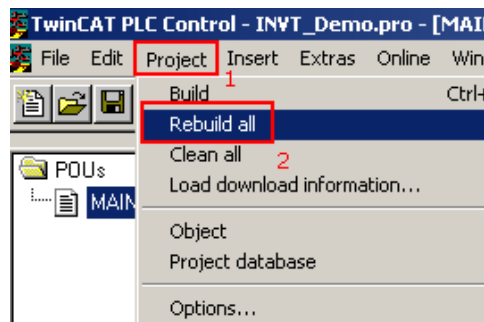


Write a program in the shown interface, where area 1 is the variable definition area and area 2 is the programming area. The example program sends commands to the inverter module through PLC to increase 1Hz every 0.5s until

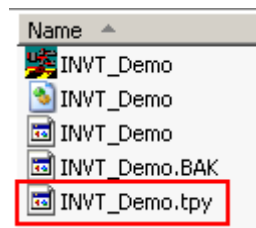
50Hz and then decrease 1Hz until 0, and repeat the cycle. Meanwhile, when the frequency increases to more than 5Hz, the inverter module receives a run command; when it decreases to less than 5Hz, the inverter module receives a stop command. The following parameters must be set on the inverter unit of the VFD in advance. After correctly completing the EtherCAT-to-CANopen gateway configuration as described in section 6.7.5.1, and set the following inverter function codes: P00.00=2, P00.01=2, P00.02=1, P00.06=9, P14.10=1 (Frequency setting), P14.22=2 (Frequency setting). The PLC program is shown in the following figure. The area marked 1 is the variable declaration section, and the area marked 2 is the programming section.



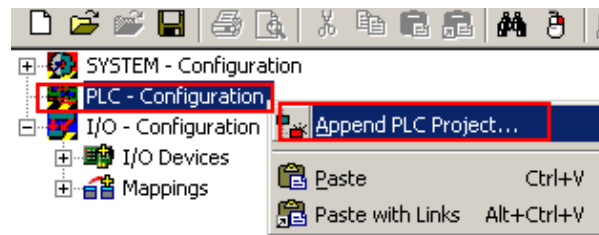
After editing the program, compile it as shown in the following figure.



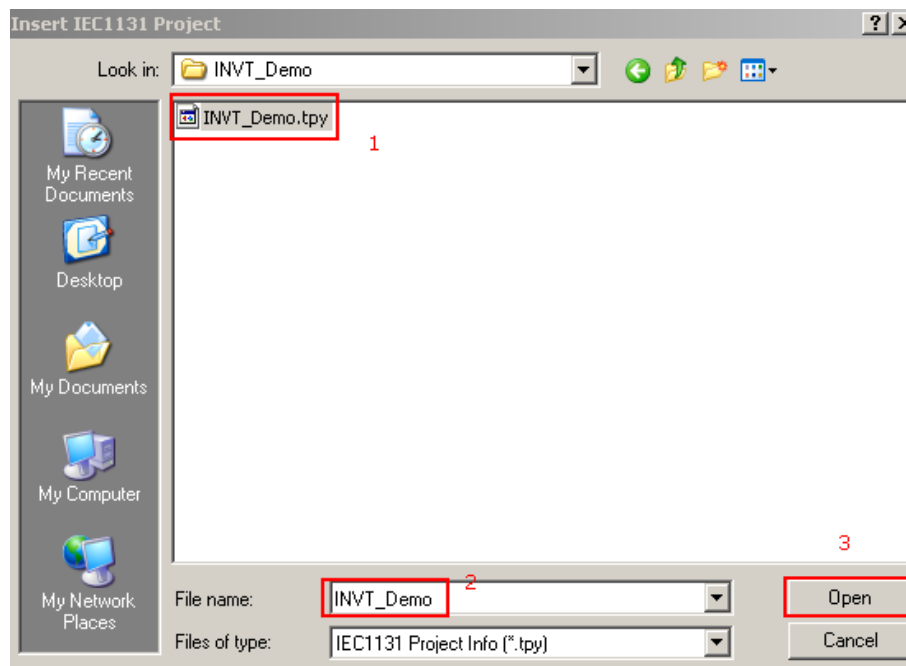
After compilation, a **.tpy** file is generated in the project directory. This file is essential for linking the PLC program to the configuration.



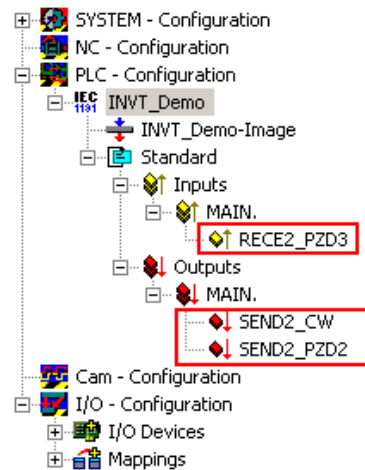
Open the **TwinCAT System Manager**, choose **PLC-Configuration > Append PLC Project...** for the new-created configuration to load the PLC project.



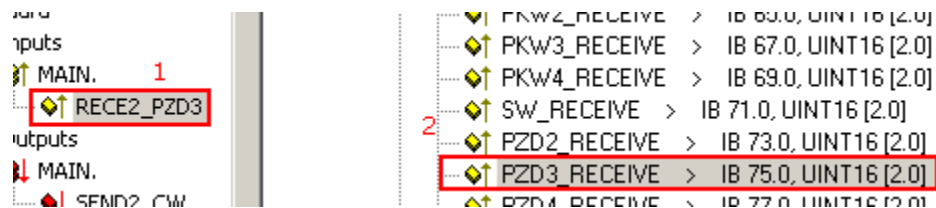
Select the generated **.tpy** file.



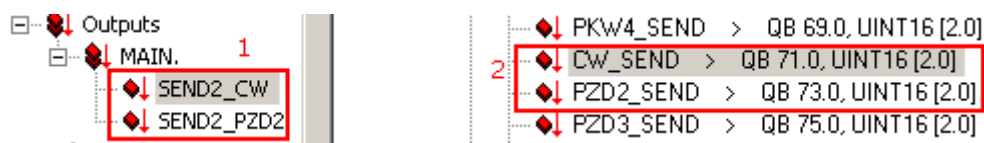
The user variables defined in the PLC program are displayed as follows.



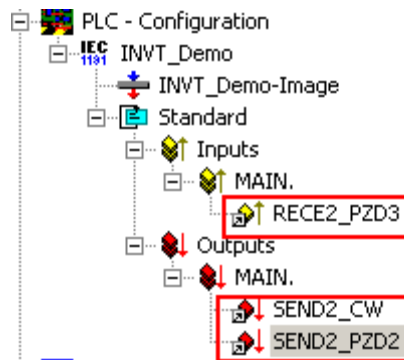
Double-click the variable as shown in the figure, and in the dialog box that appears, select the corresponding object to link the input variable.



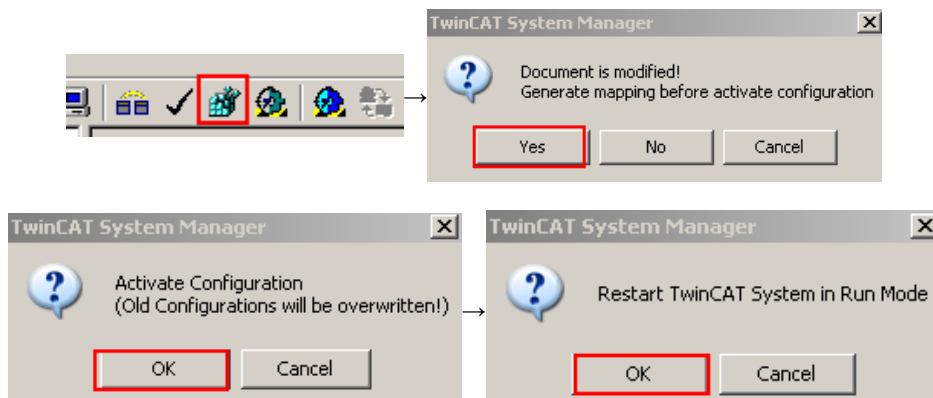
Similarly, link the output variables in the same way, as shown in the following figure.



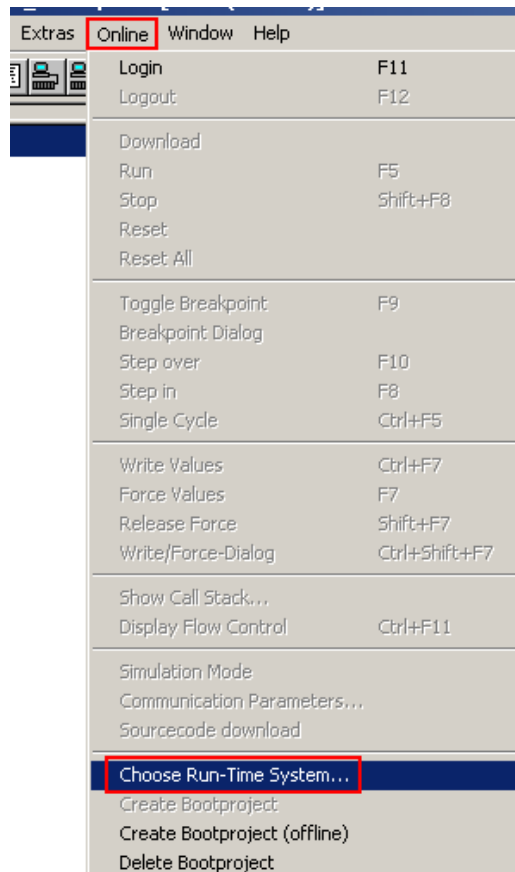
After linking, the variables are indicated by an arrow icon, as shown in the following figure.



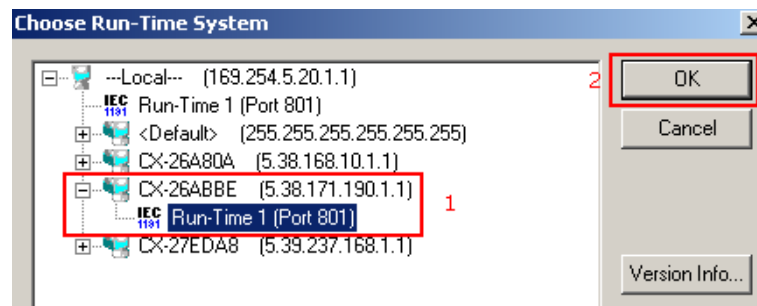
Click the icon shown in the following figure to activate the configuration just selected, and follow the prompts as shown.



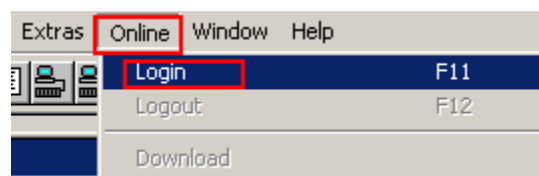
On the TwinCAT PLC Control interface, choose **Online > Choose Run-Time System**.



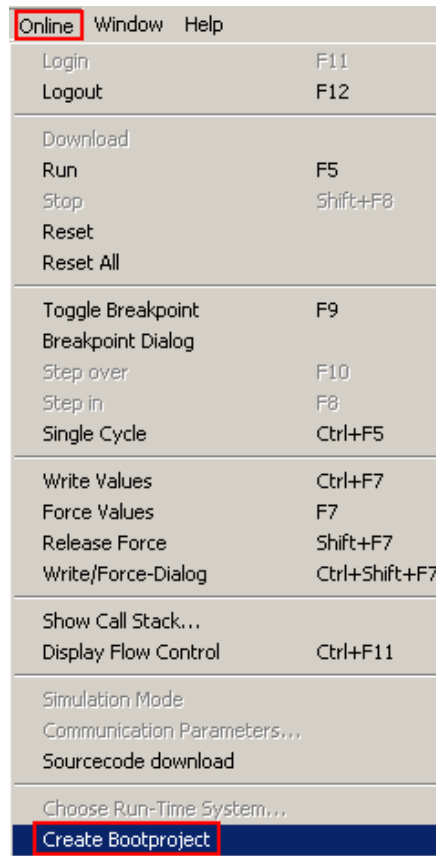
Choose the connected PLC.



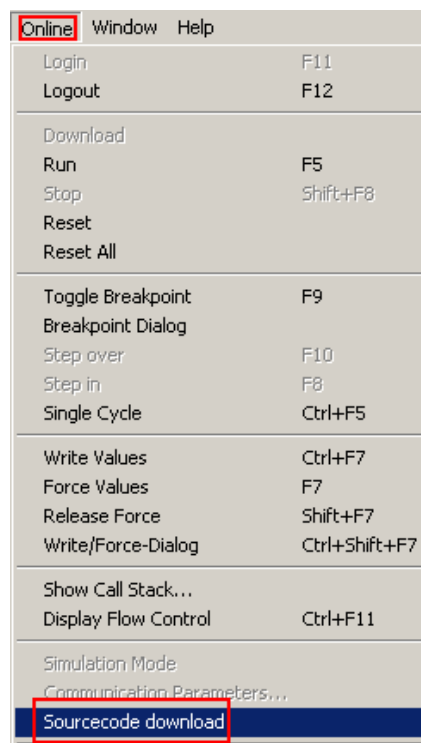
Choose **Online > Login**.



Choose **Online > Create Bootproject** to create a boost project before you download the PLC program.



Choose **Online** > **Sourcecode download** to download the sourcecode.



At this point, the PLC program has been downloaded to the PLC. After a power cycle, the PLC automatically runs the program. For online debugging, log in to the PLC as described previously.

6.7.5.3 IN/OUT module mapping description

In the configuration of EtherCAT to CANopen communication, to ensure efficient CANopen communication, the IN/OUT modules support selectable data lengths of 2, 4, 8, 10, and 12 words, but do not support 16 words. Selecting different word types causes data mapping difference.

- When the IN/OUT module is configured for more than 8 words, function code read/write operations are supported. Mapping starts from PKW, and up to 7 PZD data items (PZD2–PZD8) can be read and written.
- When the IN/OUT module selects 8 words or less, the mapping starts from CW/SW and it supports data reading and writing of up to 7 PZDs, but it does not support reading and writing of PKW function codes.

6.7.6 Related parameters

The EtherCAT and PROFINET communications share the same channel in this product; therefore, the related function codes are identical. Refer to 6.6 PROFINET-to-CANopen networking for details. Table 6-49 Lists only the EtherCAT-specific function codes.

Table 6-49 Rectifier unit parameters

Rectifier function code	Name	Description	Default
P22.24	EtherCAT communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s

6.7.6.1 PDO count configuration parameters

By setting P21.33 (Number of slave nodes) and P21.51/P21.52, the maximum number of supported PDOs can be configured. See Table 6-50 for details.

Table 6-50 GD600A EtherCAT expansion card PDO count configuration

PDO receive/transmit enable (P21.51/P21.52)	Number of CANopen slave nodes (P21.33)
0x0F: Max. support (PDO1, 2, 3, 4)	<16
0x07: Max. support (PDO1, 2, 3)	≥16, ≤20
0x06: Max. support (PDO2, 3)	>20, ≤31

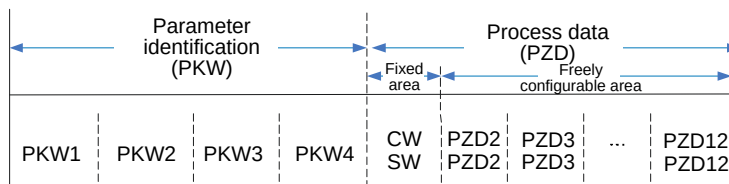
6.7.6.2 CANopen master PDO transmission period parameters

Refer to section 6.6.6.2 CANopen master PDO transmission period parameters.

6.8 PROFIBUS-DP bus communication networking

6.8.1 Communication telegram structure

The communication data frame structure (PKW + PZD) of PROFIBUS-DP is identical to that of PROFINET. Refer to section 6.6.6.2 CANopen master PDO transmission period parameters.



6.8.2 Network topology

In this network, each unit is inserted with a PROFIBUS-DP communication card so that the PLC or another master device can connect to the rectifier and inverter units.

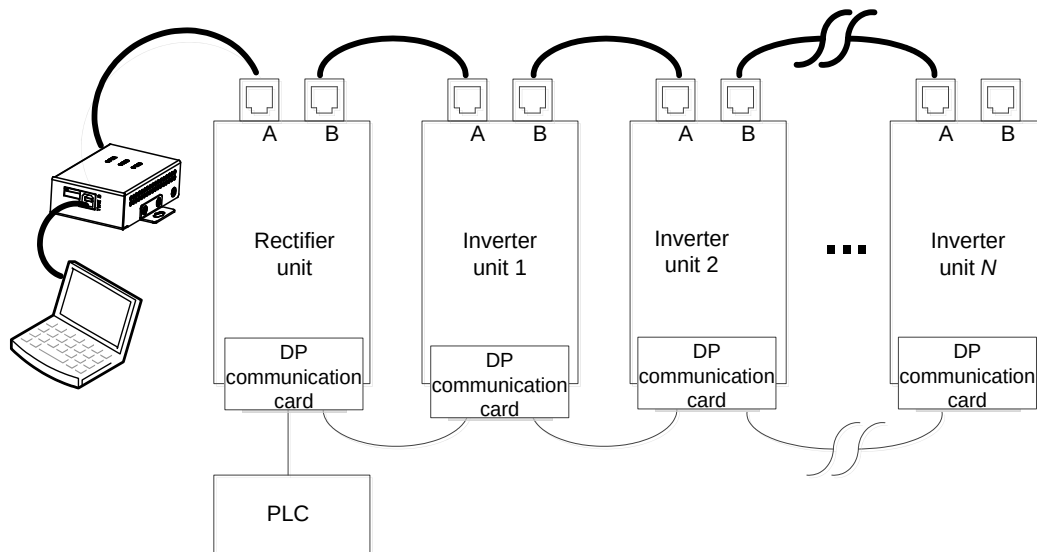


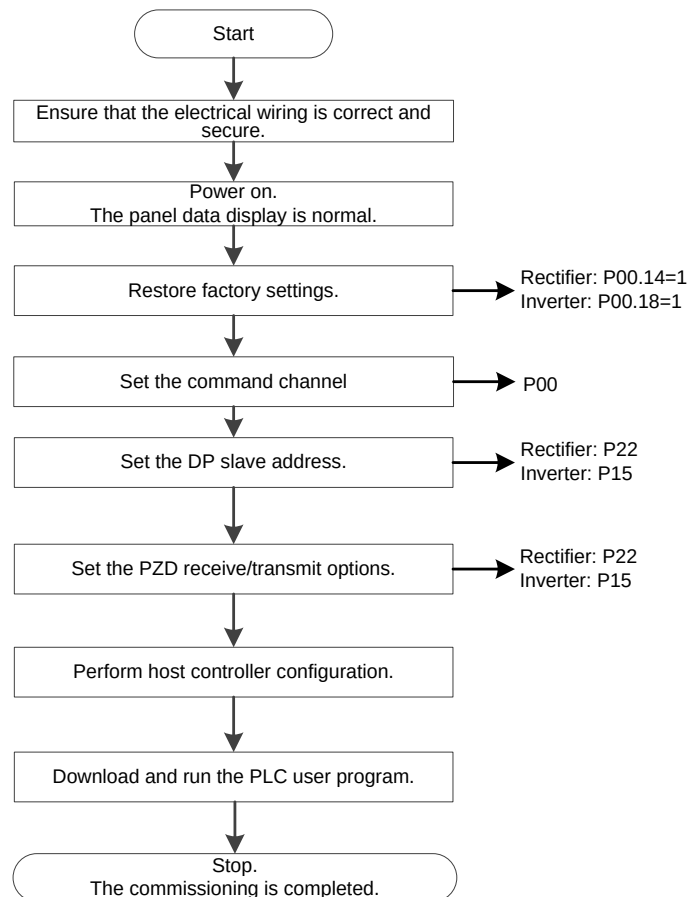
Figure 6-12 PROFIBUS-DP communication network topology

6.8.3 Communication performance

In the GD600A PROFIBUS-DP bus communication networking, the number of nodes is determined by the number of nodes supported by the PLC CPU. A maximum of 32 nodes (including the repeaters) are allowed to be connected in a segment consisting of two repeaters. If there are more than 32 nodes, a repeater is required for relaying.

6.8.4 Commissioning procedure

6.8.4.1 Commissioning flowchart for the PROFIBUS-DP network

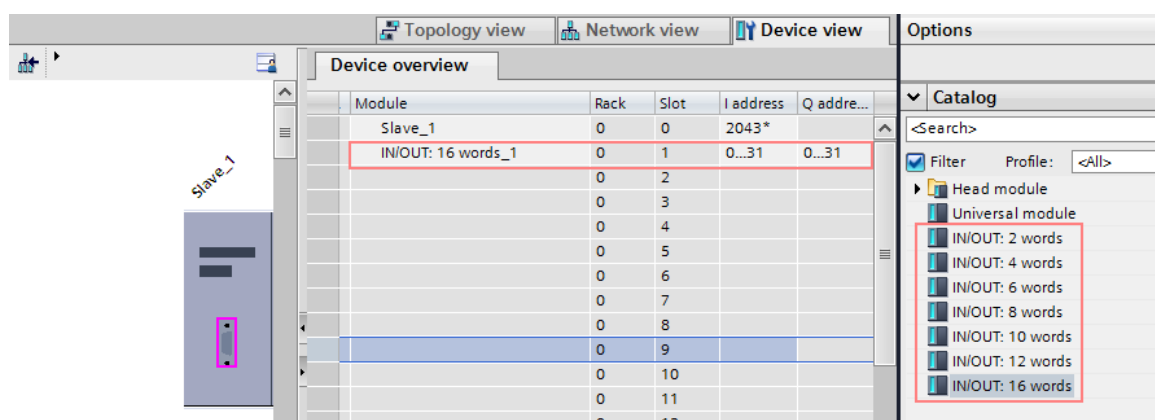


6.8.4.2 TIA portal configuration (S7-300)

Refer to section 6.5.6.2 TIA portal configuration (S7-300).

Note: In PROFIBUS-DP slave device configuration, there are differences between direct PROFIBUS-DP network configuration and PROFIBUS-DP-to-CANopen gateway configuration.

In PROFIBUS-DP-to-CANopen gateway applications, each device must be configured with a corresponding number of slots based on the number of CANopen slave nodes. In direct PROFIBUS-DP network configuration, multiple PROFIBUS-DP devices are added to the network, and each device only requires the first slot module to be configured.



6.8.4.3 IN/OUT module mapping description

In the configuration of PROFIBUS-DP bus communication, IN/OUT modules support selectable data lengths of 2, 4, 6, 8, 10, 12, and 16 words.

When the IN/OUT module selects more than 8 words, it supports the reading and writing of function codes. To be specific, mapping from PKW, it also supports data receiving and sending of up to 11 PZDs (PZD2–PZD12).

When the IN/OUT module selects 8 words or less, the mapping starts from CW/SW and it supports data reading and writing of up to 7 PZDs (PZD2–PZD8), but it does not support reading and writing of PKW function codes.

6.8.5 Related parameters

Table 6-51 Rectifier unit parameters

Rectifier function code	Name	Description	Default
P17.16	Slot 1 expansion card type (Near relay terminals)	0: No card 6: DP communication card	0
P17.17	Slot 2 expansion card type (Near AC input cables)		0
P17.18	Slot 1 expansion card software version	Displays the software version of the expansion card in slot 1. Range: 0.00–655.35	0.00
P17.19	Slot 2 expansion card software version	Displays the software version of the expansion card in slot 2. Range: 0.00–655.35	0.00
P22.13– P22.23	PZD2 transmit–PZD12 transmit	Setting range: 0–20 For details, see Group P22—Communication expansion function group 1 (PROFIBUS-DP) in the gateway-type rectifier function parameter section.	/

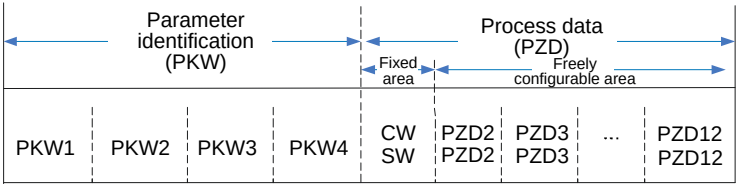
Table 6-52 Inverter unit parameters

Inverter function code	Name	Description	Default
P15.01	Module address	Setting range: 0–127	2
P15.02– P15.12	PZD2 receive–PZD12 receive	Setting range: 0–47 For details, see Group P15—Communication card 1 functions (PROFIBUS-DP) in the inverter function parameter section.	/
P15.13– P15.23	PZD2 transmit–PZD12 transmit	Setting range: 0–47 For details, see Group P15—Communication card 1 functions (PROFIBUS-DP) in the inverter function parameter section.	/
P19.00	Slot 1 expansion card type (Near relay terminals)	0: No card 6: DP communication card	0
P19.01	Slot 2 expansion card type (Near AC output cable)		0
P19.03	Slot 1 expansion card software version	Setting range: 0.00–655.35	0.00
P19.04	Slot 2 expansion card software version	Setting range: 0.00–655.35	0.00

6.9 PROFINET bus communication networking

6.9.1 Communication telegram structure

The PROFINET communication telegram structure (PKW + PZD) is shown in the following figure. Refer to section 6.6.2.2 PROFINET telegram structure for details.



6.9.2 Network topology

PROFINET communication uses standard RJ45 ports. Line topology and star topology are supported. The electrical connections are shown in Figure 6-13 and Figure 6-14. By installing PN communication cards in each unit, multiple PN cards and the PLC form a PROFINET communication network.

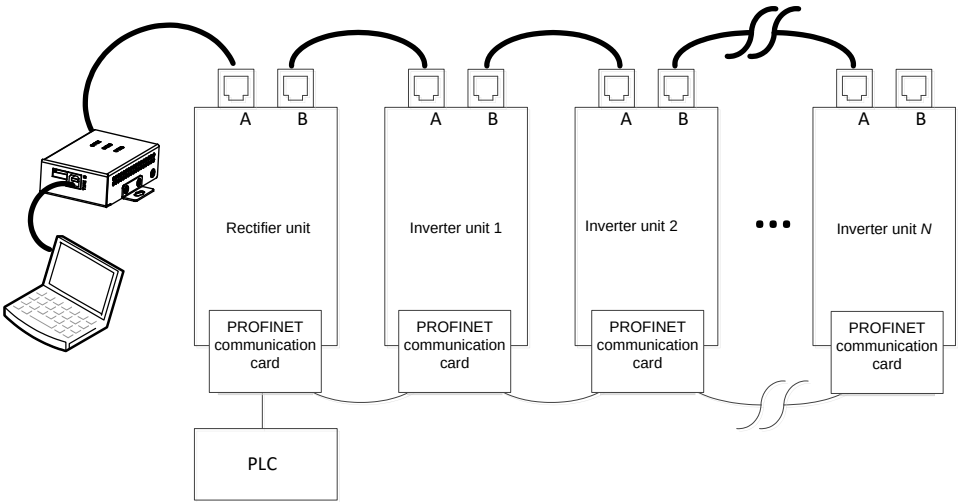


Figure 6-13 PROFINET communication network line topology

Note: For star topology, a PROFINET switch is required.

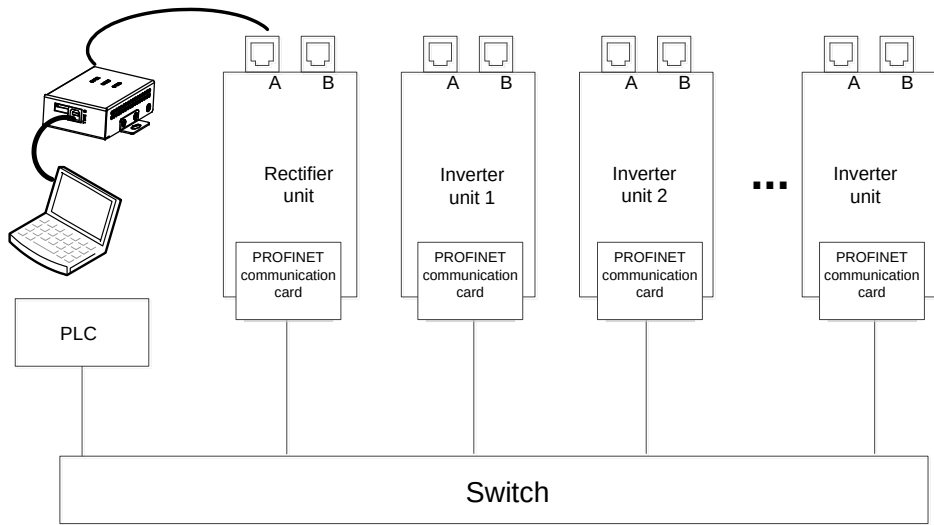


Figure 6-14 PROFINET communication network star topology

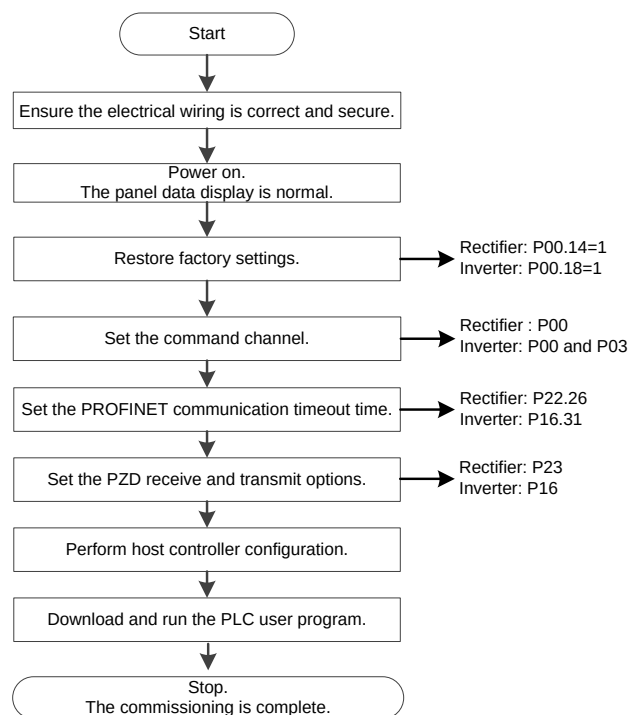
6.9.3 Communication performance

In the Goodrive600A PROFINET bus communication networking, the number of nodes is determined by the number of nodes supported by the PLC CPU. Take the Siemens S7-1200 PLC as an example: each PROFINET device occupies one I/O device slot. The S7-1200 PLC supports up to 16 I/O devices. As a result, a maximum of 15 PROFINET devices can be connected in the control system, as one slot is occupied by the PLC itself.

PLC model	PROFINET	
	I/O devices	Submodules
S7-1200 series	16	16*16

6.9.4 Commissioning procedure

6.9.4.1 Commissioning flowchart for the PROFINET communication network

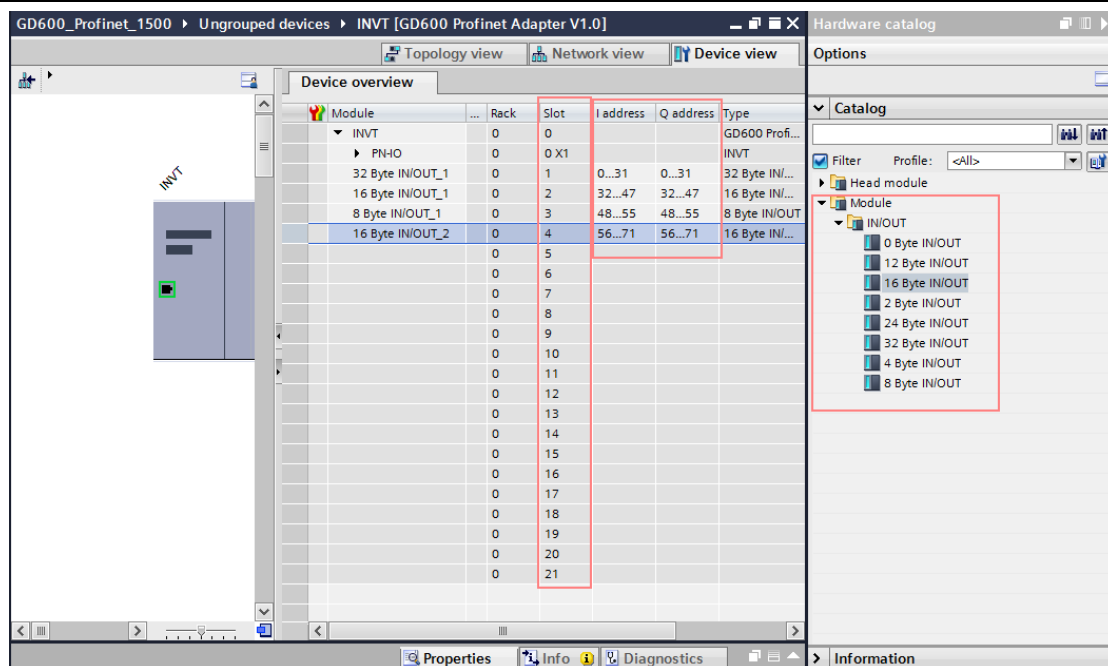


6.9.4.2 TIA portal configuration (S7-1500)

Refer to section 6.6.5.2 TIA portal configuration (S7-1500).

Note: In PROFINET slave device configuration, there are differences between direct PROFINET network configuration and PROFINET-to-CANopen gateway configuration.

In PROFINET-DP-to-CANopen gateway applications, each device must be configured with a corresponding number of slots based on the number of CANopen slave nodes. In direct PROFINET network configuration, multiple PROFINET devices are added to the network, and each device only requires the first slot module to be configured.



6.9.4.3 IN/OUT module mapping description

In the configuration of PROFINET bus communication, IN/OUT modules support the data length of only 16 words. The IN/OUT module with a 16-word data length supports function code read/write operations. Mapping starts from PKW, and up to 11 PZD data items (PZD2–PZD12) can be read and written.

6.9.5 Related parameters

Table 6-53 Rectifier unit parameters

Inverter function code	Name	Description	Default
P17.16	Slot 1 expansion card type (Near relay terminals)	0: No card 15: PROFINET communication card	0
P17.17	Slot 2 expansion card type (Near AC input cables)		0
P17.18	Slot 1 expansion card software version	Displays the software version of the expansion card in slot 1. Range: 0.00–655.35	0.00
P17.19	Slot 2 expansion card software version	Displays the software version of the expansion card in slot 2. Range: 0.00–655.35	0.00
P22.26	PROFINET communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s
P23.28	PZD2 transmit	Setting range: 0–20 For details, see Group P23—Communication expansion function group 2 (EtherNet/PROFINET/EtherCAT) in the gateway-type rectifier function parameter section.	/
P23.29	PZD3 transmit		/
P23.30	PZD4 transmit		/
P23.31	PZD5 transmit		/
P23.32	PZD6 transmit		/
P23.33	PZD7 transmit		/
P23.34	PZD8 transmit		/
P23.35	PZD9 transmit		/

Inverter function code	Name	Description	Default
P23.36	PZD10 transmit		/
P23.37	PZD11 transmit		/
P23.38	PZD12 transmit		/

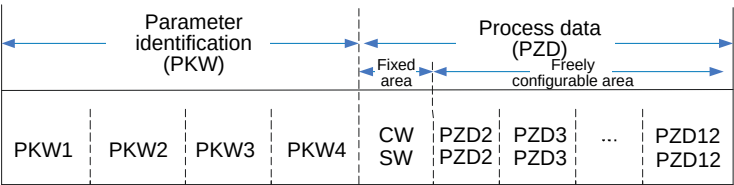
Table 6-54 Inverter unit parameters

Inverter function code	Name	Description	Default
P16.24	Time to identify expansion card 1	Setting range: 0.0–600.0s The value 0.0 indicates that identification fault will not be detected.	0.0s
P16.25	Time to identify expansion card 2	Setting range: 0.0–600.0s The value 0.0 indicates that identification faults are not detected.	0.0s
P16.27	Communication timeout time of expansion card in card slot 1	Setting range: 0.0–600.0s The value 0.0 indicates that disconnection faults are not detected.	0.0s
P16.28	Communication timeout time of expansion card in card slot 2	Setting range: 0.0–600.0s The value 0.0 indicates that disconnection faults are not detected.	0.0s
P16.31	PROFINET communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s
P16.32–P16.42	PZD2 receive–PZD12 receive	Setting range: 0–47 For details, see Group P16—Communication card 2 functions (Ethernet/PROFINET/EtherCAT) in the inverter function parameter section.	/
P16.43–P16.53	PZD2 transmit–PZD12 transmit	Setting range: 0–47 For details, see Group P16—Communication card 2 functions (Ethernet/PROFINET/EtherCAT) in the inverter function parameter section.	/
P19.00	Slot 1 expansion card type (Near relay terminals)	0: No card 11: PROFINET communication card	0
P19.01	Slot 2 expansion card type (Near AC output cable)		0
P19.03	Slot 1 expansion card software version	Setting range: 0.00–655.35	0.00
P19.04	Slot 2 expansion card software version	Setting range: 0.00–655.35	0.00

6.10 EtherCAT bus communication networking

6.10.1 Communication frame structure

The EtherCAT frame structure (PKW + PZD) is identical to the corresponding PROFINET telegram structure. Refer to section 6.6.2.2 PROFINET telegram structure for details.



6.10.2 Network topology

In this network, each unit is inserted with an EtherCAT communication card so that the PLC or another master device can connect to the rectifier and inverter units. The EtherCAT RJ45 ports are differentiated for input and output. The PLC is connected to the IN port of the first unit, and the OUT port of the first unit is connected to the IN port of the second unit, as shown in the following figure.

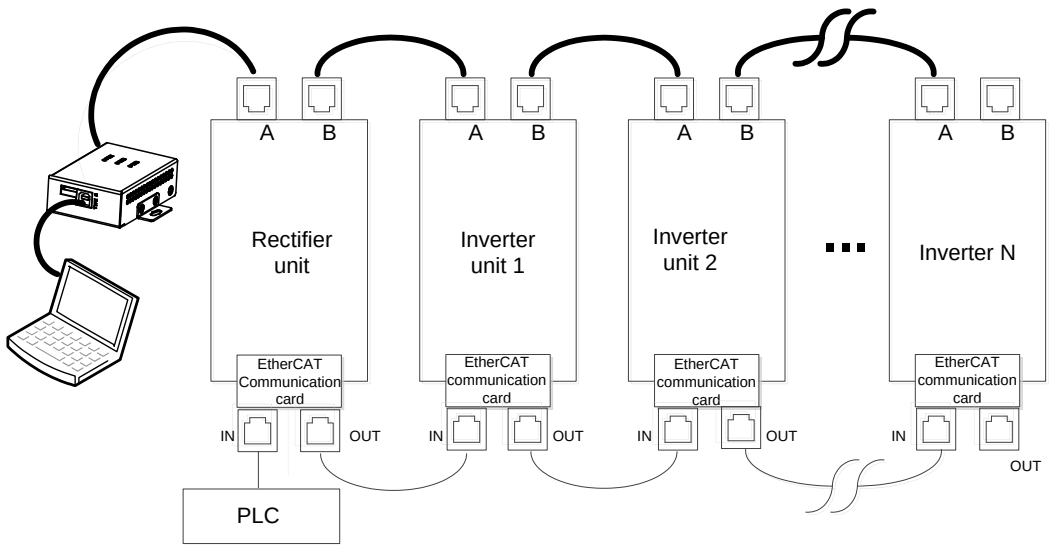


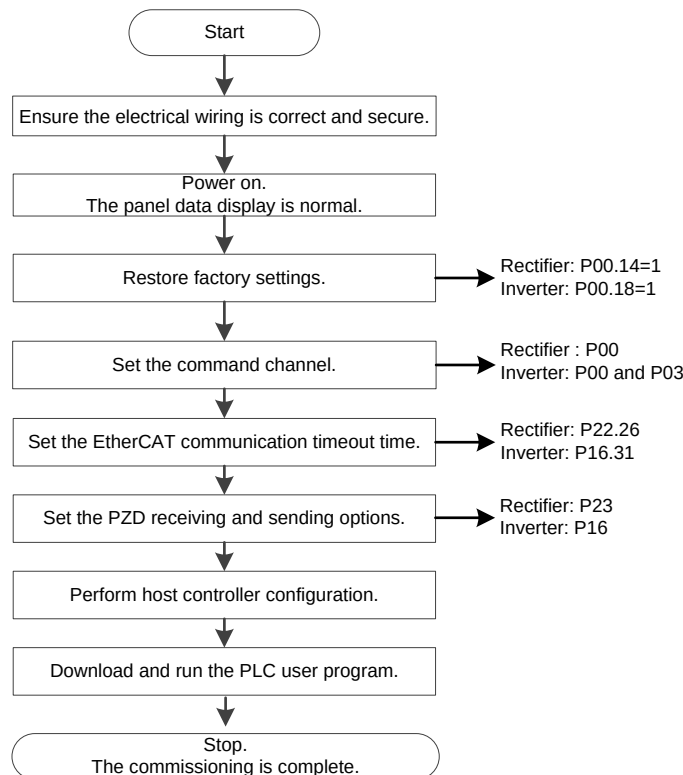
Figure 6-15 EtherCAT communication network topology

6.10.3 Communication performance

In the Goodrive600A EtherCAT bus communication networking, the number of nodes is determined by the number of nodes supported by the PLC CPU. A maximum of 32 nodes (including the repeaters) are allowed to be connected in a segment consisting of two repeaters. If there are more than 32 nodes, a repeater is required for relaying.

6.10.4 Commissioning procedure

6.10.4.1 Commissioning flowchart for the EtherCAT network

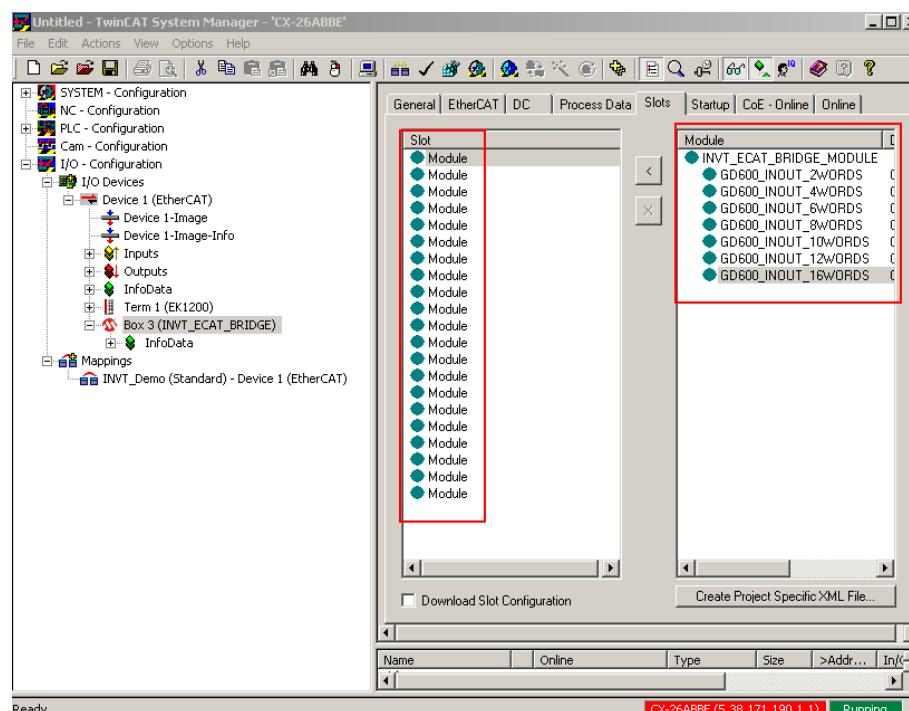


6.10.4.2 TwinCAT configuration (PLC model: Beckhoff CX5010)

Refer to section 6.7.5.2 TwinCAT portal configuration (PLC model: Beckhoff CX5010) for details.

Note: In EtherCAT slave device configuration, there are differences between direct EtherCAT bus communication network configuration and EtherCAT-to-CANopen gateway configuration.

In EtherCAT-to-CANopen gateway applications, each device must be configured with a corresponding number of slots based on the number of CANopen slave nodes. In direct EtherCAT bus communication network configuration, multiple EtherCAT devices are added to the network, and each device only requires the first slot module to be configured.



6.10.4.3 IN/OUT module mapping description

In the configuration of EtherCAT bus communication, IN/OUT modules support selectable data lengths of 2, 4, 6, 8, 10, 12, and 16 words.

When the IN/OUT module selects more than 8 words, it supports the reading and writing of function codes. To be specific, mapping from PKW, it also supports data receiving and sending of up to 11 PZDs (PZD2–PZD12).

When the IN/OUT module selects 8 words or less, the mapping starts from CW/SW and it supports data reading and writing of up to 7 PZDs (PZD2–PZD8), but it does not support reading and writing of PKW function codes.

6.10.5 Related parameters

The EtherCAT and PROFINET communications share the same channel in this product; therefore, the related function codes are identical. Refer to section 6.9.5 Related parameters for details. Table 6-55 and Table 6-56 list only the EtherCAT-specific function codes.

Table 6-55 Rectifier unit parameters

Inverter function code	Name	Description	Default
P22.24	EtherCAT communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s

Table 6-56 Inverter function parameters

Inverter function code	Name	Description	Default
P16.30	EtherCAT communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	5.0s
P16.58	Industrial Ethernet communication card IP address 1	Setting range: 0–255	192
P16.59	Industrial Ethernet communication card IP address 2	Setting range: 0–255	168
P16.60	Industrial Ethernet communication card IP address 3	Setting range: 0–255	0
P16.61	Industrial Ethernet communication card IP address 4	Setting range: 0–255	1
P16.62	Industrial Ethernet communication card subnet mask 1	Setting range: 0–255	255
P16.63	Industrial Ethernet communication card subnet mask 2	Setting range: 0–255	255
P16.64	Industrial Ethernet communication card subnet mask 3	Setting range: 0–255	255

Inverter function code	Name	Description	Default
P16.65	Industrial Ethernet communication card subnet mask 4	Setting range: 0–255	0
P16.66	Industrial Ethernet communication card gateway 1	Setting range: 0–255	192
P16.67	Industrial Ethernet communication card gateway 2	Setting range: 0–255	168
P16.68	Industrial Ethernet communication card gateway 3	Setting range: 0–255	0
P16.69	Industrial Ethernet communication card gateway 4	Setting range: 0–255	1

7 Industry application solutions

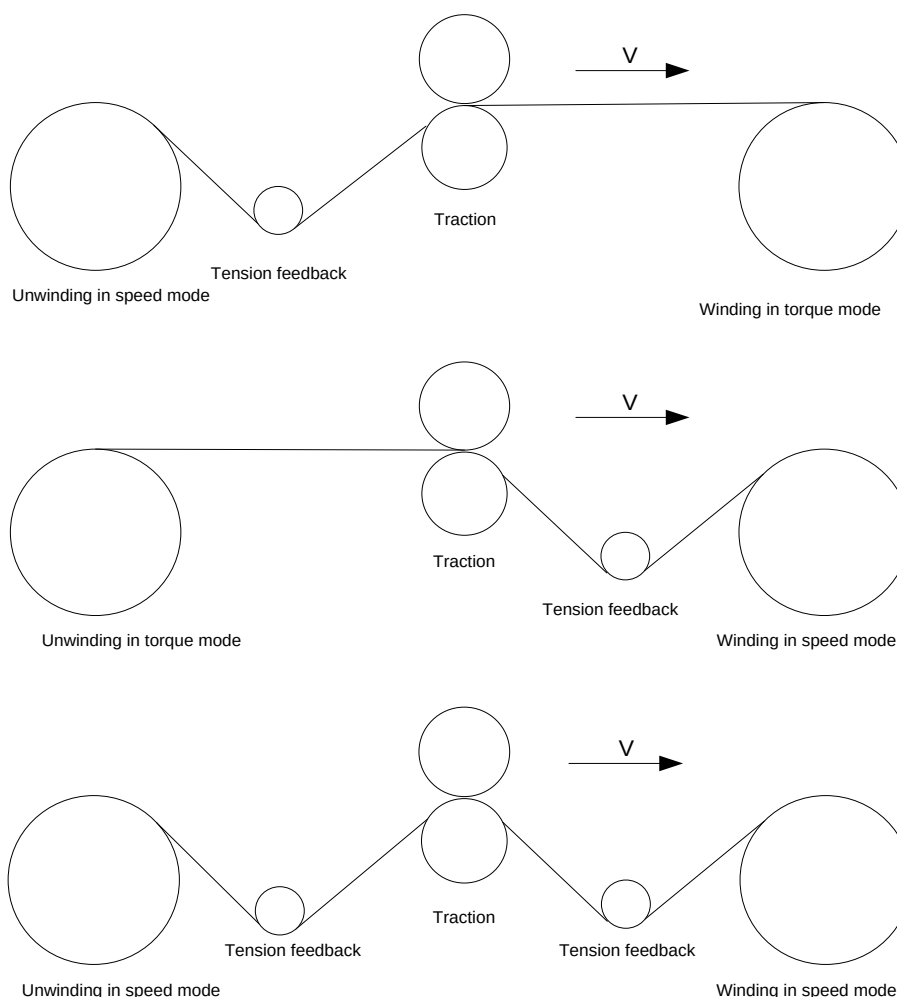
7.1 Tension control solutions

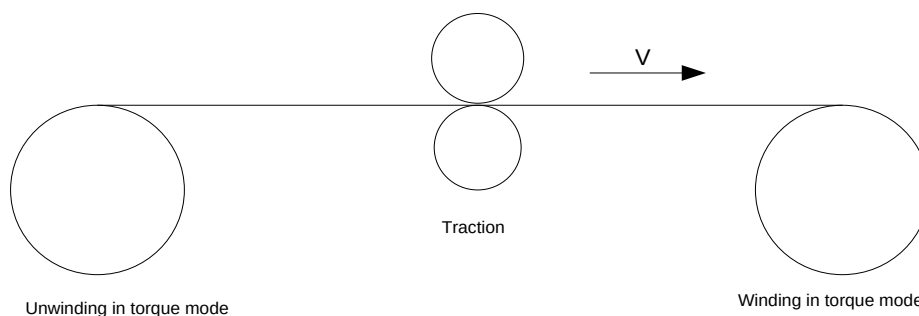
In many fields of industrial production, precise tension control is needed to maintain a constant output tension of the drive equipment, in order to improve the quality of the products. In the winding and unwinding of some industries such as paper processing, printing and dyeing, packing, wire and cable manufacturing, textile, fiber, optic cable, leather, metal foil material processing and so on, tension needs to keep constant.

The VFD controls the tension through the output torque or speed of the motor. There are three kinds of control modes: tension speed control mode, open loop tension torque control mode and close-loop tension torque control mode.

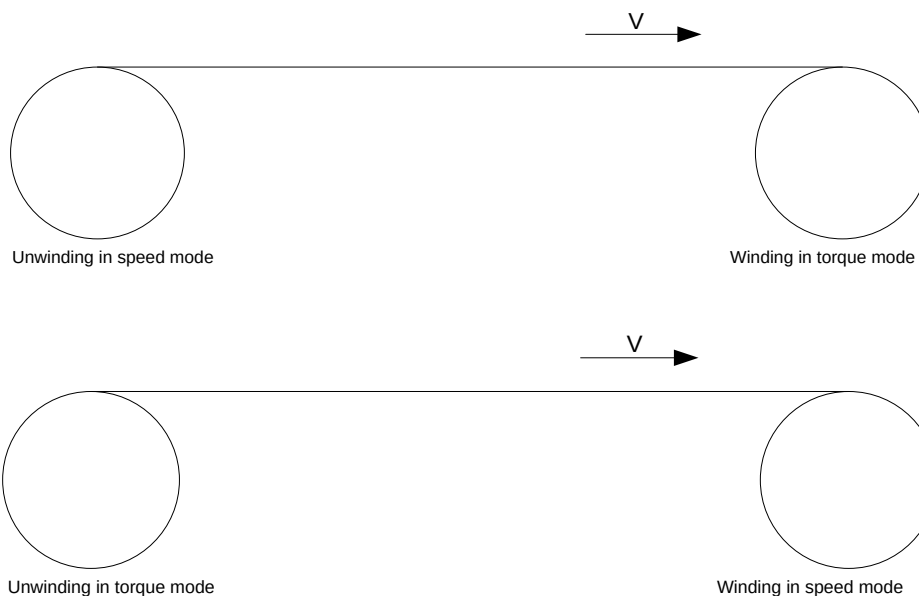
The tension control function is primarily implemented through groups P90–P92. Group P90 is the basic function group for tension control, group P91 is the closed-loop function group for tension control, and group P92 is the auxiliary function group for tension control.

7.1.1 Sketch map of tension control





In some special situations, if the coil diameter can be counted through thickness, the following modes are available:



7.1.2 Control mode selection

Different tension control modes can be selected by setting P90.00.

Function code	Name	Description	Default
P90.00	Tension control mode selection	0: Standard mode (tension control disabled; operates as a general-purpose VFD) 1: Open-loop torque mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Reserved (Constant linear speed mode) 5: Traction mode 6: Standard winding/unwinding mode (feedforward speed mode) 7: Direct speed/torque mode (torque debugging mode) 8: Reserved (Wiring mode)	0

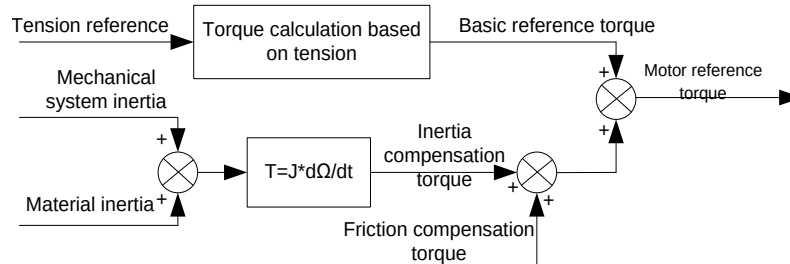
Open-loop torque mode: P90.00=1

There is no tension feedback signal in the open-loop tension torque control mode, but stable tension control can be achieved by directly adjusting the motor torque magnitude, and its speed follows the linear speed of the material automatically. The feasibility of this control method is based on the following principle: In a winding/unwinding control system, the tension F of the wire/strip material on the roll, the current roll diameter D , and the output torque T of the roll

shaft satisfy the following relationship:

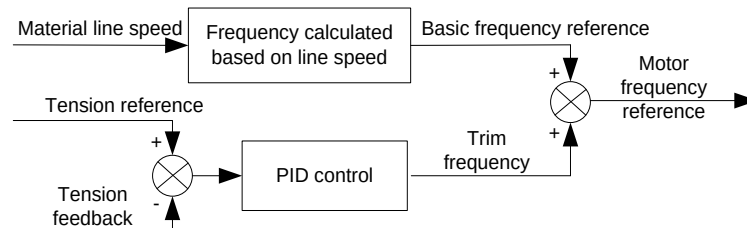
$$T = FD/2$$

Therefore, the material tension can be controlled by adjusting the output torque of the winding shaft according to changes in the roll diameter. To ensure constant tension during the acceleration and deceleration processes, the VFD is equipped with built-in friction compensation and inertia compensation modules. It calculates the present drum's rotation inertia in real time and applies inertia compensation to the torque based on the present rate of speed change. To ensure tension control accuracy, the system must run in the closed-loop vector control mode with an installed encoder. The control schematic diagram is shown as follows.



Closed-loop speed mode: P90.00=2

Closed-loop tension speed control is implemented through tension detection feedback signal (such as tension sensor or tension pendulum). In this mode, PID calculation is executed according to feedback signal, so as to adjust the motor rotation speed directly to control linear speed synchronization and tension stability. When using a tension pendulum or floating roller as feedback, changing the set value (PID given) can change the actual tension, or changing the mechanical configuration such as the counterweight of the tension pendulum or floating roller can also change the tension. The control schematic diagram is shown as follows.

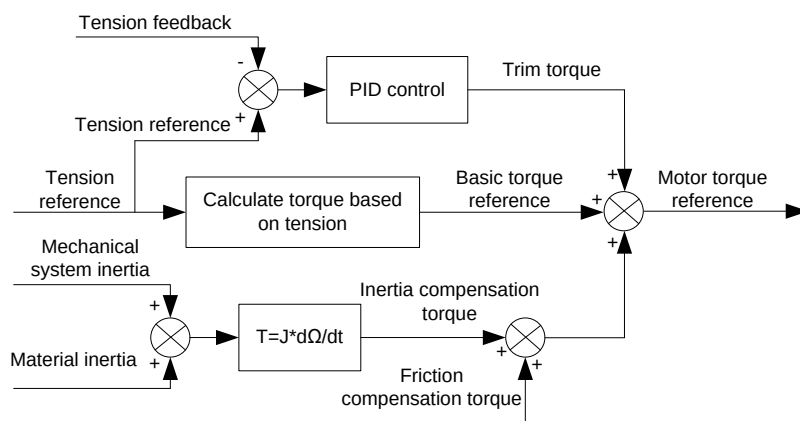


Note: This tension control mode is applicable to space voltage, SVC, and closed-loop vector control modes. When accurate tension control is required, the closed-loop vector control mode must be used.

Closed-loop torque mode: P90.00=3

The VFD keeps the tension on the material constant by controlling the motor output torque and needs to operate in the closed-loop vector control mode with an encoder installed. It is applicable to scenarios with tension detection sensors, which obtains higher tension control accuracy.

Similar to the open-loop tension torque control mode, it supports all the functional modules of open-loop tension torque control, the difference is that the closed-loop mode has a tension detection sensor installed on the winding and unwinding side and the closed-loop mode has an additional tension feedback PID closed-loop adjustment module. The control schematic diagram is shown as follows.



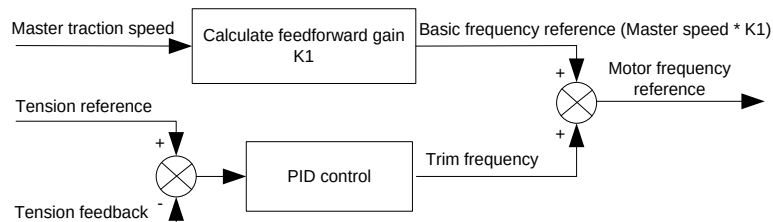
Traction mode: P90.00=5

In applications with a dual VFD wire drawing machine featuring a pendulum and a traction main drive, the traction VFD is set to this mode during the winding/unwinding process. If the system needs to run in constant speed mode, it is generally set to the standard winding/unwinding mode (P90.00=6) in coordination with the rewinding VFD.

Standard winding/unwinding mode (feedforward speed mode): P90.00=6

The standard winding/unwinding mode is a type of closed-loop speed control mode, also implemented through tension feedback signals (such as from a tension sensor or pendulum). It is suitable for simple tension applications, such as dual-VFD wire drawing machines with a pendulum and a traction main drive.

The difference from closed-loop tension speed control is that there is no roll diameter calculation frequency (using line speed calculation or thickness accumulation method). Instead, the PID tuning frequency is superimposed by the feedforward gain $K1 \cdot \text{Traction main drive speed}$. The feedforward gain $K1$ is calculated by dividing the feedback pendulum position into multiple zones, with integration performed based on the integration time set for each zone. At the same time, the real-time speed of the traction main drive needs to be transmitted to the rewinding VFD through the analog output port to respond to the acceleration and deceleration processes of the traction main drive in real time. In this mode, PID calculation is also performed based on feedback signal, and the motor speed is directly adjusted to achieve synchronized line speed and stable tension control. The control schematic diagram is shown as follows.



Direct speed/torque mode (torque debugging mode): P90.00=7

During equipment debugging, the torque debugging mode can be selected, and torque setting can be directly adjusted through P90.07, facilitating the debugging process.

7.1.3 Winding/unwinding mode

The winding/unwinding mode can be selected by simultaneously setting the function codes P09.01 and P05.05–P05.06 to 74.

Function code	Name	Description	Default
P90.01	Winding/unwinding mode	0: Winding 1: Unwinding	0

P90.01 (0: Winding, 1: Unwinding)	DI terminal No. 74 (0: Ineffective; 1: Effective)	Mode
0	0	Winding
1	0	Unwinding
0	1	Unwinding
1	1	Winding

7.1.4 Frequency upper limit of winding/unwinding

Set P90.04 to select the frequency upper limit channel in torque control.

Function code	Name	Description	Default
P90.01	Winding/unwinding mode	0: Winding 1: Unwinding	0
P90.02	Winding frequency upper limit	Setting range: 0.00Hz–P00.03	50.00Hz
P90.03	Unwinding frequency upper limit	Setting range: 0.00Hz–P00.03	1.00Hz
P90.04	Frequency upper limit channel	0: Keypad 1: AI1 2: AI2 3: AI3 4–5: Reserved 6: Automatic upper limit value (Winding runs at the present frequency)	0
P90.05	Actual frequency upper limit	Displays the actual frequency upper limit. Setting range: 0.01Hz–P00.03	20.0Hz

Speed limit in torque mode for winding/unwinding:

Setting through the keypad: P90.04=0

The frequency upper limit of winding is specified by P90.02, while the frequency upper limit of unwinding is specified by P90.03.

Setting through analog: P90.04=1, 2, or 3

It is determined by analog input voltage or current. 10V or 20mA corresponds to the frequency upper limit set by P90.02 or P90.03.

Automatic upper limit value: P90.04=6

The frequency is calculated based on the linear speed. The following formula shows how to calculate the frequency based on the linear speed and present roll diameter:

$$F = v \times i \times p / (60 \times \pi \times D)$$

In the formula, v is line speed, i is the transmission ratio, p is the motor pole pair number, and D is the current roll diameter.

7.1.5 Linear speed setting

Set P90.13 to select a linear speed input source.

Function code	Name	Description	Default
P90.13	Line speed input method	0: Line speed is 0 1: AI1	0

Function code	Name	Description	Default
		2: AI2 3: AI3 4–5: Reserved 6: Modbus communication (200FH: 0.0–P90.14) 7: Max. line speed 8: Based on master pulse calculation (encoder pulse train) 9: CANopen/PROFINET/EtherCAT/PROFIBUS-DP communication	
P90.14	Max. line speed	Specifies the max. line speed. Setting range: 0.0–3000.0m/min	300.0m/min
P90.15	Real-time line speed	Displays the real-time line speed. Setting range: 0.0m/min–P90.14	0.0m/min
P90.78	Main traction roller diameter	Specifies the main traction roller diameter. Setting range: 1–10000mm	500mm
P90.79	Traction roller transmission ratio	Master traction drive ratio = Motor rotation speed / Master traction roller rotation speed = Master traction roller diameter / Motor shaft diameter Setting range: 0.01–300.00	1.00

Linear speed=0: P90.13=0

The linear speed input is invalid.

Setting through analog: P90.13=1, 2, or 3

It is determined by analog input voltage or current. 10V or 20mA corresponds to the max. linear speed specified by P90.14.

Setting through communication: P90.13=6

It is written by communication, of which the address is 200F in hex format, with the value ranging from 0.0 to P90.14.

Max. linear speed: P90.13=7

The linear speed is set to the max. linear speed specified by P90.14.

Setting through main traction encoder frequency-divided input: P90.13=8

The line speed is calculated using the divided encoder pulses from the main traction roll shaft or motor, together with P90.78 and P90.79.

Note: When the VFD operates as the master with tension control enabled, set P90.48 and P90.49 to adjust the acceleration and deceleration time of the line speed. When it operates as a slave, set P90.48 and P90.49 to 0.

Function code	Name	Description	Default
P90.48	Traction machine ACC Time	Setting range: 0.00–300.00s	15.00s
P90.49	Traction machine DEC time	Setting range: 0.00–300.00s	15.00s

7.1.6 Roll diameter calculation

■ **Initial roll diameter selection**

Set any one of P05.01–P05.06 to 80 or 81.

The following table lists the initial roll diameter selection methods (DI1=80, DI2=81).

DI2	DI1	Initial roll diameter	
OFF	OFF	P90.18 (Winding)	P90.22 (Unwinding)
OFF	ON	P90.19 (Winding)	P90.23 (Unwinding)
ON	OFF	P90.20 (Winding)	P90.24 (Unwinding)
ON	ON	P90.21 (Winding)	P90.25 (Unwinding)

Function code	Name	Description	Default
P05.01– P05.06	Function selection of multifunction digital input terminals (S1–S4)	Setting range: 0–107 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2	1
			2
			7
			0
			0
			0
P90.17	Max. roll diameter	Setting range: 1–10000mm	1200mm
P90.18	Winding initial roll diameter 0	Setting range: 0mm–P90.17	80mm
P90.19	Winding initial roll diameter 1		100mm
P90.20	Winding initial roll diameter 2		120mm
P90.21	Winding initial roll diameter 3		150mm
P90.22	Unwinding initial roll diameter 0		800mm
P90.23	Unwinding initial roll diameter 1		900mm
P90.24	Unwinding initial roll diameter 2		1000mm
P90.25	Unwinding initial roll diameter 3		1200mm
P90.27	Roll diameter reset method selection	0: Terminal reset 1: Stop reset 2: Communication reset (When this option is selected, it automatically changes to 0 after resetting once.)	0

■ Roll diameter calculation

Set P90.16 to select a roll diameter calculation method.

Function code	Name	Description	Default
P90.16	Roll diameter calculation method	0: No calculation 1: Linear speed 2: PG thickness accumulation method 3–5: Reserved 6: AI1 calibration method 7: AI2 calibration method 8: AI3 calibration method 9: SVC evaluation method 10: Reserved (Automatic identifying switchover)	0

No roll diameter calculation: P90.16=0

Control applications without winding do not need roll diameter calculation.

Calculation method based on linear speed: P90.16=1

This calculation method is not related to material thickness, applicable to wires. You need to set P90.32=0 in this case. The calculation method is based on the linear speed and running frequency in real time, and errors are not cumulative. When the linear speed is lower than P90.28, keep the present roll diameter value without calculation. When the linear speed is higher than P90.28, the roll diameter calculation needs to be performed again. When selecting the method, certain conditions must be met for linear speed setting, and P90.06 must be set correctly.

PG thickness accumulation method: P90.16=2

This method is applicable to strips. You need to set P90.32=1 in this case. This method does not require a linear speed, and the calculation is cumulative based on the material thickness and the circle count signal, and the calculation result is smooth, but it will accumulate errors.

Note: The material thickness is determined by digital input terminals 85 (material thickness terminal 1) and 86 (material thickness terminal 2).

Material thickness terminal 2 (0: Invalid; 1: Valid)	Material thickness terminal 1 (0: Invalid; 1: Valid)	Material thickness
0	0	P90.34
0	1	P90.35
1	0	P90.36
1	1	P90.37

For every $i \times k$ motor revolutions, the roll diameter increases by twice the material thickness (where i is the gear ratio, P90.06, and k is the number of turns per layer).

Setting through the high-speed pulse: P90.16=3 or 4

It is applicable to scenarios where the roll diameter is detected with a roll diameter detection sensor, in which P90.17 (Max. roll diameter) must be set correctly.

Setting through analog: P90.16=6, 7, or 8

For applications where the roll diameter is detected with a roll diameter detection sensor, in which P90.17 (Max. roll diameter) must be set correctly. For example, if you set P90.16 =1 (Set by AI1), 100.0% of AI1 input corresponds to the roll diameter specified by P90.17.

SVC evaluation method: P90.16=9

When the motor driving mode is SVC, the roll diameter is calculated based on the evaluation of motor rotation speed.

Function code	Name	Description	Default
P90.06	Reel mechanical transmission ratio	Setting range: 0.01–300.00 When the roll diameter is calculated based on the line speed, a larger reel mechanical transmission ratio results in a larger calculated roll diameter. Refer to this rule, and calibrate the parameter according to the deviation of the calculated value of the roll diameter from the actual value. Roll shaft mechanical transmission ratio = Motor speed / Roll shaft speed = Roll shaft diameter / Motor shaft diameter	1.00
P90.28	Min. line speed for roll diameter calculation	Setting range: 0.1–300.0m/min	15.0m/min
P90.29	Roll diameter calculation interval	Setting range: 0.000–30.000s	1.000s (P90.16=1)

Function code	Name	Description	Default
			0.000s (P90.16≠1)
P90.30	Roll diameter calculation monotonicity selection	0: No restriction 1: Winding can only increase, unwinding can only decrease.	1
P90.31	Roll diameter change rate 1	Setting range: 0.00mm/T–P90.26 0.00mm/T: No restriction	0.10mm/T (P90.16=1) 0.00mm/T (P90.16≠1)
P90.41	Roll diameter calculation filter time	Setting range: 0.000–10.000s A great setting value indicates a smoother roll diameter calculation value, while the delay of the roll diameter change increases.	3.000s

7.1.7 Tension PID control

Set P91.09 to select tension adjustment parameters.

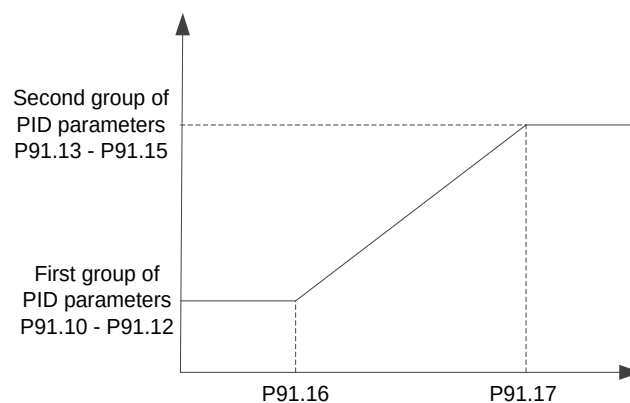
Function code	Name	Description	Default
P91.09	PID control parameter selection	0: Use the first set of parameters 1: Adjust based on roll diameter (linear change between initial winding diameter and initial unwinding diameter) 2: Adjust based on frequency 3: Adjust based on linear speed 4: Adjust based on deviation 5: Terminal Note: P90.00=6, 4 (Winding); 2 (Unwinding)	0

Fixed to the first group of PID parameter in P91: P91.09=0

Parameters P91.10–P91.12 are used (the first group of PID parameter).

Ratio of present value to max. value: P91.09=1, 2, 3, or 4

If the ratio of present value to max. value is less than P91.16, use P91.10–P91.12 (first group of PID parameter); if the ratio is greater than P91.17, use P91.13–P91.15 (second group of PID parameter); if the ratio is between P91.16 and P91.17, the linear change values are taken between the first group and second group. See the following figure for the linear change.



Terminal based switchover: P91.09=5

Set any one of P05.01–P05.06 to 83 to select different PIDs. By default, if the terminal is not on, the first group (P91.10–P91.12) is selected; if the terminal is on, the second group (P91.13–P91.15) is selected.

Function code	Name	Description	Default
P05.01	Function selection of multifunction digital input terminals (S1–S4)	Setting range: 0–107 83: Tension PID switching	1
P05.02			2
P05.03			7
P05.04			0
P05.05			0
P05.06			0
P91.10	Proportional gain 1	Setting range: 0.000–30.000 Note: P90.00=6, 0.060 (Winding); 0.300 (Unwinding)	0.200
P91.11	Integral time 1	Setting range: 0.00–30.00s	0.00s
P91.12	Differential time 1	Setting range: 0.000–30.000s	0.000s
P91.13	Proportional gain 2	Setting range: 0.000–30.000 Note: P90.00=6, 0.100 (Winding); 0.400 (Unwinding)	0.200
P91.14	Integral time 2	Setting range: 0.00–30.00s	0.00s
P91.15	Differential time 2	Setting range: 0.000–30.000s	0.000s
P91.16	PID1 switching point	Setting range: 0.00–100.00%	4.00%
P91.17	PID2 switching point	Setting range: 0.00–100.00% Note: P90.00=6, 45 (Winding); 90 (Unwinding)	45.00%

7.1.8 Tension setting

When P90.00 is set to 1 or 3 and torque control is used, tension setting must be made. The set torque can be calculated based on the roll diameter and the set tension.

Function code	Name	Description	Default
P90.00	Tension control mode selection	Setting range: 0–8 0: Standard mode (tension control disabled; operates as a general-purpose VFD) 1: Open-loop torque mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Constant linear speed mode (reserved) 5: Traction mode 6: Standard winding/unwinding mode 7: Direct speed torque mode (torque or speed execution, requires inertia compensation and friction compensation) 8: Wire alignment mode (reserved)	0
P90.55	Tension reference method selection	0: Keypad 1: AI1 2: AI2 3: AI3 4–5: Reserved 6: Modbus communication 7: Direct torque setting 8: CANopen/PROFINET/EtherCAT/PROFIBUS-DP communication	0
P90.56	Digital tension	Setting range: 0N–P90.57	0N

Function code	Name	Description	Default
	reference		
P90.57	Max. tension	Setting range: 0–60000N	10000N
P90.58	Tension reference change time	Setting range: 0–60.00s	0.00s

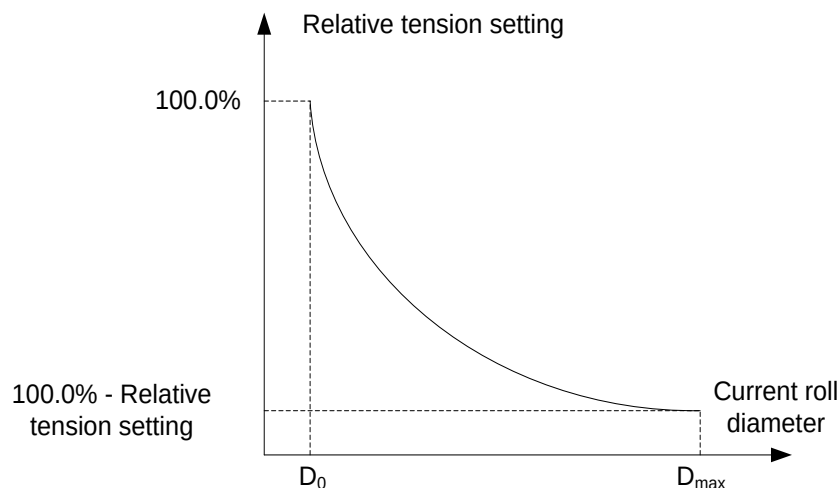
7.1.9 Tension taper

Tension taper is generally used for winding, which can control the tension to decrease accordingly as the roll diameter increases, in order to prevent damage to the roll shaft and improve the product curl effect. The VFD provides four tension taper calculation methods.

Method 1 Set P90.61 to 0 to select the inverse proportional curve calculation method. The formula is as follows.

$$F = F_0 \times [1 - k(1 - \frac{D_0 + D_1}{D + D_1})]$$

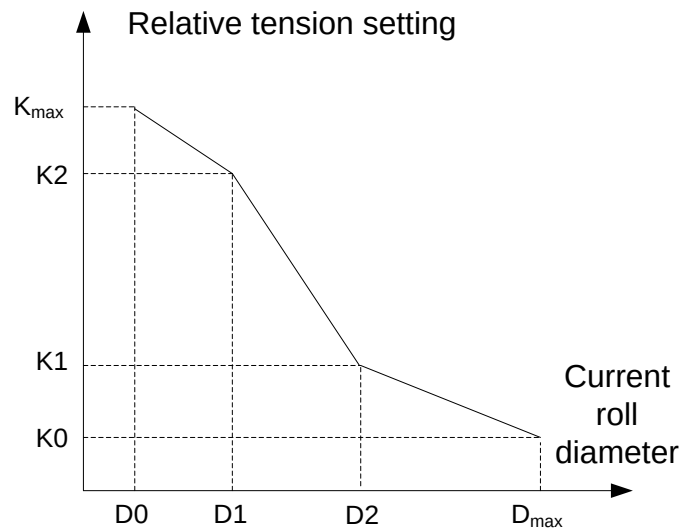
In the algorithm, F_0 is the tension setting, k is the tension taper coefficient, D_0 is the empty-roll diameter, D is the present roll diameter, D_1 is the tension taper compensation used to compensate for the difference between the calculated roll diameter value and the actual roll diameter. See the following figure.



Method 2 Set P90.61 to 1 to select the single-segment linear calculation method.

Method 3 Set P90.61 to 2 to select the two-segment linear calculation method.

Method 4 Set P90.61 to 3 to select the multi-segment linear calculation method (20 segments). This method must be used in conjunction with P92.08–P92.47. The schematic diagram is as follows.



Function code	Name	Description	Default
P90.59	Tension taper input method	0: Digital tension taper 1: AI1 (relative to digital tension taper value) 2: AI2 3: AI3 4–5: Reserved 6: Modbus communication (2011H: 0.00–100.00%)	0
P90.60	Digital tension taper	Setting range: 0.00–100.00%	0.00%
P90.61	Tension taper method	0: Curve taper 1: Single-segment linear taper (denominator 1000) 2: Two-segment linear taper (interpolation) 3: Twenty-segment linear taper (interpolation)	1
P90.62	Tension taper compensation	Setting range: 0–10000mm	1mm
P90.63	Intermediate roll diameter	Setting range: P90.18–90.22	500
P90.64	Intermediate tension	Setting range: 0.00–100.00%	80.00%
P90.65	Tension at max. roll diameter	Setting range: 0.00–100.00%	50.00%

7.1.10 Multi-segment integration

Multi-segment integration is used to calculate the feedforward gain K1 in the standard winding/unwinding mode, which is also implemented through tension feedback signals (such as from a tension sensor or pendulum). It is suitable for simple tension applications, such as dual-VFD wire drawing machines with a pendulum and a traction main drive. The feedforward gain K1 is calculated by dividing the feedback pendulum position into multiple zones, with integration performed based on the integration time set for each zone. At the same time, the real-time speed of the traction main drive needs to be transmitted to the rewinding VFD through the analog output port to respond to the acceleration and deceleration processes of the traction main drive in real time.

Function code	Name	Description	Default
P91.33	Deviation 0	Setting range: 0.00%–P91.34	4.00%
P91.34	Deviation 1	Setting range: P91.33–P91.35%	12.00%
P91.35	Deviation 2	Setting range: P91.34–P91.36%	22.00%

Function code	Name	Description	Default
P91.36	Deviation 3	Setting range: P91.35–P91.37%	37.00%
P91.37	Deviation 4	Setting range: P91.36–P91.38%	52.00%
P91.38	Deviation 5	Setting range: P91.37–100.00%	72.00%
P91.39	Soft startup integral time	Setting range: 0.0–1000.0s	167.0s (winding) 143.0s (unwinding)
P91.40	Integral time 1	Setting range: 0.0–1000.0s	909.0s (winding) 555.0s (unwinding)
P91.41	Integral time 2	Setting range: 0.0–1000.0s	333.0s (winding) 200.0s (unwinding)
P91.42	Integral time 3	Setting range: 0.0–1000.0s	133.0s (winding) 77.0s (unwinding)
P91.43	Integral time 4	Setting range: 0.0–1000.0s	67.0s (winding) 36.0s (unwinding)
P91.44	Integral time 5	Setting range: 0.0–1000.0s	25.0s (winding) 13.5s (unwinding)
P91.45	Integral time 6	Setting range: 0.0–1000.0s	9.0s (winding) 5.0s (unwinding)
P91.46	Deviation integral actual value	Setting range: 0.00–500.00%	0.00%
P91.47	Deviation integral action channel selection	0: Feedforward gain*AI1 1: Feedforward gain*AI2 2: Feedforward gain*10V 3–4: Reserved	0 or 1 (Winding) 2 (Unwinding)
P91.48	Deviation integral range selection	0: Feedforward gain unchanged 1: 0 to feedforward gain upper limit 2: -feedforward gain upper limit to + feedforward gain upper limit	1 (winding) 2 (unwinding)
P91.49	Deviation integral upper limit	Setting range: 0.00–500.00%	500.00% (winding) 100.00% (unwinding)
P91.50	Deviation integral gain	Setting range: 0.00–500.00%	50.00% (winding) 0.00%

Function code	Name	Description	Default
			(unwinding)
P91.51	Deviation integral power-loss memory	Setting range: 0x00–0x11 Ones place: 0: Automatic reset 1: Terminal reset (shared roll diameter reset terminal) Tens place: 0: Save at power off 1: Do not save at power off	0x10

7.1.11 Friction compensation

Friction compensation is valid when P90.00 is set to 1 or 3. In the process of material winding or unwinding, there is frictional resistance on the machinery. In the case of winding, for example, the frictional resistance will make the material tension smaller. By appropriately setting the friction compensation value, the friction resistance can be reduced to some extent, and the tension control effect can be improved. The system has inconsistent resistance values at high speed and low speed, and constant tension cannot be obtained throughout the entire process only by using constant friction compensation torque. Proper setting of P90.08–P90.12 can compensate for the effect caused by system resistance.

Function code	Name	Description	Default
P90.08	Static friction torque compensation	Setting range: 0.0–100.0%	0.0%
P90.09	Dynamic friction torque compensation	Setting range: 0.0–100.0%	0.0%
P90.10	Torque compensation for max. line speed	Setting range: 0.0–100.0%	0.0%
P90.11	Static friction frequency threshold	Setting range: 0.01Hz–P00.03	1.00Hz
P90.12	Dynamic friction frequency threshold	Setting range: 0.01Hz–P00.03	5.00Hz

7.1.12 Inertia compensation

Inertia compensation is valid when P90.00 is set to 1 or 3. In the case of fast ACC/DEC control, on the winding side, the material tends to slacken during acceleration and tighten during deceleration; on the unwinding side, it tends to tighten during acceleration and slacken during deceleration. Inertia compensation is required in these cases.

When the keypad is used as the control channel and there are empty axes, set P03.44 to 1 to enable mechanical-system inertia identification, and then issue a start command to the VFD. If the motor runs for a long period of time, stop the VFD and increase the value of P03.43, and then restart the VFD. During inertia identification, the motor starts the ACC/DEC process twice. When the inertia identification is completed, the VFD stops automatically, and P03.44 is updated to 0 automatically.

Function code	Name	Description	Default
P03.40	Inertia compensation enable	0: Disable 1: Enable	0
P03.41	Inertia compensation torque upper limit	Setting range: 0.0–150.0% (of the motor rated torque) The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large.	10.0%
P03.42	Inertia compensation filter count	Setting range: 0–10 Filter times of inertia compensation torque, used to smooth	7

Function code	Name	Description	Default
		inertia compensation	
P03.43	Inertia identification torque	Setting range: 0.0–100.0% (of the motor rated torque) Due to friction force, certain identification torque needs to be set for the inertia identification to be performed properly.	10.0%
P03.44	Enabling motor inertia identification	0: No operation 1: Enable	0
P90.45	Material density	Setting range: 0–60000kg/m ³	0kg/m ³
P90.46	Material inertia	Setting range: 0.00–300.00kg·m ²	0.00 kg·m ²
P90.47	Mechanical inertia	Setting range: 0.00–300.00kg·m ²	0.00 kg·m ²
P90.50	Inertia compensation torque	Setting range: 0.0–300.0%	0.0%
P90.51	Line acceleration	Setting range: -99.00–99.00m/s ²	0.00m/s ²
P90.52	Inertia compensation ACC/DEC time	Setting range: 0.000–10.000s	0.100s

7.1.13 Related I/O parameters

Function code	Name	Description	Default
P05.01	S1 function	Setting range: 0–107	1
P05.02	S2 function	0: No function	2
P05.03	S3 function	73: Roll diameter reset	7
P05.04	S4 function	74: Winding/unwinding switchover 75: Tension control pre-driving 79: Trigger a forcible material feeding interrupt signal 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 83: Tension PID switching 84: PID pause 85: Thickness switchover selection 1 86: Thickness switchover selection 2 87: Clear length 89: Tension mode switching	0
P06.01	Y1 output	Setting range: 0–63 0: Invalid 1: Running 2: Running forward 3: Running in reverse 4: Jogging 5: VFD in fault 53: Specified roll diameter reached 54: Roll diameter of stop reached 55: Length reached	0

7.2 Introduction to the full closed-loop solution

In industries such as logistics and warehousing, position control is often required. In our product portfolio, the corresponding solution is full closed-loop control, in which the encoder mounted on the motor shaft is used for speed control, while the sensor connected at the mechanism side (such as a laser rangefinder or an SSI absolute encoder) is

used for position control. In this case, the SSI absolute encoder communication PG card (EC-PG708-24) must be used to connect two input signals simultaneously. For related expansion card information and wiring, refer to appendix A.6.5 SSI absolute PG card EC-PG708-24.

7.2.1 Full closed-loop expansion card parameter settings

When the SSI absolute encoder communication PG card is selected, set P21.34 = 0x0000.

Function code	Name	Description	Parameter setting
P21.34	Full closed-loop PG card selection	Setting range: 0x0000–0x3111 Ones place, tens place, and hundreds place: Reserved Thousands place: 0: SSI signal as position feedback, incremental signal as speed feedback 1–2: Reserved 3: SSI signal as speed feedback	0x0000

7.2.2 Motors parameter settings

The motor parameters in group P02 correspond to a motor connected in star (Y) configuration. If the motor used is actually connected in delta (Δ) configuration, convert the delta-configuration parameters on the motor nameplate into their equivalent star-configuration values, and then enter them into the corresponding parameters in group P02. The conversion method is as follows:

$$P_{\text{star}} = P_{\Delta} * \sqrt{3}, f_{\text{star}} = f_{\Delta} * \sqrt{3}, n_{\text{star}} = n_{\Delta} * \sqrt{3}, U_{\text{star}} = U_{\Delta} * \sqrt{3}, I_{\text{star}} = I_{\Delta}$$

Example: The information shown on the left below is typically the content on the motor nameplate. If the motor on site is connected in delta (Δ), set the motor parameters in group P02 as follows:

Asynchronous motor (AM)			
Mounting type M48	Gear ratio 17.87	Output torque 870 Nm	P02.01 Motor power: $P=7.5\text{kW} * \sqrt{3}=13\text{kW}$
Frequency 50Hz	Speed 1468/82 r/min	Power 7.5 kW	P02.02 Rated frequency: $f=50\text{Hz} * \sqrt{3}=87\text{Hz}$
Insulation class 155(F)	Voltage 220 Δ /380Y V	Current 27.5/16.00 A	P02.03 Rated speed: $n=1468\text{r/min} * \sqrt{3}=2542\text{r/min}$
IP rating IP55	IP rating IP55	Power factor 0.78	P02.04 Rated voltage: $U=220\text{V} * \sqrt{3}=380\text{V}$
		Motor efficiency % 90.4 IE3	P02.05 Rated current: $I=I_{\Delta}=27.5\text{A}$

7.2.3 Motor parameter autotuning

After a full closed-loop mechanism has been installed, the motor shaft is generally not convenient to decouple from the driven mechanism. Therefore, only static autotuning is suitable (P00.15 = 0x002). Static parameter autotuning can be performed via the RS485 host controller or the keypad. The parameters obtained through autotuning are automatically saved in the motor parameter group P02.

7.2.4 Motor shaft-end encoder parameter settings

First, set the encoder pulses to P20.01 = 1024, P00.00 = 2, and P00.10 = 5.00 Hz.

If the equipment brake is controlled by the VFD, set the mechanical brake to be controlled by relay RO1, and set P06.03 = 57 and P60.04 = 1, or set P06.03 = 1, to ensure that the brake is released before operation. For the initial commissioning of lifting mechanism, perform this procedure under no-load conditions.

Run the VFD via the host controller. If the motor rotates normally, check whether the speed feedback value in P18.00 is correct:

- If P18.00 is negative, the encoder direction is reversed. Set P20.02 = 0x001.

- If P18.00 deviates significantly, P20.01 is set incorrectly.
- After P18.00 becomes normal, set P00.00 = 3.

Check whether P18.02 (encoder Z pulse count value) fluctuates. If yes, it indicates the encoder is subject to interference or P20.01 is set improperly. Then check the wiring and the shield layer.

Function code	Name	Description	Parameter setting
P20.01	Encoder PPR	Number of pulses generated per encoder revolution. Setting range: 0–60000	1024
P20.02	Encoder direction	Ones place: AB direction 0: Forward 1: Reverse	0x000

7.2.5 Mechanism-side SSI sensor parameter settings

Set the resolutions of P20.25 and P20.26 according to the sensor manual. For example, if the SSI sensor resolution is 24 bits, set P20.25 = 16 and P20.26 = 8. At the same time, select its decoding mode by the tens place of P20.27.

Function code	Name	Description	Parameter setting
P20.25	SSI encoder resolution LSB	Setting range: 0–20	16
P20.26	SSI encoder resolution MSB	Setting range: 0–20	8
P20.27	SSI encoder 1 data format	Setting range: 0x000–0x111 Ones place: Reserved Tens place: Binary/Gray code selection for transmission type 0: Gray code parsing 1: Binary parsing Hundreds place: Position data direction 0: Default direction 1: Reverse direction	0x000

Check P18.46 and P18.47 to view the current position feedback from the SSI sensor and verify that it is correct.

Function code	Name	Description	Parameter setting
P18.46	SSI encoder present position low word	Setting range: 0–65535	Display value
P18.47	SSI encoder present position high word	Setting range: 0–65535	Display value

Example: If the SSI sensor resolution is 24 bits and the minimum unit is 0.1 mm, the current feedback position is:
 $(P18.47 \times 65536 + P18.46) \times 0.1 \text{ mm}$

7.2.6 Determining the relationship between the mechanism-side sensor position direction and the motor running direction

In full closed-loop positioning, especially in lifting applications, the direction in which the position feedback from the mechanism-side sensor (such as a laser rangefinder) increases generally needs to be defined so that it is consistent with the motor forward direction. If it is opposite to the motor forward direction, interchange the motor U-phase and V-phase connections, and at the same time change the ones-place direction setting of the motor shaft-end P20.02.

Determining the motor forward direction: After the motor runs in closed-loop mode (P00.00 = 3), if the feedback value of P18.00 is positive, the current running direction is the forward direction.

Note: In lifting applications, make sure that upward travel corresponds to motor forward rotation and downward travel corresponds to motor reverse rotation. If the direction in which the mechanism-side sensor feedback position increases cannot be made consistent with upward travel, set the hundreds place of P20.27 to 1.

7.2.7 Determining the electronic gear ratio of the mechanism-side sensor position feedback signal

In full closed-loop positioning, the reduction ratio of the mechanism-side sensor position feedback signal must be calculated to obtain the electronic gear ratio. Specifically, closed-loop speed mode can be used. Run the motor at 5 Hz for about 3 s and then stop it. Record the difference in the motor rotation pulse count and the difference in the horizontal travel pulse count before and after the run. The ratio of these two values is the electronic gear ratio. The test can be repeated several times to verify data accuracy.

Function code	Name	Description	Parameter setting
P21.11	Numerator of position command ratio	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement. Setting range: 1–65535	1930
P21.12	Denominator of position command ratio	Setting range: 1–65535	271
P18.14	Encoder pulse count high word	Encoder pulse count value. The count value is accumulated only if the VFD is powered on. Setting range: 0–65535	Display value
P18.15	Encoder pulse count low word		Display value
P18.46	SSI encoder present position low word	Setting range: 0–65535	Display value
P18.47	SSI encoder present position high word	Setting range: 0–65535	Display value

Example: Before the run, if P18.46 = 26710 and P18.47 = 2, the actual position is: $2 \times 65536 + 26710 = 157782$

Before the run, if P18.14 = 3 and P18.15 = 29291, the PG card pulse feedback count is: $3 \times 65536 + 29291 = 225899$

After the run, if P18.46 = 26439 and P18.47 = 2, the actual position is: $2 \times 65536 + 26439 = 157511$

After the run, if P18.14 = 3 and P18.15 = 31221, the PG card pulse feedback count is: $3 \times 65536 + 31221 = 227829$

Set the position command ratio numerator P21.11 to:

$$|227829 - 225899| = 1930$$

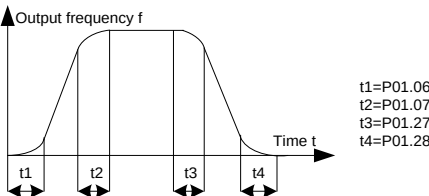
Set the position command ratio denominator P21.12 to:

$$|157511 - 157782| = 271$$

7.2.8 Common parameter settings for reference

This parameter table uses PROFINET communication as an example. The parameters are as follows.

Function code	Name	Description	Parameter setting
P00.00	Speed control mode	Closed-loop vector control mode	3
P00.01	Channel of run commands	For reference only. Adjust the setting according to actual requirements.	2
P00.02	Communication mode of run commands	PROFINET; for reference only. Adjust the setting according to actual requirements.	3
P00.03	Max. output frequency	For reference only. Adjust the setting according to actual	87.00Hz

Function code	Name	Description	Parameter setting
		requirements.	
P00.04	Running frequency upper limit	For reference only. Adjust the setting according to actual requirements.	87.00Hz
P00.06	A frequency command source	PROFINET; for reference only. Adjust the setting according to actual requirements.	13
P00.14	Carrier frequency	For reference only. Adjust the setting according to actual requirements.	4.0Hz
P01.01	Starting frequency of direct start	Setting range: 0.00–50.00Hz	0.00Hz
P01.05	ACC/DEC mode	1: S curve Note: If option 1 is selected, set P01.06, P01.07, P01.27 and P01.28 accordingly.	1
P01.06	Time of starting segment of ACC S curve	The curvature of S curve is determined by the ACC range and ACC/DEC time.  t1=P01.06 t2=P01.07 t3=P01.27 t4=P01.28 Setting range: 0.0–50.0s	0.5s
P01.07	Time of ending segment of ACC S curve		0.5s
P01.15	Stop speed	Setting range: 0.00–100.00Hz	0.00Hz
P01.26	DEC time for emergency stop	For reference only. Adjust the setting according to actual requirements.	6.0
P01.27	Time of starting segment of DEC S curve	Setting range: 0.0–50.0s	0.5s
P01.28	Time of ending segment of DEC S curve	Setting range: 0.0–50.0s	0.5s
P06.03	RO1 output selection	Set to "1: Running" or "57: Brake output" as required.	According to actual requirements
P06.04	RO2 output selection	Set to "30: Positioning complete" as required.	According to actual requirements
P14.48	PZD-to-function-code mapping channel selection	Selects the channel used for mapping PZD to function codes.	0x0012
P14.49	Mapped function code for PZD2 receive	Positioning speed digital setting	0x1513
P14.52	Mapped function code for PZD5 receive	Speed control ACC time.	0x000b
P14.53	Mapped function code for PZD6 receive	Speed control DEC time.	0x000c
P14.54	Mapped function code	DEC time for emergency stop	0x011a

Function code	Name	Description	Parameter setting
	for PZD7 receive		
P14.57	Mapped function code for PZD10 receive	Positioning ACC time	0x1514
P14.58	Mapped function code for PZD11 receive	Positioning DEC time	0x1515
P14.64	Mapped function code for PZD6 transmit	Encoder pulse count low word	0x120f
P14.65	Mapped function code for PZD7 transmit	Encoder pulse count high word	0x120e
P14.66	Mapped function code for PZD8 transmit	SSI position feedback low word	0x122e
P14.67	Mapped function code for PZD9 transmit	SSI position feedback high word	0x122f
P14.68	Mapped function code for PZD10 transmit	Current motor control mode.	0x1128
P14.33	Communication card control and status word format selection	0: Decimal system 1: Binary system Note: This parameter must be set identically for both the rectifier unit and the inverter unit.	0
P16.32	PZD2 receive	Function code mapping (Digital positioning speed setting)	19
P16.33	PZD3 receive	Position reference high word	14
P16.34	PZD4 receive	Position reference low word	15
P16.35	PZD5 receive	Function code mapping (Speed control ACC time)	19
P16.36	PZD6 receive	Function code mapping (Speed control DEC time)	19
P16.37	PZD7 receive	Function code mapping (Emergency stop DEC time)	19
P16.38	PZD8 receive	Virtual input terminal command (Speed/position switching), write 0x2000	9
P16.39	PZD9 receive	Set frequency	1
P16.40	PZD10 receive	Function code mapping (Positioning ACC time)	19
P16.41	PZD11 receive	Function code mapping (Positioning DEC time)	19
P16.43	PZD2 transmit	Running frequency	1
P16.44	PZD3 transmit	Terminal output status	17
P16.45	PZD4 transmit	Output current	5
P16.46	PZD5 transmit	Fault code	11
P16.47	PZD6 transmit	Function code mapping (Encoder pulse count low word)	31
P16.48	PZD7 transmit	Function code mapping (Encoder pulse count high word)	31
P16.49	PZD8 transmit	Function code mapping (SSI position feedback low word)	31
P16.50	PZD9 transmit	Function code mapping (SSI position feedback high word)	31
P16.50	PZD10 transmit	Function code mapping (Current motor control mode)	31
P20.05	Encoder detection filter count	Setting range: 0x00–0x99 Ones place: Low-speed filter count, corresponding to $2^{(0-9)} \times 125\mu s$. Tens place: High-speed filter count, corresponding to $2^{(0-9)} \times 125\mu s$.	0x11
P21.00	Positioning mode	Setting range: 0x0000–0x7321 Ones place: Control mode selection 0: Speed control	0x0311

Function code	Name	Description	Parameter setting
		1: Position control Tens place: Position command source 0: Pulse train 1: Digital position 2: Photoelectric switch stop positioning Hundred place: Position feedback source 0: P-channel pulses of PG1 (channel A1/B1/Z1) 1: F-channel pulses of PG1 (channel A2/B2/Z2) 2: Reserved 3: SSI absolute position Thousands place: Servo mode (Reserved) 0: Servo disabled, no position deviation 1: Servo disabled, position deviation present 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved	
P21.16	Digital positioning mode selection	Setting range: 0x0000–0xFFFF Bit0: Positioning mode selection 0: Relative position 1: Absolute position (home position)(Reserved) Bit1: Positioning cycle selection 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit2: Cyclic mode 0: Continuous 1: Reciprocating (supported only in automatic cyclic positioning) Bit3: P21.17 digital setting mode 0: Incremental 1: Position-based (not supported in continuous mode) Bit 4: Home search mode 0: Search for home only once 1: Search for home at each run Bit 5: Home correction mode 0: Real-time correction 1: One-time correction Bit 6: Positioning completion signal selection 0: Active within the positioning completion signal hold time set by P21.25 1: Always active Bit 7: First positioning selection for terminal control 0: Disable (no rotation) 1: Enable Bit 8: Positioning enable signal type selection 0: Pulse signal 1: Level signal Bit 9: Position source 0: Digital target position	0x5242

Function code	Name	Description	Parameter setting
		1: PROFIBUS/CANopen/EtherCAT communication Bit 10: Encoder pulse count retention after power loss 0: Not retained 1: Retained Bit 11: Incremental position retention after power loss 0: Not retained 1: Retained Bit 12: Positioning curve selection 0: Linear 1: S curve Bit13: Reserved 0–1: Reserved Bit 14: 0Hz hold within P21.25 after positioning 0: No 1: Yes Bit15: Interruption support during positioning 0: No 1: Yes	
P05.04	S4 function	51: Position/speed control switching terminal	51
P05.10	Virtual terminal setting	Setting range: 0x0–0xF (0: disable; 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal	0x8

7.2.9 Commissioning of bus-free positioning control

Use the RS485 host controller for commissioning. First, modify the following parameters and ensure that the mechanical brake can be released properly during operation.

Function code	Name	Description	Parameter setting
P00.01	Channel of run commands	2: Communication	2
P00.02	Communication mode of run commands	0: Modbus	0
P00.06	A frequency command source	0: Keypad	0
P00.10	Frequency set through keypad	When the A and B frequency command sources are set to keypad digital setting, the value of this function code is used as the initial value of the digital frequency setting of the inverter unit. Setting range: 0.00 Hz–P00.03 (Max. output frequency)	5.00Hz
P00.11	ACC time 1	Acceleration (ACC) time refers to the time required for the inverter unit to accelerate from 0 Hz to the acceleration/deceleration time base frequency (P08.21).	10.0s
P00.12	DEC time 1	Deceleration (DEC) time refers to the time required for the inverter unit to decelerate from the acceleration/deceleration time base frequency (P08.21) to	10.0s

Function code	Name	Description	Parameter setting
		0 Hz. The inverter unit has four groups of ACC/DEC time, which can be selected by P05. The default ACC/DEC time of the inverter unit is the first group. P00.11 and P00.12 setting range: 0.0–3600.0s	
P21.00	Positioning mode	Setting range: 0x0000–0x7321 Ones place: Control mode selection 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train 1: Digital position 2: Photoelectric switch stop positioning Hundred place: Position feedback source 0: P-channel pulses of PG1 (channel A1/B1/Z1) 1: F-channel pulses of PG1 (channel A2/B2/Z2) 2: Reserved 3: SSI absolute position Thousands place: Servo mode (Reserved) 0: Servo disabled, no position deviation 1: Servo disabled, position deviation present 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved	0x0311
P21.09	Positioning completion range	If the required positioning accuracy is ± 2 mm, the allowable deviation value should be set to 2 mm. Given an absolute position unit of 0.1 mm, with P21.11 = 2816 and P21.12 = 625, the parameter P21.09 is calculated as follows: $P21.09 = 20 \times 2816/625 = 90$	90

Open the Workshop host software and establish a connection via RS485 (or Ethernet). Monitor the following variables to begin commissioning:

- Ramp reference frequency
- Output frequency
- Position reference high word; unsigned value; range: 0–65535
- Position reference low word; unsigned value; range: 0–65535
- Position feedback high word; unsigned value; range: 0–65535
- Position feedback low word; unsigned value; range: 0–65535

Commissioning 1: Modify the following parameters and run

Function code	Name	Description	Setting
P21.08	APR output limit	Position regulator output Value. When the APR output limit is 0, the APR is invalid, and no position control can be performed, however, speed control is valid. Setting range: 0.0–100.0% (of the max. output frequency)	0.0%
P14.44	Modbus digital position reference low word	Use $P14.45 \times 65535 + P14.44$ as the absolute position reference. With reference to the current feedback absolute	/

Function code	Name	Description	Setting
P14.45	Modbus digital position reference high word	position, set an absolute position with a relatively small difference.	
P21.19	Positioning speed digital setting	Setting range: 0–100.0% (of the max. output frequency)	40.0%
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process.	10.00s
P21.21	Positioning DEC time	Positioning ACC time refers to the time required for the inverter unit to accelerate from 0 Hz to the max. output frequency (P00.03). Positioning DEC time refers to the time required for the inverter unit to decelerate from the max. output frequency (P00.03) to 0 Hz. P21.20 setting range: 0.01–300.00s Setting range of P21.21: 0.01–300.00s	10.00s

After running, check whether the output frequency follows the ramp reference frequency correctly and whether the position feedback follows the position reference correctly.

If the output frequency cannot follow the ramp reference frequency correctly, adjust the speed loop, generally by increasing P03.00 and P03.03 at the same time.

If the deviation between the position feedback and the position reference keeps increasing, interchange the motor UVW phase sequence (swap phases U and V) and change the ones place setting of P20.02 to the opposite value.

Commissioning 2: If Commissioning 1 is normal, continue to modify the following parameters and run

Function code	Name	Description	Setting
P14.44	Modbus digital position reference low word	Use $P14.45 \times 65535 + P14.44$ as the absolute position reference. With reference to the current feedback absolute position, set absolute position 1 to an absolute position with a relatively large difference.	/
P14.45	Modbus digital position reference high word		
P21.02	Position-loop gain 1	The two position-loop gains are switched according to the position loop gain switching mode set by P21.04. In spindle orientation mode, gain switching is performed automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used to maintain the locked state. Setting range: 0.0–400.0	0.10
P21.03	Position-loop gain 2		0.10
P21.08	APR output limit	Position regulator output Value. When the APR output limit is 0, the APR is invalid, and no position control can be performed, however, speed control is valid. Setting range: 0.0–100.0% (of the max. output frequency)	20.0%
P21.19	Positioning speed digital setting	Setting range: 0–100.0% (of the max. output frequency)	80.0%
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process.	10.00s
P21.21	Positioning DEC time	Positioning acceleration (ACC) time refers to the time required for the inverter unit to accelerate from 0 Hz to the acceleration/deceleration time base frequency (P08.21). Positioning deceleration (DEC) time refers to the time required for the inverter unit to decelerate from the acceleration/deceleration time base frequency (P08.21) to	10.00s

Function code	Name	Description	Setting
		0 Hz. P21.20 setting range: 0.01–300.00s Setting range of P21.21: 0.01–300.00s	
P18.48	SSI position deviation during positioning	Example: If P18.48 = 1 and the laser rangefinder resolution is 0.1 mm/pls, the deviation at positioning completion is 1 mm.	Display value
P18.49	Final SSI position deviation	Example: If P18.49 = 1 and the laser rangefinder resolution is 0.1 mm/pls, the final positioning deviation is 1 mm.	Display value

After running, check whether the ramp reference frequency and the output frequency remain stable without fluctuation, whether the position feedback finally converges to the position reference, and whether P17.62 and P17.63 finally meet the positioning accuracy requirements. If the deceleration process is obviously too long, gradually increase P21.02 and P21.03 by 0.10 each time until the deceleration process becomes normal.

Commissioning 3: If Commissioning 2 is normal, continue to modify the following parameters and run

Function code	Name	Description	Setting
P21.08	APR output limit	Position regulator output Value. When the APR output limit is 0, the APR is invalid, and no position control can be performed, however, speed control is valid. Setting range: 0.0–100.0% (of the max. output frequency)	20.0%
P14.44	Modbus digital position reference low word	Use $P14.45 \times 65535 + P14.44$ as the absolute position reference. With reference to the current feedback absolute position, set absolute position 1 to an absolute position with a relatively large difference.	/
P14.45	Modbus digital position reference high word		
P21.19	Positioning speed digital setting	Setting range: 0–100.0% (of the max. output frequency)	100.0%
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process.	8.00s
P21.21	Positioning DEC time	Positioning acceleration (ACC) time refers to the time required for the inverter unit to accelerate from 0 Hz to the acceleration/deceleration time base frequency (P08.21). Positioning deceleration (DEC) time refers to the time required for the inverter unit to decelerate from the acceleration/deceleration time base frequency (P08.21) to 0 Hz. P21.20 setting range: 0.01–300.00s P21.21 setting range: 0.01–300.00s	8.00s

After running, check whether the ramp reference frequency and the output frequency remain stable without fluctuation, and whether the position feedback finally converges to the position reference.

- If the running is abnormal, return to Commissioning 2 for further adjustment.
- If the running is normal, manual keypad positioning commissioning is complete.

7.2.10 Fieldbus positioning commissioning

Using PROFINET communication as an example, set parameters as follows:

Function code	Name	Description	Setting
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	2
P00.02	Communication mode of run commands	0: Modbus 1: CANopen 2: Ethernet 3: EtherCAT/PROFINET 4: PLC card 5: Wireless communication card (Reserved) 6: PROFIBUS-DP Note: The options 2, 3, 4, 5, and 6 are add-on functions and are available only when corresponding expansion cards are configured.	3
P00.06	A frequency command source	0: Keypad 1: AI1 2: AI2 3: AI3 4: Reserved 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: CANopen communication 10: Ethernet communication 11: Reserved 12: Pulse train AB 13: EtherCAT/PROFINET communication 14: PLC card 15: PROFIBUS-DP communication 16: Tension setting (valid only for A frequency command)	13

Notes on the PZD data exchanged between the VFD and the controller: pay attention to the unit of the data transmitted in each PZD.

Function code	Name	Description	Setting
P16.32	PZD2 receive	Function code mapping (Digital positioning speed setting, 0.0–100.0%)	19
P16.33	PZD3 receive	Position reference high word, 0–65535	14
P16.34	PZD4 receive	Position reference low word, 0–65535	15
P16.35	PZD5 receive	Function code mapping (Speed control ACC time, 0.0–60.0s)	19
P16.36	PZD6 receive	Function code mapping (Speed control DEC time, 0.0–60.0s)	19
P16.37	PZD7 receive	Function code mapping (Emergency stop DEC time, 0.0–60.0s)	19

Function code	Name	Description	Setting
P16.38	PZD8 receive	Virtual input terminal command (Speed/position switching, 0–1)	9
P16.39	PZD9 receive	Set frequency, unit: 0.01Hz	1
P16.40	PZD10 receive	Function code mapping (Positioning ACC time, 0.00–30.00s)	19
P16.41	PZD11 receive	Function code mapping (Positioning DEC time, 0.00–30.00s)	19
P16.43	PZD2 transmit	Running frequency, unit: 0.01Hz	1
P16.44	PZD3 transmit	Terminal output status (values: 8 indicates RO2 active, 4 indicates RO1 active, and 9 indicates both RO1 and RO2 active)	17
P16.45	PZD4 transmit	Output current, unit: 0.1A	5
P16.46	PZD5 transmit	Fault code	11
P16.47	PZD6 transmit	Function code mapping (Encoder pulse count value LSB, 0–65535)	31
P16.48	PZD7 transmit	Function code mapping (Encoder pulse count value MSB, 0–65535)	31
P16.49	PZD8 transmit	Function code mapping (SSI position feedback LSB, 0–65535)	31
P16.50	PZD9 transmit	Function code mapping (SSI position feedback MSB, 0–65535)	31
P16.50	PZD10 transmit	Function code mapping (Current motor control mode; tens place = 0 indicates speed mode, and tens place = 2 indicates position mode)	31

Note 1: For values involving MSB and LSB, the overall data value represented in the host controller is as follows: $\text{MSB} \times 65536 + \text{LSB}$

Example: SSI position feedback value = SSI position feedback MSB $\times$ 65536 + SSI position feedback LSB

Note 2: If the control word and status word of the host controller are represented in binary, set P14.33 to 1.

Note 3: By switching the value of PZD8 between 0 and 1 through the controller, speed mode and position mode can be switched. Check the value received by PZD10 or the value of P17.40 in the VFD to check whether the switching is successful.

Note 4: To test speed control in communication mode, set the following parameters in the controller:

- Set frequency, unit: 0.01Hz
- Speed control ACC time, unit: 0.1s
- Speed control DEC time, unit: 0.1s
- Emergency stop DEC time, unit: 0.1s

The following parameters need to be read in the controller:

- Running frequency, unit: 0.01Hz
- Output current, unit: 0.1A
- Fault code
- Current motor control mode; tens place = 0 indicates speed mode

Note 5: To test position control in communication mode, set the following parameters in the controller:

- Digital positioning speed setting, unit: 0.1%; the percentage is relative to the max. frequency
- Position reference MSB, high 16-bit value of the absolute position
- Position reference LSB, low 16-bit value of the absolute position
- Positioning ACC time, unit: 0.01s
- Positioning DEC time, unit: 0.01s

The following parameters need to be read in the controller:

- Running frequency, unit: 0.01Hz
- SSI position reference MSB, high 16-bit value of the absolute position
- SSI position reference LSB, low 16-bit value of the absolute position
- Motor encoder pulse count value MSB, high 16-bit value of the relative position of motor rotation
- Motor encoder pulse count value LSB, low 16-bit value of the relative position of motor rotation

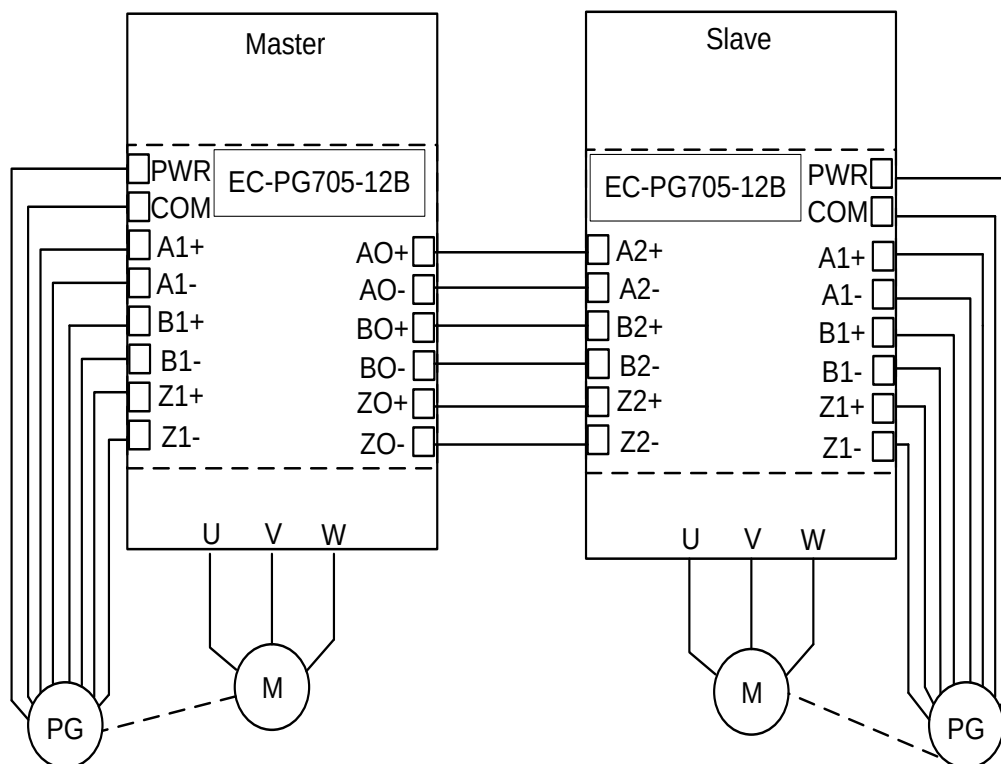
Current motor control mode; tens place = 1 indicates position mode

7.3 Master/slave synchronization function (master encoder pulse division)

In the logistics industry, dual-drive applications are common, such as the traveling mechanism of a stacker crane and the fork mechanism. In such cases, master/slave synchronous control is required. As encoders are generally used in these applications, it is recommended to adopt a synchronization scheme in which the master encoder signal is divided and then fed to the slave. For the related PG expansion card, refer to EC-PG705-12B. For this function, only the slave parameters need to be set.

Note: If the master motor is not equipped with an encoder, refer to the master/slave communication card solution.

7.3.1 Common wiring



Note: The figure shows only the wiring of the EC-PG705-12B PG card. The wiring of other PG cards is similar.

7.3.2 Key slave parameter settings

When P21.00 (Positioning mode) = 0x0001, the slave operates in position following mode.

When P21.00 (Positioning mode) = 0x0000 and the frequency source is set to "12: Pulse train AB setting", the slave operates in speed following mode.

If both the master and slave involve brake control, it is generally recommended to set the relay function used for brake control on the slave to "1: Running". This helps prevent force fighting between the master and slave during start and stop due to mechanism deformation during acceleration and deceleration.

Function code	Name	Description	Setting
P00.00	Speed control mode	3: Closed-loop vector control mode	3
P00.06	A frequency source command selection (Speed control)	0: Keypad	0
P00.07	B frequency source command selection (Speed control)	12: Pulse train AB	12
P00.09	Combination mode of setting source (Speed control)	0: A frequency source 1: B frequency source	/
P06.03	RO1 output selection	1: Running Configurable only when RO1 connects to the mechanical brake.	1
P18.17	Pulse command frequency	Pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Setting range: -3276.8~3276.7Hz	Display value
P18.32	Main control board measured speed in pulse reference mode	Setting range: -3276.8~3276.7Hz	Display value
P18.33	PG card measured speed in pulse reference mode	Setting range: -3276.8~3276.7Hz	Display value
P21.00	Positioning mode	Position control, AB pulse train reference	0x0001
P21.01	Pulse command mode	Tens place: Pulse direction setting 0: Forward 1: Reverse	0x0000

7.4 Lifting solution introduction

The inverter unit supports the brake control function. When this function is enabled, that the VFD takes account of mechanical brake action response time and drives and controls the mechanism brake through relays of control terminals so as to achieve stable control on brake release and closing.

The brake logic commissioning procedure is as follows:

Step 1 Set P60.04 to 1 to enable the brake function.

Step 2 Set relay brake output. If RO1 is connected to the braking contactor, set P06.03 to 57.

Step 3 If the brake contactor has a feedback function, connect the brake feedback wiring to an input terminal, such as terminal S6, that is, set P25.02 (Input terminal S6 function) to 101: Brake feedback signal. Then set the thousands

place of P60.35 to a non-zero value to enable brake feedback detection.

In non-closed-loop mode, a brake feedback fault will be reported once brake feedback is detected.

In closed-loop mode, if the thousands place of P60.35 is set to 1, a brake feedback fault will be reported once brake feedback is detected. If the thousands place of P60.35 is set to 2, brake current monitoring is performed automatically. When the brake is abnormal, the corresponding protective action is taken based on the actual current value and the setting of P60.47. If the thousands place of P60.35 is set to 3, not only the brake current is monitored automatically, but the speed is also monitored.

If the brake contactor does not have a feedback function, no action is required.

Step 4 Set the torque verification value during brake release to ensure there is enough torque before the brake is opened.

When open-loop vector mode or closed-loop vector mode is used, generally set P60.10 (Forward torque verification torque value) and P60.11 (Reverse torque verification torque value).

When SVPWM is used, generally set P60.08 (Forward torque verification current value) and P60.09 (Reverse torque verification current value).

Step 5 Set the brake timing, including the forward/reverse brake release frequency, forward/reverse brake closing frequency, delay before forward brake release (T1), delay before reverse brake release (T5), delay after forward brake release (T2), delay after reverse brake release (T6), delay before forward brake closing (T3), delay before reverse brake closing (T7), delay after forward brake closing (T4), and delay after reverse brake closing (T8).

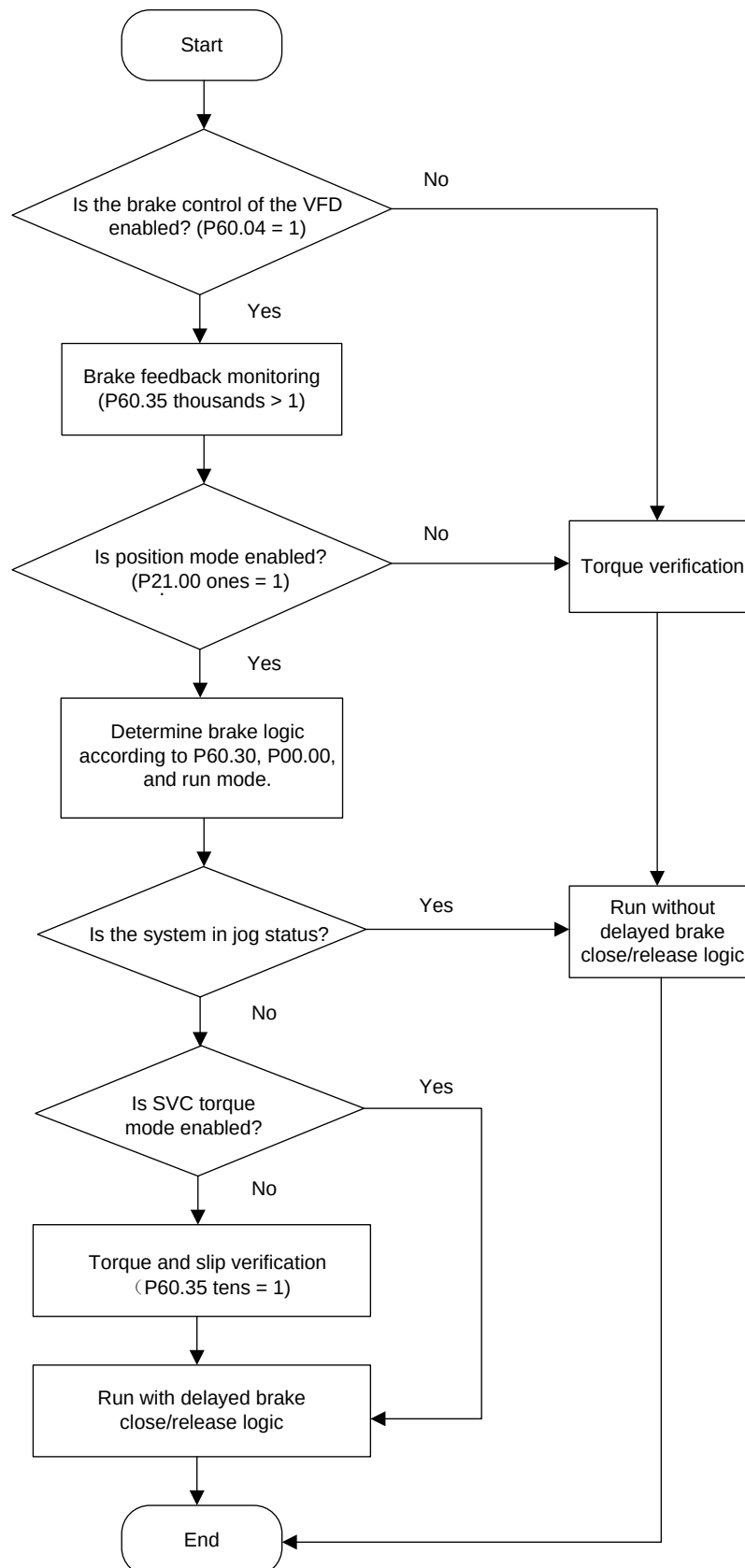
Note: If delay before reverse brake release (T5), delay after reverse brake release (T6), delay before reverse brake closing (T7), and delay after reverse brake closing (T8) are set to 0, the delay parameters for forwarding running are used.

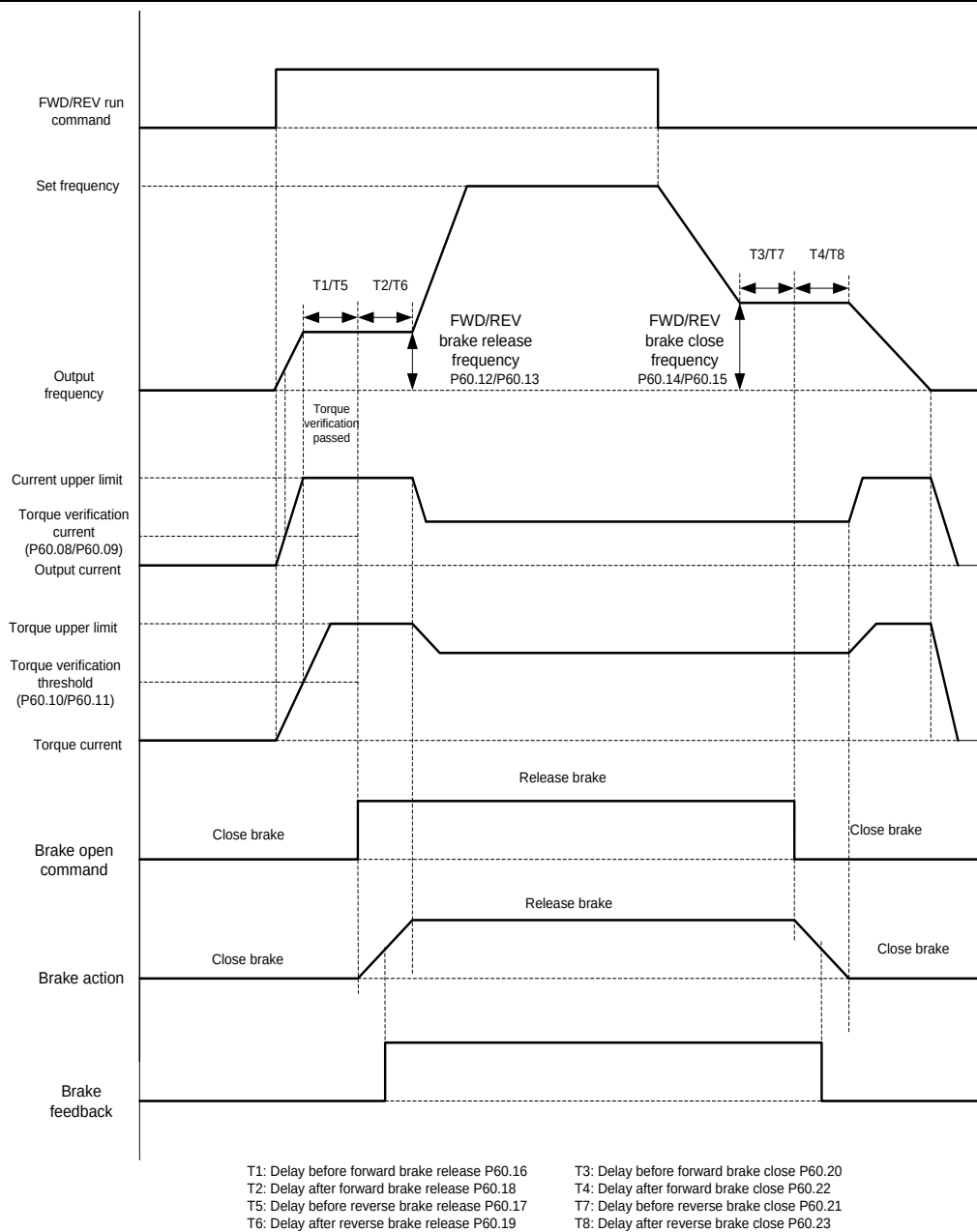
Step 6 T1, T5, T3, and T7 are usually set to 0 (default value).

T2, T6, T4, and T8 are related to the mechanical brake action time. For electromagnetic brake, the time is generally in the range of 0.200–0.400s; for hydraulic brake, the time is generally in the range of 0.300–1.000s. The time needs to be adjusted based on actual conditions.

- In closed loop vector control mode, the brake release frequency is generally in the range of 0.20–0.50Hz, and the brake closing frequency is 0.00Hz.
- In open-loop vector mode and SVPWM mode, under full-load lifting conditions, the recommended brake release/close frequency is 1.50 Hz or higher. The actual setting shall be based on the application conditions.

Perform a test run and check whether the brake timing is correct. The brake flowchart and timing diagram are shown in the following.





7.4.1 Protective functions before brake release

7.4.1.1 Power-on brake self-check or user-initiated self-check function

Function 101 assigned to the S terminal can be used for a brake self-check. By applying torque and speed to the motor, the VFD detects potential brake slippage.

Function code	Name	Description	Default
P60.42	Brake detection torque setting	Setting range: 0.0–180.0%	100.0%
P60.43	Brake detection frequency setting	Setting range: 0.00–20.00Hz	2.00Hz
P60.44	Brake detection time setting	Setting range: 0.0–30.0s	1.5s
P60.45	Brake detection pulse threshold (closed-loop)	Setting range: 0–20000	1000

7.4.1.2 Torque verification function

After the VFD starts and before the brake is released, the VFD performs a torque verification based on the setting in the ones place of P60.35.

Standard torque verification mode

Non-position mode: Torque verification is considered successful when both the current and torque exceed the output current and torque settings (P60.08–P60.11) for a duration of 60 ms.

Position mode: Torque verification is considered successful when the current exceeds the output current setting (P60.07) for a duration of 60 ms.

Fast torque verification mode:

Non-position mode: Torque verification is considered successful if both the current and torque exceed the output current and torque settings (P60.08–P60.11) 60 ms after the VFD starts.

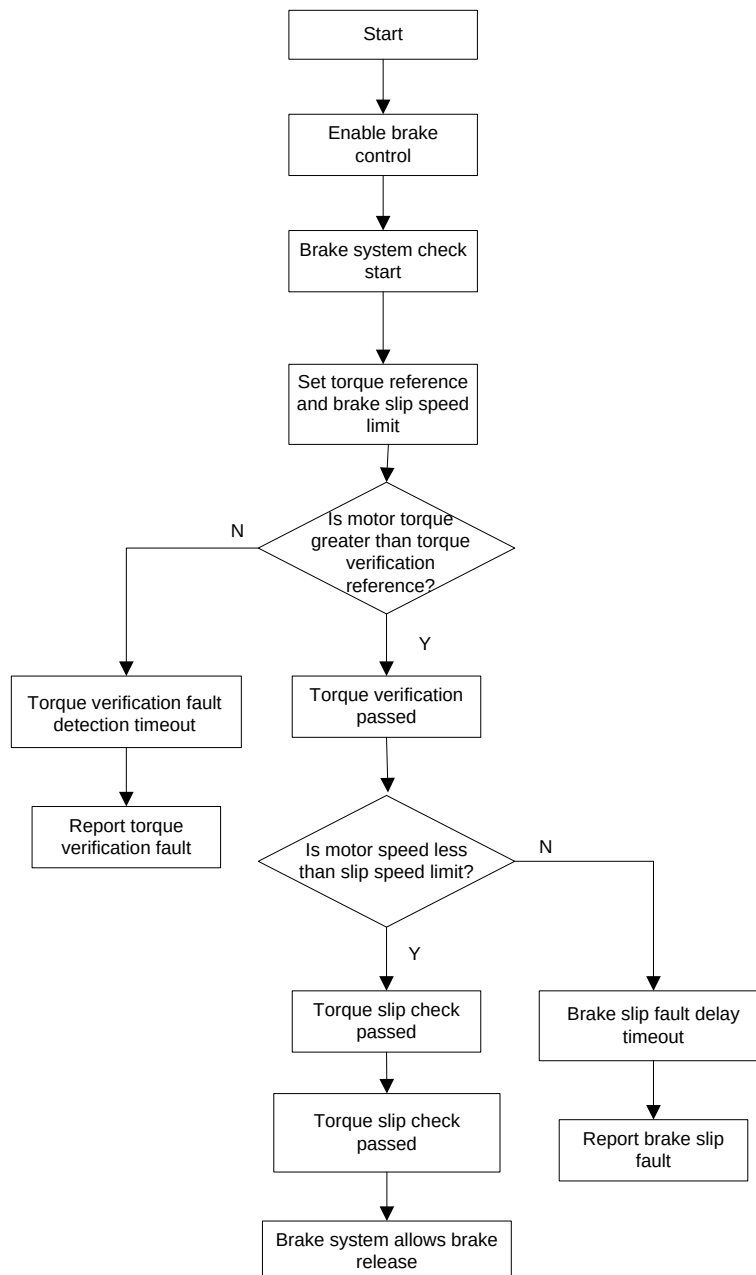
Position mode: Torque verification is considered successful when the current exceeds the output current setting (P60.07) for a duration of 60 ms. If the torque verification is not successful before the torque verification time (P60.36) expires, a torque verification failure will be triggered, and fault E073 will be reported.

Function code	Name	Description	Default
P60.35	Brake extension control selection	Setting range: 0x0000–0x3211 Ones place: Torque verification mode 0: Standard torque verification mode 1: Quick torque verification mode Tens place: Pre-brake-release brake slip detection enable (closed-loop) 0: Disable 1: Enable Hundreds place: Brake detection enable 0: Disable (S terminal enabling is active) 1: Enable power-on brake detection 2: Manual single brake detection (this bit is automatically restored after detection) Thousands place: Brake status monitoring enable 0: Disable 1: Enable brake feedback detection 2: Enable brake detection + Current detection upon a fault (closed-loop) 3: Enable brake detection + Current & speed detection upon a fault (closed-loop)	0x0010
P60.07	Brake release current in position control	Setting range: 0.0–200.0%	0.0%
P60.08	Forward brake release current	Setting range: 0.0–200.0%	0.0%
P60.09	Reverse brake release current	Setting range: 0.0–200.0%	0.0%
P60.10	Forward brake release torque	Setting range: 0.0–200.0%	0.0%
P60.11	Reverse brake release torque	Setting range: 0.0–200.0%	0.0%
P60.36	Torque verification fault detection time	Setting range: 0.000–10.000s	6.000s
P60.37	Brake slip speed deviation (Close-loop)	Setting range: 0.05–1.00Hz	0.05Hz
P60.39	Brake slip fault delay	Setting range: 0.000–5.000s	0.500s

7.4.1.3 Brake slip detection function

In closed-loop mode: If brake slip detection is enabled (tens place of P60.35 = 1), the brake slip detection function is enabled. During torque verification, if the motor speed (encoder speed) approaches the min. of the forward/reverse brake release frequencies minus the brake slip speed deviation value, that is, $\text{Min}(P60.12, P60.13) - P60.37$, and this condition persists longer than the slip fault delay time P60.39, a brake failure fault is reported, that is, fault E079 is reported. The torque verification and brake slip flowchart is as follows:

Function code	Name	Description	Default
P60.46	Brake feedback fault delay time	Setting range: 0.000–20.000s	1.000s
P60.47	Brake monitoring current threshold	Setting range: 0.0–200.0%	100.0%



7.4.2 Speed mode brake function

Brake control generally refers to brake control in speed mode, or to applications in which at least one operating condition

uses speed-mode brake control. The main related parameters are listed in the following. Refer to section 7.4 Lifting solution introduction for the brake logic.

Function code	Name	Description	Default
P60.04	Brake-specific logic enable	0: The brake is controlled by an external controller. 1: The brake is controlled by the VFD.	0
P60.12	FWD run brake release frequency	Setting range: 0.00–20.00Hz	2.50Hz
P60.13	REV run brake release frequency	Setting range: 0.00–20.00Hz	2.50Hz
P60.14	FWD run brake close frequency	Setting range: 0.00–20.00Hz	1.50Hz
P60.15	REV run brake close frequency	Setting range: 0.00–20.00Hz	1.50Hz
P60.16	Delay before forward brake release	Setting range: 0.000–5.000s	0.000s
P60.17	Delay before reverse brake release	Setting range: 0.000–5.000s	0.000s
P60.18	Delay after forward brake release	Setting range: 0.000–5.000s	0.300s
P60.19	Delay after reverse brake release	Setting range: 0.000–5.000s	0.000s
P60.20	Delay before forward brake closing	Setting range: 0.000–5.000s	0.000s
P60.21	Delay before reverse brake closing	Setting range: 0.000–5.000s	0.000s
P60.22	Delay after forward brake closing	Setting range: 0.000–5.000s	0.300s
P60.23	Delay after reverse brake closing	Setting range: 0.000–5.000s	0.000s
P60.24	DEC buffer frequency	Setting range: 0.00–50.00Hz	5.00Hz
P60.25	DEC buffer frequency duration	Setting range: 0.000–5.000s	0.000s

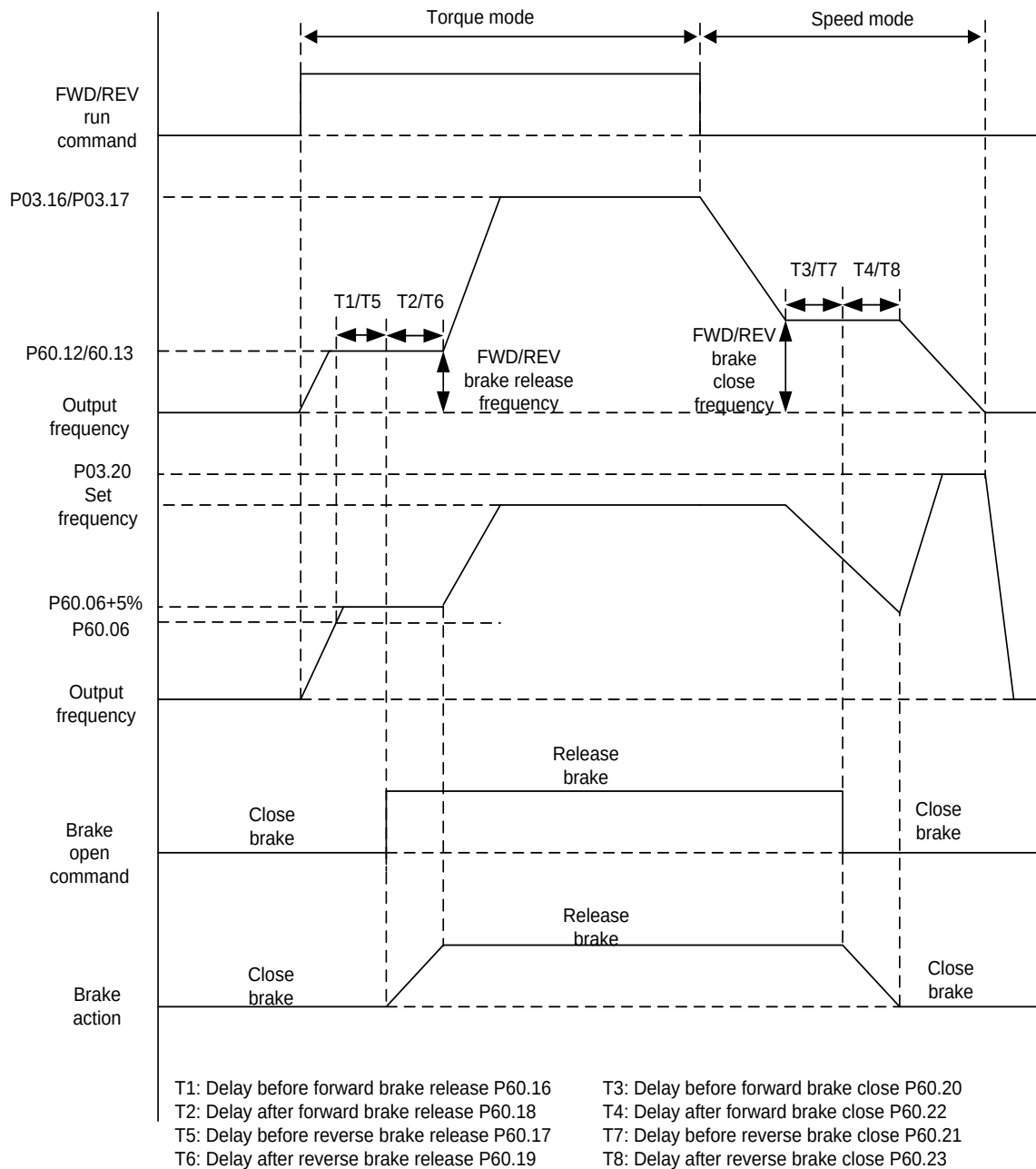
7.4.3 Torque mode brake function

In vector control mode, when torque mode (P03.32=1) and brake control (P60.04=1) are both enabled, the torque mode brake is enabled.

Brake release start timing:

1. Before brake release, the frequency upper limit in forward/reverse run equals the brake release frequency reference in forward/reverse run, and the set torque equals P60.06+5.0%.
2. If the detected output torque is greater than or equal to the preset brake opening torque value (P60.06), the delay before brake release starts. When the delay time reaches, the release output is carried out, and then the delay after brake release starts. When the delay time reaches, it indicates that the release timing ends.
3. After brake release, the set torque and the torque mode forward/reverse frequency upper limits resume their normal values. That is, determined by the parameters in group P03, the VFD runs in standard torque mode.

Brake closing timing for stop: The VFD automatically switches from the torque mode to the speed mode and then decelerates to stop. Then the brake logic can directly use the brake closing logic in the speed mode. The brake timing diagram is as follows:



For details about torque control function code settings, see P03.11–P03.17 and P03.32.

The parameters that are different from those for the speed mode brake function are listed in the following.

Function code	Name	Description	Default
P60.05	Brake release/close torque limiting (vector mode)	Setting range: 0.0–300.0% In speed mode, under vector control, this parameter specifies the torque limit during the delay period before and after brake release/close. Relative to the motor rated current, torque limiting is applied before the brake is released.	250.0%
P60.06	Torque mode brake release torque	Setting range: 0.0–200.0% During the running, when the torque feedback value $\geq$ P60.06,	50.0%

Function code	Name	Description	Default
		brake release timing is entered. (It is valid only when P60.04=1, which indicates the brake is controlled by the VFD, and the VFD uses the torque mode.)	

Note: Set P60.05 to an appropriate torque limit according to the actual application to prevent speed overshoot after the brake is released.

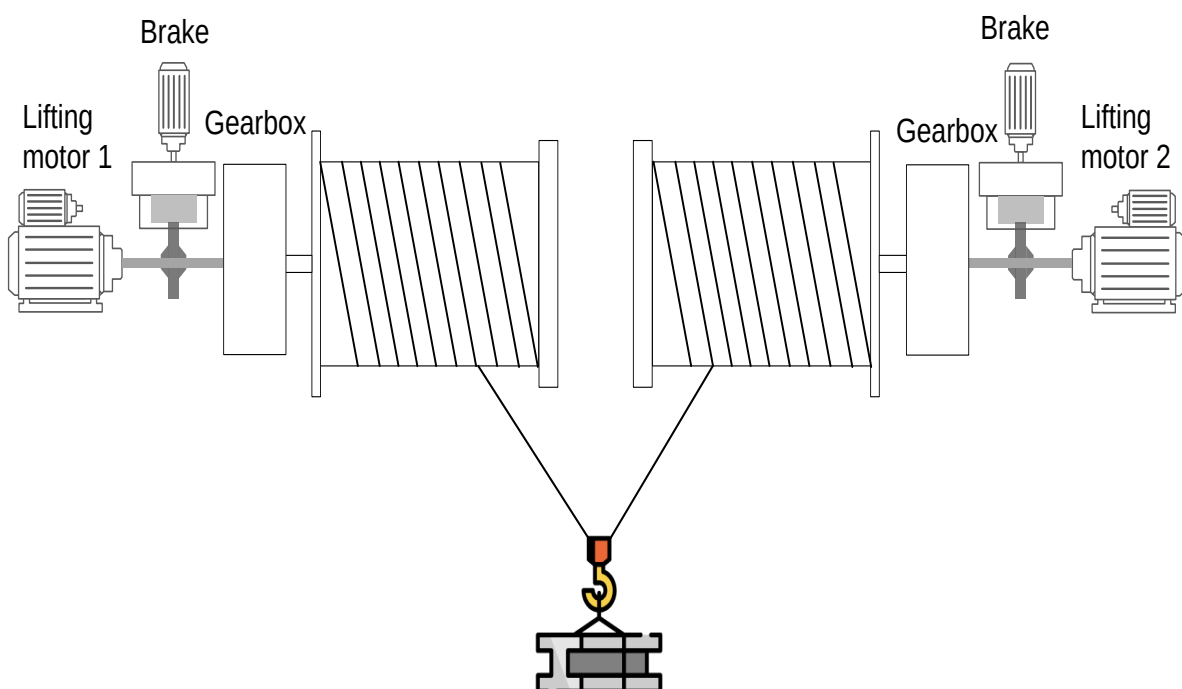
7.4.4 Master/slave mode brake function

In master/slave mode, if you need to perform brake release/closing for both the master and slave, refer to the following procedure:

- Step 1 Set P60.04 to 1 on both the master and slave to enable the brake function for the master and slave.
- Step 2 Set P28.00=1 for the master and P28.00=2 for the slave, and set P28.02 to select a master/slave mode.
- Step 3 Set P28.18 to 0x11 to enable the master/slave brake synchronization function for the master and slave.
- Step 4 Set relay brake output for the master and slave. If RO1 is connected to the brake contactor, set P06.03 to 57.
- Step 5 Set the forward and reverse pre-brake-close delays of the master and slave to 0 (P60.16 = 0 and P60.17 = 0).
- Step 6 For the remaining brake parameters, refer to the commissioning method above. For the remaining master/slave parameters, refer to section 5.6.18 Master/slave control.
- Step 7 Perform a test run and check whether the brake timing is correct.

Note:

- In master/slave mode, you need to set the delay before forward brake closing and delay before reverse brake closing to 0; otherwise the master and slave will not synchronize.
- In applications with a rigid master/slave connection, the brake can be controlled solely by the master. Master/slave brake synchronization control can be disabled (P28.18=0x00 for both master and slave), and the slave's brake logic should not be activated (P60.04=1 for the master and P60.04=0 for the slave).



Master/slave brake synchronization control requires the following additional function codes to be set.

Function code	Name	Description	Setting
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	Master: 1 Slave: 2
P28.02	Master/slave control mode	Setting range: 0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0 1: Master/slave mode 1 2: Master/slave mode 2 Tens place: Slave start command source 0: Master 1: P00.01 setting Hundreds place: Enable master/slave to transmit/receive data 0: Enable 1: Disable	Refer to the master/slave mode.
P28.18	Master/slave brake synchronization control	Setting range: 0x00–0x11 Ones place: Brake release synchronization 0: Invalid 1: Enable Tens place: brake closing synchronization 0: Invalid 1: Enable	0x11

8 Function parameter list

8.1 Overview

This chapter lists and briefly describes the function codes of the rectifier and inverter units of the VFD.

The function parameters of the inverter unit are divided into groups by function. Among the function parameter groups, group P98 is the analog input and output calibration group, while group P99 contains the factory function parameters, which are user inaccessible. Each group includes several function codes (each function code identifies a function parameter). A three-level menu style is applied to function codes. For example, "P08.08" indicates the 8th function code in the P08 group.

The function group numbers correspond to the level-1 menus, the function codes correspond to the level-2 menus, and the function parameters correspond to the level-3 menus.

1. The content of the function code table is as follows:

Column 1 "Function code": Code of the function group and parameter.

Column 2 "Name": Full name of the function parameter.

Column 3 "Description": Detailed description of the function parameter.

Column 4 "Default": Initial value set in factory.

Column 5 "Modify": Whether the function parameter can be modified, and conditions for the modification.

"○" indicates that the value of the parameter can be modified when the power unit is in stopped or running state.

"◎" indicates that the value of the parameter cannot be modified when the power unit is in running state.

"●" indicates that the value of the parameter is detected and recorded, and cannot be modified.

(The power unit automatically checks and constrains the modification of parameters, which helps prevent incorrect modifications.)

2. The parameters adopt the decimal system (DEC). If the hexadecimal system is adopted, all bits are mutually independent on data during parameter editing, and the setting ranges at some bits can be hexadecimal (0–F).
3. "Default" indicates the factory setting of the function parameter. If the value of the parameter is detected or recorded, the value cannot be restored to the factory setting.
4. To better protect parameters, the VFD provides the password protection function. After a password is set (that is, P07.00 is set to a non-zero value), "0.0.0.0.0" is displayed when you press the **PRG/ESC** key to enter the function code editing interface. You need to enter the correct user password to enter the interface. For the factory parameters, you need to enter the correct factory password to enter the interface. (You are not advised to modify the factory parameters. Incorrect parameter setting may cause operation exceptions or even damage to the power unit.) If password protection is not in locked state, you can change the password any time. You can set P07.00 to 0 to cancel the user password. When P07.00 is set to a non-zero value during power-on, parameters are prevented from being modified by using the user password function. When you modify function parameters through serial communication, the user password protection function is also applicable and compliant with the same rule.

8.2 Gateway-type rectifier function parameter list

Group P00—Basic functions

Rectifier function code	Name	Description	Default	Modify
P00.00	Control board software version number (Uncontrolled rectifier unit version number)	Actual control board software version Range: 1.00–655.35	Depends on version	●
P00.01	Channel of run commands	Used to select the channel of rectifier unit control commands, including the start, stop, and fault reset commands. 0: Keypad (external LCD keypad) (LED off) The running commands are controlled through external keypad keys, such as RUN and STOP/RST. 1: Terminal (the LED flashing) The running commands such as run, stop, and fault reset are controlled through multi-function input terminals. 2: Communication (LED on) The run commands are controlled by the host controller through communication.	1	○
P00.02	Communication mode of run commands	Used to select the rectifier unit communication command mode. 0: Modbus 1: CANopen 2: PLC card 3: PROFIBUS-DP 4: PROFINET/EtherCAT 5: Ethernet	0	○
P00.03	Undervoltage point for bus voltage	Undervoltage point for bus voltage for protection purpose. When the bus voltage is lower than the value of this function parameter during running, the VFD stops and reports the bus undervoltage fault. Setting range: 0.0–500.0V	350.0V	○
P00.04	Braking unit braking start voltage	Voltage at which the braking unit starts braking. When the bus voltage reaches the value of this function parameter during running, the braking transistor starts braking. This function is valid only for the models configured with built-in braking units, invalid for the models connected to external braking units. Setting range: 400.0–800.0V	700.0V	○
P00.05	Overvoltage point for bus voltage	Overvoltage point for bus voltage for protection purpose. When the bus voltage is higher than the value of this function parameter during running, the VFD stops and reports the bus overvoltage fault. Setting range: 500.0–850.0V	800.0V	○

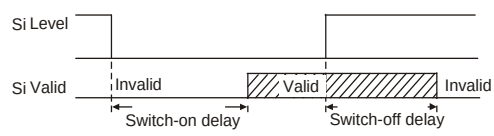
Rectifier function code	Name	Description	Default	Modify
P00.06	Urs voltage calibration coefficient	Setting range: 100.0–200.0	100.0	
P00.07	Ust voltage calibration coefficient	Setting range: 100.0–200.0	100.0	
P00.08	Urt voltage calibration coefficient	Setting range: 100.0–200.0	100.0	
P00.09	Cooling fan operating mode	0: Normal mode In this mode, the fan starts when the rectifier unit is running. The fan also runs even when the rectifier unit is stopped if the rectifier bridge temperature exceeds 55°C or the rectifier bridge current exceeds 30% of the rated current. 1: The fan keeps running after power-on When the main power supply is powered on, and the rectifier unit detects that the grid voltage is normal, the fan starts to run.	0	○
P00.10	Braking transistor shoot-through protection enable	Setting range: 0–0x111 P00.10 specifies the fault protection mode for the braking transistor. 0: Disable 1: Enable Ones place: Braking transistor shoot-through enable selection. Tens place: Braking transistor overcurrent enable selection. Hundreds place: Braking transistor overload enable selection. Note: Valid only for the rectifier unit with the built-in braking unit.	0x111	○
P00.11	3PH input exception protection enable	Setting range: 0x000–0x111 P00.11 is used to select the mode of protection against grid voltage detection faults. 0: Disable 1: Enable Ones place: indicates whether to enable input phase loss protection Tens place: indicates whether to enable grid overvoltage protection Hundreds place: indicates whether to enable grid undervoltage protection Note: Exercise caution before using this parameter.	0x011	○
P00.12	Dynamic braking enable	0: Disable 1: Enable	1	○
P00.13	Grid power frequency selection	0: 50Hz 1: 60Hz	0	○
P00.14	Function parameter restore	0: No operation 1: Restore default values	0	◎

Rectifier function code	Name	Description	Default	Modify
		2: Clear fault records Note: - After the selected operation is performed, the function code is automatically restored to 0. - Restoring default values may clear the user password. Exercise caution before using this function.		

Group P01—Rectifier and inverter interaction

Rectifier function code	Name	Description	Default	Modify
P01.00	Permissible line voltage distortion for operation	12.5%–50.0%	25.0%	○
P01.01–P01.09	Reserved	/	/	/
P01.10	Grid undervoltage ride-through time	A fault is triggered if the grid undervoltage ride-through time exceeds the time (P01.10+0.3, in seconds). Setting range: 0.000–5.000s	0.000s	○
P01.11	Precharge time	Grid charge time = P01.11 x 2 x 1.46s Increasing P01.11 can extend the charging time. Setting range: 1–30	1	○
P01.12	Test mode selection	0: Normal mode 1: Pilot run mode	0	○
P01.13	PLL mode switching	0: Adaptive phase-locked loop (PLL) 1: Single synchronous PLL	0	○
P01.14	Auto run enable	0: Disable 1: Enable When the rectifier side detects that run conditions are met at initial power on, it starts running automatically. Note: If the grid voltage is not established within 10s, the auto run will be canceled. A restart is required for the change to take effect.	0	○
P01.15	Inverter protection action upon bus communication fault	0–3 0: Keep running 1: Decelerate to stop 2: Coast to stop 3: Emergency stop	0	○
P01.16	CW & SW mode selection	0: Decimal 1: Binary Note: The value of this parameter must be the same as that of the inverter parameter P14.33.	0	○

Group P05—Input terminal functions

Rectifier function code	Name	Description	Default	Modify										
P05.00	Reserved	/	/	/										
P05.01	S1 function	0: No function	1	○										
P05.02	S2 function	1: Run (rising edge active)	2	○										
P05.03	S3 function	2: Fault reset (rising edge active)	0	○										
P05.04	S4 function	3: External fault (rising edge active)	0	○										
P05.05	S5 function	4: Incoming circuit breaker feedback (level active) 5–6: Reserved 7: Disable inverter unit run (level active) 8: Enable the inverter unit to coast to stop (level active) 9: Enable the inverter unit to stop in the set manner (level active) 10–15: Reserved	0	○										
P05.06	Input terminal polarity selection	Used to set the polarity of input terminals. When a bit is 0, the input terminal is positive. When a bit is 1, the input terminal is negative. <table border="1"> <tr> <td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr> <tr> <td>S5</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr> </table> Setting range: 0x00–0x1F	Bit4	Bit3	Bit2	Bit1	Bit0	S5	S4	S3	S2	S1	0x00	○
Bit4	Bit3	Bit2	Bit1	Bit0										
S5	S4	S3	S2	S1										
P05.07	Digital input filter time	Used to set the filter time of sampling for terminals S1–S5. In strong interference cases, increase the value to avoid maloperation. Setting range: 0.000–1.000s	0.010s	○										
P05.08–P05.12	Reserved	/	/	/										
P05.13	S1 switch-on delay	These function codes specify delay time corresponding to the level changes of programmable input terminals during switch-on or switch-off. 	0.000s	○										
P05.14	S1 switch-off delay		0.000s	○										
P05.15	S2 switch-on delay		0.000s	○										
P05.16	S2 switch-off delay		0.000s	○										
P05.17	S3 switch-on delay		0.000s	○										
P05.18	S3 switch-off delay		0.000s	○										
P05.19	S4 switch-on delay		0.000s	○										
P05.20	S4 switch-off delay		0.000s	○										
P05.21	S5 switch-on delay		0.000s	○										
P05.22	S5 switch-off delay		0.000s	○										

Group P06—Output terminal functions

Rectifier function code	Name	Description	Default	Modify
P06.00–P06.02	Reserved	/	/	/
P06.03	RO1 output selection	0: No output	0	○

Rectifier function code	Name	Description	Default	Modify				
P06.04	RO2 output selection	1: Phase lock completed 2: Running 3: Fault output 4: Bus overvoltage 5: Bus undervoltage 6: Three-phase input overvoltage 7: Three-phase input undervoltage 8: Module overheat output 9: Braking unit overtemperature output 10: Breaker action 11: Grid fault output (power loss, distortion, or phase loss) 12: Output when bus voltage > P07.13 13–31: Reserved	0	○				
P06.05	Reserved	/	/	/				
P06.07	Output terminal polarity selection	The function code is used to set the output terminal polarity. When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. <table><tr><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td></tr></table> Setting range: 0x0–0x3	Bit1	Bit0	RO2	RO1	0x0	○
Bit1	Bit0							
RO2	RO1							
P06.08–P06.09	Reserved	/	/	/				
P06.10	RO1 switch-on delay	These function codes specify delay time corresponding to the level changes of programmable input terminals during switch-on or switch-off. Setting range: 0.000–50.000s	0.000s	○				
P06.11	RO1 switch-off delay		0.000s	○				
P06.12	RO2 switch-on delay		0.000s	○				
P06.13	RO2 switch-off delay		0.000s	○				

Group P07—HMI

Rectifier function code	Name	Description	Default	Modify
P07.00	User password	Setting range: 0–65535 When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and password protection is disabled. After the user password is set and takes effect, you cannot enter the parameter menu if you enter an incorrect password. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is enabled	0	○

Rectifier function code	Name	Description	Default	Modify
		within 1 minute. If password protection is enabled, "0.0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface. Note: - Restoring the default values may clear the user password. Exercise caution before using this function. - The uncontrolled rectifier unit does not support this function.		
P07.01	Local accumulated run time (h)	Displays the accumulated run hours. Range: 0–65535h	0h	●
P07.02	Local accumulated run time (min)	Displays the accumulated run minutes. Range: 0–59min	0min	●
P07.03	Factory bar code 1	Range: 0x0000–0xFFFF	0x0000	●
P07.04	Factory bar code 2	Range: 0x0000–0xFFFF	0x0000	●
P07.05	Factory bar code 3	Range: 0x0000–0xFFFF	0x0000	●
P07.06	Factory bar code 4	Range: 0x0000–0xFFFF	0x0000	●
P07.07	Factory bar code 5	Range: 0x0000–0xFFFF	0x0000	●
P07.08	Factory bar code 6	Range: 0x0000–0xFFFF	0x0000	●
P07.09	Reserved	/	/	/
P07.10	Braking current rated value selection	0: Braking transistor rated current 60A 1: Braking transistor rated current 47.5A	0	◎
P07.11	Terminal reset function selection	Setting range: 0–3 0: Valid only for terminal	3	○
P07.12	Communication reset function selection	1: Valid for terminal and keypad 2: Valid for terminal and communication 3: Valid for all channels	3	○
P07.13	RO output bus voltage	Setting range: 400.0–800.0V The voltage hysteresis for RO switching is 10V.	550.0V	◎
P07.14	Selection of parameters displayed in running state	Setting range: 0x0–0xF Bit0: Grid frequency (Hz on, flashing slowly) Bit1: 3PH AC average value Bit2: Bus voltage Bit3: Grid voltage	0xF	○
P07.15	Reserved	/	/	/
P07.16	Selection of parameters displayed in stopped state	Setting range: 0x0–0xF Bit0: Grid frequency (Hz on, flashing slowly) Bit1: 3PH AC average value Bit2: Bus voltage Bit3: Grid voltage	0xF	○
P07.17	Drive layer display	0: Uncontrolled rectifier 1: Half-controlled rectifier	0x0000	●
P07.18	Auto fault reset enable	Setting range: 0x00–0x11 Ones place: Enable automatic reset for rectifier function faults	0x00	○

Rectifier function code	Name	Description	Default	Modify
		0: Disable 1: Enable Tens place: Enable automatic reset for network communication faults 0: Disable 1: Enable		
P07.19	Auto-run enable when fault-free	0: Disable 1: Enable	0	○

Group P17—Status viewing functions

Rectifier function code	Name	Description	Default	Modify
P17.00	Rectifier unit rated power	Displays the rated power of the rectifier unit. Range: 0.0–3000.0kW	Depends on model	●
P17.01	Rectifier unit rated current	Displays the rated current of the rectifier unit. Range: 0.00–6000.00A	Depends on model	●
P17.02	Braking unit CW	Displays whether the current control word for the braking unit is run or stop. 0: Run 1: Stop	0	●
P17.03	Fan CW	Displays whether the current control word for the fan is run or stop. 0: Run 1: Stop	0	●
P17.04	Rectifier unit run/stop command	Displays whether the control word currently exchanged with the rectifier unit is Run or Stop. Range: 0x0000–0xFFFF Bit0: Run Bit1: Stop Bit2–Bit4: Reserved Bit5: Reset Bit6: Emergency stop Bit7–Bit14: Reserved Bit15: Auto run command	0x0000	●
P17.05	Bus voltage	Displays the present DC bus voltage. Range: 0.0–2000.0V	0.0V	●
P17.06	Grid frequency	Displays the present grid frequency of the rectifier unit. Range: 0.0–120.0Hz	0.0Hz	●
P17.07	Grid voltage	Displays the present grid voltage of the inverter. Range: 0.0–2000.0V	0.0V	●
P17.08	3PH voltage unbalance factor	Displays the factor of imbalanced three-phase voltage of the grid. Range: 1.00–10.00	0.00	●
P17.09	Braking transistor module temperature	Displays the braking transistor module temperature.	0.0°C	●

Rectifier function code	Name	Description	Default	Modify										
		Range: -20.0–120.0°C Note: Valid only for the 45kW rectifier unit model.												
P17.10	Rectifier bridge temperature	Displays the rectifier bridge temperature. Range: -20.0–120.0°C	0.0°C	●										
P17.11	3PH AC current	Displays the AC input current of the rectifier unit. Range: 0.0–1000.0A The 160kW and 355kW rectifier unit models support the use of the optional current detection module.	0.0A	●										
P17.12	Digital input terminal state	Displays the present digital input terminal status of the rectifier unit. Range: 0x00–0x1F <table><tr><td>Bit4</td><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>S5</td><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table>	Bit4	Bit3	Bit2	Bit1	Bit0	S5	S4	S3	S2	S1	0x00	●
Bit4	Bit3	Bit2	Bit1	Bit0										
S5	S4	S3	S2	S1										
P17.13	Digital output terminal state	Displays the present digital output terminal status of the rectifier unit. Range: 0x0–0x3 <table><tr><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td></tr></table>	Bit1	Bit0	RO2	RO1	0x0	●						
Bit1	Bit0													
RO2	RO1													
P17.14	Braking unit current	Displays the current of the braking unit. Range: 0.0–6000.0A Only the 45kW rectifier unit model has the built-in braking unit. Other rectifier unit models support only external braking units, and the displayed value is invalid for these models.	0.0A	●										
P17.15	Actual online slave nodes	Number of actual online slave nodes. Range: 0–31	0	●										
P17.16	Slot 1 expansion card type (Near relay terminals)	P17.16 setting range: 0–18 (Slot 1 expansion card type) P17.17 setting range: 0–18 (Slot 2 expansion card type)	0	●										
P17.17	Slot 2 expansion card type (Near AC input cables)	0: No card 1: PLC card 2: I/O card 3–4: Reserved 5: Ethernet 6: DP communication card 7–14: Reserved 15: PROFINET communication card 16: Reserved 17: EtherCAT communication card 18: Reserved	0	●										
P17.18	Slot 1 expansion card software version	Displays the software version of the expansion card in slot 1. Range: 0.00–655.35	0.00	●										

Rectifier function code	Name	Description	Default	Modify
P17.19	Slot 2 expansion card software version	Displays the software version of the expansion card in slot 2. Range: 0.00–655.35	0.00	●
P17.20	Status of slaves 02–17	Displays the online status of slave nodes 02–17. Range: 0x0000–0xFFFF 0: Offline 1: Online	0x0000	●
P17.21	Status of slaves 18–32	Displays the online status of slave nodes 18–31. Range: 0x0000–0x7FFF 0: Offline 1: Online	0x0000	●
P17.22	Rectifier unit status word	0x0000–0xFFFF	0x0000	●
P17.23	CANopen bus load rate	Displays the CANopen bus load rate. Range: 0.0–100.0%	0.0%	●
P17.24	R-phase current	Displays the R-phase current. Range: 0.0–1000.0A Note: This function is available when the optional current detection module is used for 160kW and higher models. The same applies below.	0.0A	●
P17.25	S-phase current	Displays the S-phase current. Range: 0.0–1000.0A	0.0A	●
P17.26	T-phase current	Displays the T-phase current. Range: 0.0–1000.0A	0.0A	●

Group P19—Fault information

Rectifier function code	Name	Description	Default	Modify
P19.00	Present fault type	Common fault type: 0: No fault 1: Grid undervoltage (Lv1) 2: Grid overvoltage (ov1) 3: Grid phase-A loss (SPI1) 4: Grid phase-B loss (SPI2) 5: Grid phase-C loss (SPI3) 6: Phase lock failure (PLLf) 7: DC undervoltage (Lv) 8: DC overvoltage (ov) 9: Reserved 10: EEPROM operation fault (EEP) 11: Braking unit straight-through fault (bCE) 12: External fault (EF) 13: Braking unit overload fault (bOL) 14: Braking unit overcurrent fault (bOC) 15: RS485 communication fault (E-485) 16: CANopen communication fault (E-CAN)		●
P19.01	Last fault type			●
P19.02	2nd-last fault type			●
P19.03	3rd-last fault type			●
P19.04	4th-last fault type			●
P19.05	5th-last fault type		0	●

Rectifier function code	Name	Description	Default	Modify
		17: Reserved 18: DP communication fault (E-DP) 19: Reserved 20: PLC card communication fault (E-PLC) 21: Module overheating (OH1) 22: Braking unit overheating fault (bOH) 23: Reserved 24: PROFINET communication timeout fault (E-PN) 25–54: Reserved 55: Parameter download error (E-DNE) 56: Some inverter units are offline (OFFL) 57: EtherCAT communication timeout (E-CAT) 58: CAN master/slave fault (SECAN) 59: CAN master/slave slave fault (S-Err) 60: Reserved		
P19.06	Grid frequency at present fault		0 . 0	●
P19.07	DC voltage at present fault		0 . 0	●
P19.08	Grid voltage at present fault		0	●
P19.09	Brake current at present fault		0 . 0	●
P19.10	Brake temperature at present fault		0 . 0	●
P19.11	Rectifier bridge temperature at present fault		0 . 0	●
P19.12	Input terminal state at present fault		0	●
P19.13	Output terminal state at present fault		0	●
P19.14	Offline unit node ID		/	/
P19.15	Reserved		/	/
P19.16	Grid frequency at last fault		0 . 0	●
P19.17	DC voltage at last fault		0 . 0	●
P19.18	Grid voltage at last fault		0	●
P19.19	Braking unit current at last fault		0 . 0	●
P19.20	Braking unit temperature at last fault		0 . 0	●
P19.21	Rectifier bridge temperature at last fault		0 . 0	●
P19.22	Input terminal state at last fault		0	●
P19.23	Output terminal state at last fault		0	●
P19.24– P19.25	Reserved		/	/
P19.26	Grid frequency at 2nd-last fault		0 . 0	●
P19.27	DC voltage at 2nd-last fault		0 . 0	●
P19.28	Grid voltage at 2nd-last fault		0	●
P19.29	Braking unit current at 2nd-last fault		0 . 0	●
P19.30	Braking unit temperature at 2nd-last fault		0 . 0	●
P19.31	Rectifier bridge temperature at 2nd-last fault		0 . 0	●
P19.32	Input terminal state at 2nd-last fault		0	●
P19.33	Output terminal state at 2nd-last fault		0	●
P19.34	Reserved		/	/

Rectifier function code	Name	Description	Default	Modify
P19.35	Function codes in parameter download error	Displays the function code of the parameter in the parameter download error for you to check the corresponding value and range.	0	●

Group P20—Serial communication

Rectifier function code	Name	Description	Default	Modify
P20.00	Terminal RS485 local communication address	Setting range: 1–127 If the slave communication address in the message frame sent from the master is set to 0, it serves as a broadcast communication address. All slaves on the Modbus bus will receive the frame, but the slaves will not respond to it. The communication addresses on the communication network are unique, which is the basis of the point-to-point communication between the host controller and the VFD. Note: The slave address cannot be set to 0.	1	○
P20.01	Terminal RS485 communication baud rate setting	Used to set the rate of data transmission between the host controller and rectifier unit. 0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps Note: The baud rate set on the rectifier unit must be consistent with that on the host controller. Otherwise, the communication fails. A greater baud rate indicates faster communication.	4	○
P20.02	Terminal RS485 data bit parity setting	The data format set on the rectifier unit must be consistent with that on the host controller. Otherwise, the communication fails. 0: No parity (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No parity (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1	○
P20.03	Communication response delay	Setting range: 0–200ms Used to indicate the communication response delay, that is, the interval from when the rectifier	5ms	○

Rectifier function code	Name	Description	Default	Modify
		unit completes receiving data to when it sends response data to the host controller. If the response delay is shorter than the system processing time, the system sends response data to the host controller after processing data. If the delay is longer than the system processing time, the system does not send response data to the host controller until the delay is reached although data has been processed.		
P20.04	Communication timeout fault time	Setting range: 0.0 (invalid), 0.1–60.0s When the function code is set to 0.0, the communication timeout time is invalid. When the function code is set to a non-zero value, the system reports the "485 communication fault" (CE) if the communication interval exceeds the value. In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.	0.0s	○
P20.05	Transmission fault handling	0: Report an alarm and stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0	○
P20.06	Communication handling action selection	Setting range: 0x00–0x11 LED ones place: 0: Respond to write operations. The rectifier unit responds to both read and write commands from the host controller. 1: Do not respond to write operations. The rectifier unit does not respond to the write commands, but responds only to the read commands from the host controller. This setting can improve the communication efficiency. Tens place: Communication password protection 0: Communication user password protection is invalid. 1: Communication user password protection is valid.	0x00	○
P20.07	RJ45 port RS485 communication address	Setting range: 1–247 Note: If the local communication address is set to 0, the unit cannot be recognized by the LCD keypad. For details, see E.9.2 LCD keypad.	1	○

Rectifier function code	Name	Description	Default	Modify
P20.08	RJ45 port RS485 communication baud rate	0: 1200 bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps	4	○
P20.09	RJ45 port RS485 data bit parity setting	0: No parity (N, 8, 1) for RTU 1: Even parity (E, 8, 1) for RTU 2: Odd parity (O, 8, 1) for RTU 3: No parity (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	0	○

Group P21—CANopen communication

Rectifier function code	Name	Description	Default	Modify
P21.00	Reserved	/	/	/
P21.01	CANopen module address	Setting range: 0–127	1	○
P21.02–P21.12	Reserved	/	/	/
P21.13	PZD2 transmit	Used when the rectifier unit works as the CANopen slave node or used in PLC-to-CANopen networking. 0: Invalid 1: Fault code 2: DC voltage (×10, V) 3: Grid voltage (×1, V) 4: Grid frequency (×10, Hz) 5: Braking unit current (×10, A) 6: Terminal input status 7: Terminal output status	0	○
P21.14	PZD3 transmit		0	○
P21.15	PZD4 transmit		0	○
P21.16	PZD5 transmit		0	○
P21.17	PZD6 transmit		0	○
P21.18	PZD7 transmit		0	○
P21.19	PZD8 transmit		0	○
P21.20	PZD9 transmit		0	○
P21.21	PZD10 transmit		0	○
P21.22	PZD11 transmit		0	○
P21.23	PZD12 transmit	8: Number of online slave nodes 9: Online/offline status of slave nodes 02–17 10: Online/offline status of slave nodes 18–32 11: CANopen bus load rate 12: Type of card at slot 1 13: Type of card at slot 2 14: Software version of card at slot 1 15: Software version of card at slot 2 16: R-phase current value (P07.17 enabled) 17: S-phase current value (same as above) 18: T-phase current value (same as above) 19–20: Reserved	0	○
P21.24–P21.26	Reserved	/	/	/
P21.27	SYNC message transmission period	0–3000(ms)	10ms	○

Rectifier function code	Name	Description	Default	Modify
P21.28	CAN sampling rate selection	0: TI standard CAN sample point (approximately 65%) 1: Industry-standard CAN sample point (approximately 80% ± 5%)	0	○
P21.29	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4	○
P21.30	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–100.0s	0.0s	○
P21.31	Reserved	/	/	/
P21.32	CANopen_RXPDO data exchange cycle setting mode	0: Rectifier manual mode 1: Rectifier automatic regulation mode (by CAN load rate) 2: Inverter manual regulation mode	0	○
P21.33	Number of CANopen slave nodes	Setting range: 0–31 (Set this parameter only when the master is active.)	0	○
P21.34	CANopen master/slave selection	0: Slave 1: Master	0	○
P21.35	PDO1 transmission cycle	Setting range: 5–3000ms	20ms	○
P21.36	PDO2 transmission cycle	Setting range: 5–3000ms	10ms	○
P21.37	PDO3 transmission cycle	Setting range: 5–3000ms	30ms	○
P21.38	PDO4 transmission cycle	Setting range: 5–3000ms	50ms	○
P21.39	TPDO1 trigger mode	Setting range: 1–255	255	●
P21.40	TPDO2 trigger mode	Setting range: 1–255 Note: Restart the unit after modifying this setting.	255	○
P21.41	TPDO3 trigger mode	Setting range: 1–255 Note: Restart the unit after modifying this setting.	255	○
P21.42	TPDO4 trigger mode	Setting range: 1–255 Note: Restart the unit after modifying this setting.	255	○
P21.43	Slave heartbeat cycle	Setting range: 0–10000ms	500ms	○
P21.44	TPDO2 event timer	Setting range: 0–10000ms	0ms	○
P21.45	TPOO3 event timer	Setting range: 0–10000ms	0ms	○
P21.46	TPOO4 event timer	Setting range: 0–10000ms	0ms	○
P21.47	TPDO2 inhibit time	Setting range: 0–10000ms	50ms	○
P21.48	TPDO3 inhibit time	Setting range: 0–10000ms	50ms	○
P21.49	TPDO4 inhibit time	Setting range: 0–10000ms	50ms	○
P21.50	PDO_CW transmission cycle	Setting range: 0: invalid, 1–200ms	0 ms	○
P21.51	PDO receive enable	Setting range: 0x0–0xF (0: Disable; 1: Enable) Bit0: PDO1	0x7	○

Rectifier function code	Name	Description	Default	Modify
P21.52	PDO transmit enable	Bit1: PDO2 Bit2: PDO3 Bit3: PDO4 Bit4–bit15: Reserved	0x7	○
P21.53	PN/ECAT/DP card PZD configuration selection	0: PKW1–PZD8 1: PKW1–PZD12	1	○
P21.54	CAN extended frame enable	0–1 0: Enable 1: Disable	0	○
P21.55	Industry macro	0–1 0: Reserved 1: HNKS-specific macro 2: FS-specific macro	0	○
P21.56	CAN master/slave communication address	Setting range: 0–4	1	○
P21.57	CAN master/slave communication rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4	○
P21.58	CAN master/slave communication timeout time	Setting range: 0.0–30.0s	5.0s	○
P21.59	Master/slave mode	0: Invalid 1: Master 2: Slave	0	○
P21.60	Master/slave control mode	Setting range: 0x000–0x110 Ones place: Reserved Tens place: Whether slave receives control commands from master 0: Slave receives control commands from master 1: Slave does not receive control commands from master Hundreds place: Enable master/slave to transmit/receive data 0: Enable 1: Disable	0x000	○
P21.61	Slave count	Setting range: 0–3	1	○
P21.62	Parallel-operation synchronized braking adjustment voltage	Setting range: 0.0–100.0V	23.0V	○

Group P22—Communication expansion function group 1 (PROFIBUS-DP)

Rectifier function code	Name	Description	Default	Modify
P22.00	Reserved	/	/	/
P22.01	PROFIBUS-DP expansion card module address	Setting range: 0–127	3	○
P22.02–P22.12	Reserved	/	/	/
P22.13	PZD2 transmit	Used only when the rectifier unit has been configured with a PROFIBUS-DP communication card. 0: Invalid 1: Fault code 2: DC voltage (×10, V) 3: Grid voltage (×1, V) 4: Grid frequency (×10, Hz) 5: Braking unit current (×10, A) 6: Terminal input status 7: Terminal output status 8: Number of online slave nodes 9: Online/offline status of slave nodes 02–17 10: Online/offline status of slave nodes 18–32 11: CANopen bus load rate 12: Type of card at slot 1 13: Type of card at slot 2 14: Software version of card at slot 1 15: Software version of card at slot 2 16: R-phase current value (P07.17 enabled) 17: S-phase current value (same as above) 18: T-phase current value (same as above) 19–20: Reserved	0	○
P22.14	PZD3 transmit		0	○
P22.15	PZD4 transmit		0	○
P22.16	PZD5 transmit		0	○
P22.17	PZD6 transmit		0	○
P22.18	PZD7 transmit		0	○
P22.19	PZD8 transmit		0	○
P22.20	PZD9 transmit		0	○
P22.21	PZD10 transmit		0	○
P22.22	PZD11 transmit		0	○
P22.23	PZD12 transmit		0	○
P22.24	EtherCAT communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s	○
P22.25	PROFIBUS-DP communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s	○
P22.26	PROFINET communication timeout time	Setting range: 0.0 (invalid), 0.1–30.0s	5.0s	○
P22.27	Reserved	/	/	/
P22.28	Inverter unit PKW area compatibility	0: 8 bytes (PKW1–4) 1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of inverter function parameter P14.42.	1	○
P22.29–P22.46	Reserved	/	/	/

Group P23—Communication expansion function group 2 (EtherNet/PROFINET/EtherCAT)

Rectifier function code	Name	Description	Default	Modify
P23.00	Ethernet communication rate setting	0: Self adaptive 1: 100M full duplex 2: 100M half duplex 3: 10M full duplex 4: 10M half duplex	0	○
P23.01	Ethernet IP address 1	Setting range: 0–255	192	○
P23.02	Ethernet IP address 2		168	○
P23.03	Ethernet IP address 3		0	○
P23.04	Ethernet IP address 4		1	○
P23.05	Ethernet subnet mask 1	Setting range: 0–255	255	○
P23.06	Ethernet subnet mask 2		255	○
P23.07	Ethernet subnet mask 3		255	○
P23.08	Ethernet subnet mask 4		0	○
P23.09	Ethernet gateway address 1	Setting range: 0–255	192	○
P23.10	Ethernet gateway address 2		168	○
P23.11	Ethernet gateway address 3		0	○
P23.12	Ethernet gateway address 4		1	○
P23.13	Ethernet monitoring address 1	Setting range: 0x0000–0xFFFF Note: Used for software debugging.	0x0000	○
P23.14	Ethernet monitoring address 2		0x0000	○
P23.15	Ethernet monitoring address 3		0x0000	○
P23.16	Ethernet monitoring address 4		0x0000	○
P23.17–P23.27	Reserved	/	/	/
P23.28	PZD2 transmit	Used only when the rectifier unit has been configured with a PROFINET or EtherCAT communication card. 0: Invalid 1: Fault code 2: Bus voltage (×10, V) 3: Grid voltage (×1, V) 4: Grid frequency (×10, Hz) 5: Braking current (×10, A) 6: Input terminal status 7: Output terminal status 8: Number of online slave nodes 9: Online/offline status of slave nodes 02–17	0	○
P23.29	PZD3 transmit		0	○
P23.30	PZD4 transmit		0	○
P23.31	PZD5 transmit		0	○
P23.32	PZD6 transmit		0	○
P23.33	PZD7 transmit		0	○
P23.34	PZD8 transmit		0	○
P23.35	PZD9 transmit		0	○
P23.36	PZD10 transmit		0	○
P23.37	PZD11 transmit		0	○
P23.38	PZD12 transmit		0	○

Rectifier function code	Name	Description	Default	Modify
		10: Online/offline status of slave nodes 18–32 11: CANopen bus load rate 12: Type of card at slot 1 13: Type of card at slot 2 14: Software version of card at slot 1 15: Software version of card at slot 2 16: R-phase current value (P07.17 enabled) 17: S-phase current value (same as above) 18: T-phase current value (same as above) 19–20: Reserved		

Group P24—PLC card functions

Rectifier function code	Name	Description	Default	Modify
P24.00	PLC card function enable	0: Disable 1: Enable	0	⊙
P24.01	C_WrP1	Setting range: 0–65535 Used to write a value to WrP1 of the PLC card.	0	○
P24.02	C_WrP2	Setting range: 0–65535 Used to write a value to WrP2 of the PLC card.	0	○
P24.03	C_WrP3	Setting range: 0–65535 Used to write a value to WrP3 of the PLC card.	0	○
P24.04	C_WrP4	Setting range: 0–65535 Used to write a value to WrP4 of the PLC card.	0	○
P24.05	C_WrP5	Setting range: 0–65535 Used to write a value to WrP5 of the PLC card.	0	○
P24.06	C_WrP6	Setting range: 0–65535 Used to write a value to WrP6 of the PLC card.	0	○
P24.07	C_WrP7	Setting range: 0–65535 Used to write a value to WrP7 of the PLC card.	0	○
P24.08	C_WrP8	Setting range: 0–65535 Used to write a value to WrP8 of the PLC card.	0	○
P24.09	C_WrP9	Setting range: 0–65535 Used to write a value to WrP9 of the PLC card.	0	○
P24.10	C_WrP10	Setting range: 0–65535 Used to write a value to WrP10 of the PLC card.	0	○
P24.11	PLC card status	0: Stop 1: Run	0	●
P24.12	C_MoP1	Used to monitor/view the MoP1 value of the PLC card.	0	●
P24.13	C_MoP2	Used to monitor/view the MoP2 value of the PLC card.	0	●
P24.14	C_MoP3	Used to monitor/view the MoP3 value of the PLC card.	0	●
P24.15	C_MoP4	Used to monitor/view the MoP4 value of the	0	●

Rectifier function code	Name	Description	Default	Modify
		PLC card.		
P24.16	C_MoP5	Used to monitor/view the MoP5 value of the PLC card.	0	●
P24.17	C_MoP6	Used to monitor/view the MoP6 value of the PLC card.	0	●
P24.18	C_MoP7	Used to monitor/view the MoP7 value of the PLC card.	0	●
P24.19	C_MoP8	Used to monitor/view the MoP8 value of the PLC card.	0	●
P24.20	C_MoP9	Used to monitor/view the MoP9 value of the PLC card.	0	●
P24.21	C_MoP10	Used to monitor/view the MoP10 value of the PLC card.	0	●
P24.22–P24.23	Reserved	/	/	/
P24.24	PLC card power-loss retention enable	0: Disable 1: Enable	0	◎

8.3 Non-gateway-type rectifier unit function parameter list

Group P00—Basic functions

Rectifier function code	Name	Description	Default	Modify
P00.00	Control board software version number (Uncontrolled rectifier unit version number)	Actual control board software version Setting range: 1.00–655.35	Depends on version	●
P00.03	Undervoltage point for bus voltage	Undervoltage point for bus voltage for protection purpose. When the bus voltage is lower than the value of this function parameter during running, the VFD stops and reports the bus undervoltage fault. Setting range: 0.0–500.0V	350.0V	◎
P00.04	Braking unit braking start voltage	Voltage at which the braking unit starts braking. When the bus voltage reaches the value of this function parameter during running, the braking transistor starts braking. This function is valid only for the models configured with built-in braking units, invalid for the models connected to external brakes. Setting range: 400.0–800.0V	700.0V	○
P00.05	Overvoltage point for bus voltage	Overvoltage point for bus voltage for protection purpose. When the bus voltage is higher than the value of this function parameter during running, the VFD stops and reports the bus overvoltage	800.0V	◎

Rectifier function code	Name	Description	Default	Modify
		fault. Setting range: 500.0–850.0V		
P00.09	Cooling fan operating mode	0: Normal mode In this mode, when the rectifier detects that the rectifier bridge temperature exceeds 55°C, the fan also runs in the stopped state. 1: The fan keeps running after power-on The fan starts running when the main power is switched on.	0	○
P00.10	Braking transistor shoot-through protection enable	Setting range: 0x000–0x111 P00.10 specifies the fault protection mode for the braking transistor. 0: Disable 1: Enable Ones place: Braking transistor shoot-through enable selection. Tens place: Braking transistor overcurrent enable selection. Hundreds place: Braking transistor overload enable selection. Note: Valid only for the rectifier unit with the built-in braking unit.	0x111	◎
P00.11	3PH input exception protection enable	Setting range: 0x000–0x101 P00.11 is used to select the mode of protection against grid voltage detection faults. 0: Disable 1: Enable Ones place: indicates whether to enable input phase loss protection Tens place: Reserved Hundreds place: indicates whether to enable grid undervoltage protection Note: Exercise caution before modifying the function parameter.	0x001	◎
P00.12	Dynamic braking enable	0: Disable 1: Enable	1	○
P00.14	Function parameter restore	0: No operation 1: Restore default values 2: Clear fault records Note: ● After the selected operation is performed, the function code is automatically restored to 0. ● Restoring the default values may clear the user password. Exercise caution before using this function.	0	◎

Group P01—Rectifier and inverter interaction

Rectifier function code	Name	Description	Default	Modify
P01.10	Grid undervoltage ride-through time	A fault is triggered if the grid undervoltage ride-through time exceeds the time (P01.10+0.3, in seconds). Setting range: 0.000–5.000s	0.000s	◎

Group P06—Output terminal functions

Rectifier function code	Name	Description	Default	Modify
P06.03	RO1 output selection	0: No output 1: Reserved 2: Running 3: Fault output 4–5: Reserved 6: Three-phase input overvoltage 7: Three-phase input undervoltage 8: Module overheat output 9: Braking unit overtemperature output 10–11: Reserved 12: Output when bus voltage > P07.13	3	○
P06.07	Output terminal polarity selection	The function code is used to set the output terminal polarity. When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. Bit0: RO1 Setting range: 0x00–0x01	0x00	○
P06.10	RO1 switch-on delay	These function codes specify delay time corresponding to the level changes of programmable input terminals during switch-on or switch-off. Setting range: 0.000–50.000s	0.000s	○
P06.11	RO1 switch-off delay		0.000s	○

Group P07—HMI

Rectifier function code	Name	Description	Default	Modify
P07.01	Accumulated run time in hours	Displays the accumulated run hours. Range: 0–65535h	0h	●
P07.02	Accumulated run time in minutes	Displays the accumulated run minutes. Range: 0–59min	0min	●
P07.03	Factory bar code 1	Range: 0x0000–0xFFFF	/	●
P07.04	Factory bar code 2	Range: 0x0000–0xFFFF	/	●
P07.05	Factory bar code 3	Range: 0x0000–0xFFFF	/	●

Rectifier function code	Name	Description	Default	Modify
P07.06	Factory bar code 4	Range: 0x0000–0xFFFF	/	●
P07.07	Factory bar code 5	Range: 0x0000–0xFFFF	/	●
P07.08	Factory bar code 6	Range: 0x0000–0xFFFF	/	●
P07.13	RO output bus voltage	Setting range: 400.0–800.0V The voltage hysteresis for RO switching is 10V.	550.0V	◎
P07.18	Auto fault reset enable	0: Disable 1: Enable	0	○

Group P17—Status viewing

Rectifier function code	Name	Description	Default	Modify
P17.00	Rectifier unit rated power	Displays the rated power of the rectifier unit. Range: 0.0–3000.0kW	Depends on model	●
P17.01	Rectifier unit rated current	Displays the rated current of the rectifier unit. Range: 0.00–6000.00A	Depends on model	●
P17.02	Braking unit CW	Displays whether the current control word for the braking unit is run or stop. 0: Run 1: Stop	0	●
P17.03	Fan CW	Displays whether the current control word for the fan is run or stop. 0: Run 1: Stop	0	●
P17.05	Bus voltage	Displays the present DC bus voltage. Range: 0.0–2000.0V	0.0V	●
P17.09	Braking transistor module temperature	Displays the braking transistor module temperature. Range: -20.0–120.0°C Note: Valid only for the 45kW rectifier unit model.	0.0°C	●
P17.10	Rectifier bridge temperature	Displays the rectifier bridge temperature. Range: -20.0–120.0°C	0.0°C	●
P17.13	Digital output terminal state	Displays the present digital output terminal status of the rectifier unit. Range: 0x00–0x01 Bit0: RO1	0x00	●
P17.14	Braking unit current	Displays the current of the braking unit. Range: 0.0–6000.0A	0.0A	●
P17.15	Actual online slave nodes	Number of actual online slave nodes. Range: 0–31	0	●
P17.20	Status of slaves 02–17	Range: 0x0000–0xFFFF	0x0000	●
P17.21	Status of slaves 18–32	Range: 0x0000–0x7FFF	0x0000	●

Group P19—Fault information

Rectifier function code	Name	Description	Default	Modify
P19.00	Present fault type	0: No fault	0	●
P19.01	Last fault type	1: Grid undervoltage (Lv1)		●
P19.02	2nd-last fault type	2: Reserved		●
P19.03	3rd-last fault type	3: Grid phase loss (SPI)		●
P19.04	4th-last fault type	4–6: Reserved		●
P19.05	5th-last fault type	7: DC undervoltage (Lv)		●
		8: DC overvoltage (ov)		
		9: Reserved		
		10: EEPROM operation fault (EEP)		
		11: Braking transistor shoot-through fault (bCE)		
		12: Reserved		
		13: Braking transistor overload fault (bOL)		
		14: Braking transistor overcurrent fault (bOC)		
		15: RS485 communication fault (E-485)		
		16: CAN communication fault (E-CAN)		
		17–20: Reserved		
		21: Rectifier module overheat (oH1)		
		22: Braking transistor overheating fault (bOH)		
		23–27: Reserved		
		28: RJ45 port RS485 node ID auto-assignment failure (A-IDF)		
		29–57: Reserved		
		58: CAN master/slave fault		
P19.07	DC voltage at present fault		0 . 0 V	●
P19.09	Brake current at present fault		0 . 0 A	●
P19.10	Brake temperature at present fault		0 . 0 ° C	●
P19.11	Rectifier bridge temperature at present fault		0 . 0 ° C	●
P19.17	DC voltage at last fault		0 . 0 V	●
P19.19	Braking unit current at last fault		0 . 0 A	●
P19.20	Braking unit temperature at last fault		0 . 0 ° C	●
P19.21	Rectifier bridge temperature at last fault		0 . 0 ° C	●
P19.27	DC voltage at 2nd-last fault		0 . 0 V	●
P19.29	Braking unit current at 2nd-last fault		0 . 0 A	●
P19.30	Braking unit temperature at 2nd-last fault		0 . 0 ° C	●
P19.31	Rectifier bridge temperature at 2nd-last fault		0 . 0 ° C	●

Group P20—Serial communication

Rectifier function code	Name	Description	Default	Modify
P20.00–P20.02	Reserved	/	/	/
P20.03	Communication response delay	Setting range: 0–200ms	5ms	○

Rectifier function code	Name	Description	Default	Modify
P20.04	Communication timeout fault time	Setting range: 0.0 (invalid)–60.0s	0.0s	○
P20.05	Transmission fault handling	0: Do not report a fault 1: Report a fault	0	○
P20.06	Communication handling action selection	Setting range: 0x00–0x11 LED ones place: 0: Respond to write operations 1: Do not respond to write operations Tens place: Communication password protection 0: Communication user password protection is invalid. 1: Communication user password protection is valid.	0x00	○
P20.07	RJ45 port RS485 communication address	Setting range: 1–247	1	○
P20.08	RJ45 port RS485 communication baud rate	0: 1200kbps 1: 2400kbps 2: 4800kbps 3: 9600kbps 4: 19200kbps 5: 38400kbps 6: 57600kbps 7: 115200kbps	4	○
P20.09	RJ45 port RS485 data bit parity setting	0: No check (N, 8, 1) for RTU 1: Even check (E, 8, 1) for RTU 2: Odd check (O, 8, 1) for RTU 3: No check (N, 8, 2) for RTU 4: Even check (E, 8, 2) for RTU 5: Odd check (O, 8, 2) for RTU	0	○

Group P21—CANopen communication

Rectifier function code	Name	Description	Default	Modify
P21.01	CAN module address	Setting range: 100–103	100	○
P21.29	CAN communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4	○
P21.33	CAN inverter slave count	Setting range: 0–31 Note: When this parameter is set to 0, inverter offline detection based on rectifier CAN broadcast is not performed.	0	○

Rectifier function code	Name	Description	Default	Modify
P21.62	Parallel-operation synchronized braking adjustment voltage	Setting range: 0.0–100.0V	23.0V	○

8.4 Inverter function parameter list

Group P00—Basic functions

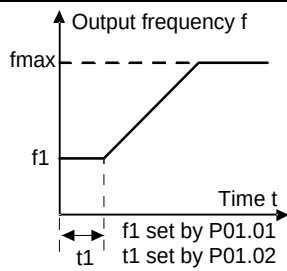
Inverter function code	Name	Description	Default	Modify
P00.00	Speed control mode	0: Sensorless vector control (SVC) mode 0 1: Sensorless vector control (SVC) mode 1 2: Space voltage vector PWM control mode (SVPWM) 3: Closed-loop vector control mode Note: Before using a vector control mode (0, 1, or 3), enable the VFD to perform motor parameter autotuning first.	2	◎
P00.01	Channel of run commands	0: Keypad 1: Terminal 2: Communication	0	○
P00.02	Communication mode of run commands	0: Modbus 1: CANopen 2: Ethernet 3: EtherCAT/PROFINET 4: PLC card 5: Wireless communication card (Reserved) 6: PROFIBUS-DP Note: The options 2, 3, 4, 5, and 6 are add-on functions and are available only when corresponding expansion cards are configured.	0	○
P00.03	Max. output frequency	Used to set the max. output frequency of the inverter unit. Pay attention to the function code because it is the foundation of the frequency setting and the speed of acceleration (ACC) and deceleration (DEC). Setting range: Max(P00.04,10.00)–590.00Hz	50.00Hz	◎
P00.04	Running frequency upper limit	The upper limit of the running frequency is the upper limit of the output frequency of the inverter unit, which is lower than or equal to the max. output frequency. When the set frequency is higher than the upper limit of the running frequency, the upper limit of the running frequency is used for running. Setting range: P00.05–P00.03 (Max. output frequency)	50.00Hz	◎

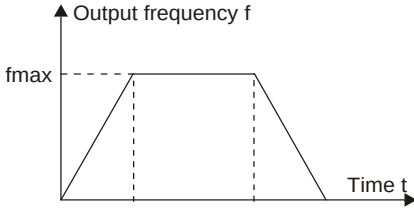
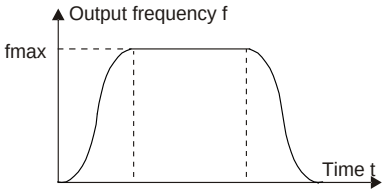
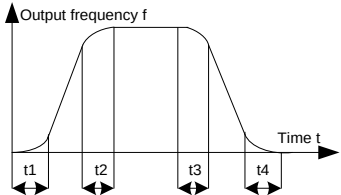
Inverter function code	Name	Description	Default	Modify
P00.05	Running frequency lower limit	The lower limit of the running frequency is the lower limit of the output frequency of the inverter unit. When the set frequency is lower than the lower limit of the running frequency, the lower limit of the running frequency is used for running. Note: Max. output frequency $\geq$ Upper limit of frequency $\geq$ Lower limit of frequency Setting range: 0.00Hz–P00.04 (Upper limit of running frequency)	0.00Hz	⊙
P00.06	A frequency command source	0: Keypad 1: AI1	0	○
P00.07	B frequency command source	2: AI2 3: AI3 4: Reserved 5: Simple PLC program 6: Multi-step speed running 7: PID control 8: Modbus communication 9: CANopen communication 10: Ethernet communication 11: Reserved 12: Pulse train AB 13: EtherCAT/PROFINET communication 14: PLC card 15: PROFIBUS-DP communication 16: Tension setting (valid only for A frequency command) Note: AI3 is an expansion function and requires an expansion card.	11	○
P00.08	B frequency command reference object	0: Max. output frequency 1: A frequency command	0	○
P00.09	Combination mode of setting source	0: A 1: B 2: (A+B) 3: (A-B) 4: Max(A, B) 5: Min(A, B)	0	○
P00.10	Frequency set through keypad	When A and B frequency commands select the keypad for setting, the value of the function code is the original setting one of the frequency data of the inverter unit. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P00.11	ACC time 1	Acceleration (ACC) time refers to the time required for the inverter unit to accelerate from	Depends on model	○
P00.12	DEC time 1	0 Hz to the acceleration/deceleration time base	Depends	○

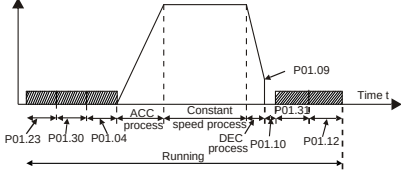
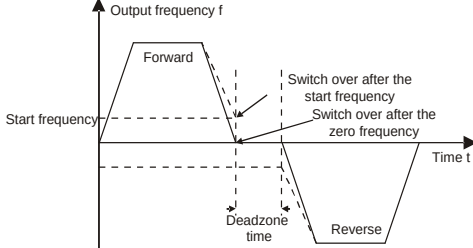
Inverter function code	Name	Description	Default	Modify																				
		frequency (P08.21). Deceleration (DEC) time refers to the time required for the inverter unit to decelerate from the acceleration/deceleration time base frequency (P08.21) to 0 Hz. The inverter unit has four groups of ACC/DEC time, which can be selected by P05. The default ACC/DEC time of the inverter unit is the first group. Setting range of P00.11 and P00.12: 0.0–3600.0s	on model																					
P00.13	Running direction selection	Setting range: 0x00–0x12 Ones place: Run mode selection 0: Run at the default direction 1: Run at the opposite direction 2: Disable reverse running Tens place: Action when the set frequency is negative with reverse run disabled 0: Decelerate to stop 1: Run forward at zero frequency	0x00	○																				
P00.14	Carrier frequency setting	<table><tr><th>Carrier frequency</th><th>Electro magnetic noise</th><th>Noise and leakage current</th><th>Cooling level</th></tr><tr><td>1 kHz</td><td rowspan="3">↑ High ↓ Low</td><td rowspan="3">↑ Low ↓ High</td><td rowspan="3">↑ Low ↓ High</td></tr><tr><td>10 kHz</td></tr><tr><td>15 kHz</td></tr></table> The relationship between models and carrier frequencies is as follows: <table><tr><th colspan="2">Model</th><th>Default carrier frequency</th></tr><tr><td rowspan="3">380V</td><td>1.5–11kW</td><td>8kHz</td></tr><tr><td>15–55kW</td><td>4kHz</td></tr><tr><td>75kW and higher</td><td>2kHz</td></tr></table> Advantage of high carrier frequency: ideal current waveform, little current harmonic wave and motor noise. Disadvantage of high carrier frequency: increasing the switch loss, increasing inverter unit temperature and the impact to the output capacity. The inverter unit needs to derate on high carrier frequency. At the same time, the leakage and electrical magnetic interference will increase. On the contrary, an extremely-low a carrier frequency may cause unstable operation at low	Carrier frequency	Electro magnetic noise	Noise and leakage current	Cooling level	1 kHz	↑ High ↓ Low	↑ Low ↓ High	↑ Low ↓ High	10 kHz	15 kHz	Model		Default carrier frequency	380V	1.5–11kW	8kHz	15–55kW	4kHz	75kW and higher	2kHz	Depends on model	○
Carrier frequency	Electro magnetic noise	Noise and leakage current	Cooling level																					
1 kHz	↑ High ↓ Low	↑ Low ↓ High	↑ Low ↓ High																					
10 kHz																								
15 kHz																								
Model		Default carrier frequency																						
380V	1.5–11kW	8kHz																						
	15–55kW	4kHz																						
	75kW and higher	2kHz																						

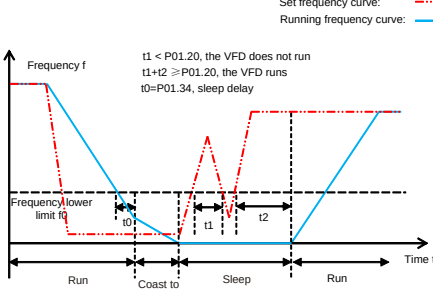
Inverter function code	Name	Description	Default	Modify
		frequency, decrease the torque, or even lead to oscillation. The carrier frequency has been properly set in the factory before the inverter unit is delivered from the factory. In general, you do not need to modify it. When the frequency used exceeds the default carrier frequency, the VFD needs to derate by 10% for each increase of 1k carrier frequency. Setting range: 1.0–15.0kHz		
P00.15	Motor parameter autotuning	Setting range: 0x000–0x234 Ones place: Motor basic parameter autotuning 0: No operation 1: Complete parameter rotary autotuning 2: Complete parameter static autotuning 3: Partial parameter static autotuning 4: VFD parameter autotuning Tens place: Initial magnetic pole angle autotuning 0: No operation 1: Rotary autotuning 2: Static autotuning 3: Rotary autotuning 2 Hundreds place: System inertia autotuning 0: No operation 1: Mode 1 2: Mode 2	0x000	⊙
P00.16	AVR function selection	0: Invalid 1: Valid during the whole procedure Automatic voltage regulation function is used to eliminate the bus voltage fluctuation impact on the inverter unit output voltage.	1	○
P00.17	Reserved	/	/	/
P00.18	Function parameter restore	0: No operation 1: Restore to default values (excluding motor parameters) 2: Clear fault records 3: Lock keypad parameters 4: Reserved 5: Restore to default values (factory test mode) 6: Restore to default values (including motor parameters) Note: After the selected operation is performed, the function code is automatically restored to 0. Restoring the default values may delete the user password. Exercise caution when using this function.	0	⊙

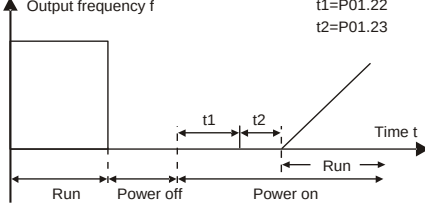
Group P01—Start and stop control

Inverter function code	Name	Description	Default	Modify
P01.00	Start mode	0: Direct start 1: Start after DC braking 2: Start after speed tracking (with excitation) 3: Start after speed tracking (without excitation) 4: Start after speed tracking (software)	0	⊙
P01.01	Starting frequency of direct start	Used to indicate the initial frequency during inverter unit start. See P01.02 (Starting frequency hold time) for detailed information. Setting range: 0.00–50.00Hz	0.50Hz	⊙
P01.02	Starting frequency hold time	 Setting a proper starting frequency can increase the torque during VFD start. During the hold time of the starting frequency, the output frequency of the inverter unit is the starting frequency. And then, the inverter unit runs from the starting frequency to the set frequency. If the set frequency is lower than the starting frequency, the inverter unit stops running and keeps in the standby state. The starting frequency is not limited in the frequency lower limit. Setting range: 0.0–50.0s	0.0s	⊙
P01.03	Braking current before start	The inverter unit performs DC braking with the braking current before start and it speeds up after the DC braking time. If the set DC braking time is 0, DC braking is invalid.	0.0%	⊙
P01.04	Braking time before start	Stronger braking current indicates larger braking power. The DC braking current before start is a percentage of the inverter unit rated output current. P01.03 setting range: 0.0–100.0% P01.04 setting range: 0.00–50.00s	0.00s	⊙
P01.05	ACC/DEC mode	Used to select the frequency change mode during starting and running. 0: Linear type. The output frequency increases or decreases linearly.	0	⊙

Inverter function code	Name	Description	Default	Modify
		 1: S curve. The output frequency increases or decreases according to the S curve. The S curve is generally applied to elevators, conveyors, and other application scenarios where smoother start or stop is required.  Note: If mode 1 is selected, set P01.06, P01.07, P01.27, and P01.28 accordingly.		
P01.06	Time of starting segment of ACC S curve	The curvature of S curve is determined by the ACC range and ACC/DEC time.	0.1s	⊙
P01.07	Time of ending segment of ACC S curve	 t1=P01.06 t2=P01.07 t3=P01.27 t4=P01.28 Setting range: 0.0–50.0s	0.1s	⊙
P01.08	Stop mode	0: Decelerate to stop. After a stop command takes effect, the inverter unit lowers output frequency based on the DEC mode and the defined DEC time; after the frequency drops to the stop speed (P01.15), the inverter unit stops. 1: Coast to stop. After a stop command takes effect, the inverter unit stops output immediately, while the load coasts to stop according to mechanical inertia.	0	○
P01.09	Starting frequency for braking at stop	Starting frequency of DC braking for stop: During the deceleration to stop, the VFD starts DC braking for stop when running frequency reaches the starting frequency determined by P01.09.	0.00Hz	○
P01.10	Demagnetization time		0.00s	○
P01.11	DC braking current at stop		0.0%	○
P01.12	DC braking time at stop	Wait time before DC braking: The inverter unit blocks the output before starting DC braking. After this wait time, DC braking is started so as to prevent overcurrent caused by DC braking	0.0s	○

Inverter function code	Name	Description	Default	Modify
		at high speed. DC braking current for stop: It indicates the applied DC braking energy. Stronger current indicates greater DC braking effect. DC braking time for stop: It indicates the hold time of DC braking. If the time is 0, DC braking is invalid, and the inverter unit decelerates to stop within the specified time.  P01.09 setting range: 0.00Hz–P00.03 P01.10 setting range: 0.00–30.00s P01.11 setting range: 0.0–100.0% (of the VFD rated output current) P01.12 setting range: 0.0–50.0s		
P01.13	FWD/REV run deadzone time	Sets the transition time at the point specified by P01.14 during switching between forward and reverse running of the inverter unit.  Setting range: 0.0–3600.0s	0.0s	○
P01.14	FWD/REV run switching mode	0: Switch at zero frequency 1: Switch at the starting frequency 2: Switch after the speed reaches the stop speed with a delay	1	◎
P01.15	Stop speed	Setting range: 0.00–100.00Hz	0.50Hz	◎
P01.16	Stop speed detection mode	0: Based on speed reference (only detection mode available in SVPWM control mode) 1: Based on speed feedback	0	◎
P01.17	Stop speed detection time	Setting range: 0.00–100.00s	0.50s	◎
P01.18	Terminal run command protection at power-up	When the channel of running commands is terminal control, the system detects the state of the running terminal during power-up. 0: The terminal running command is invalid at power-up. Even the running command is considered as valid during power-on, the inverter unit does not run and it keeps the protection state until the running command is	0	○

Inverter function code	Name	Description	Default	Modify
		canceled and enabled again. 1: The terminal running command is valid at power-on. If the running command is considered as valid during power-on, the inverter unit is started automatically after the initialization. Note: Use this function with caution. Otherwise, serious consequences may result.		
P01.19	Action when running frequency falls below the lower limit	Specifies the running state of the inverter unit when the set frequency is lower than the lower-limit one. (Valid when the frequency lower limit is greater than 0.) Setting range: 0x00–0x12 Ones place: Action selection 0: Run at the frequency lower limit 1: Stop 2: Sleep Tens place (valid only when ones place = 1 or 2): Stop method 0: Coast to stop 1: Decelerate to stop When the set frequency is lower than the lower-limit frequency, the inverter unit coasts to stop. When the set frequency becomes higher than the lower-limit frequency again and it lasts for the time set by P01.20, the inverter unit automatically resumes running.	0x00	⊙
P01.20	Wake-up-from-sleep delay	Specifies the wake-up-from-sleep delay time. When the running frequency of the inverter unit is lower than the lower limit, the inverter unit becomes standby. When the set frequency exceeds the lower limit once again and it lasts for the time set by P01.20, the inverter unit runs automatically.  Setting range: 0.0–3600.0s (Valid when P01.19ones place=2)	0.0s	○
P01.21	Power-loss restart selection	Determines whether the inverter unit will automatically start running after a power loss and subsequent power restoration.	0	○

Inverter function code	Name	Description	Default	Modify
		0: Disable restart 1: Restart allowed. That is, after power is restored following a power down, if the startup conditions are met, the inverter unit automatically runs after the time defined by P01.22 elapses.		
P01.22	Power-loss restart wait time	Indicates the wait time before the automatic running of the inverter unit that is re-powered on.  Setting range: 0.0–3600.0s (valid only when P01.21 = 1)	1.0s	○
P01.23	Start delay time	This function keeps the inverter unit in standby after a run command is given. After the delay time set by P01.23 elapses, the inverter unit starts output, enabling brake release. Setting range: 0.0–600.0s	0.0s	○
P01.24	Stop speed delay time	Setting range: 0.0–600.0s	0.0s	○
P01.25	Open-loop 0Hz output selection	0: Output without voltage 1: Output with voltage 2: Output according to the DC braking current at stop	0	○
P01.26	DEC time for emergency stop	Setting range: 0.0–60.0s	2.0s	○
P01.27	Time of starting segment of DEC S curve	Setting range: 0.0–50.0s	0.1s	◎
P01.28	Time of ending segment of DEC S curve	Setting range: 0.0–50.0s	0.1s	◎
P01.29	Short-circuit braking current	During startup, when the startup mode is direct frequency startup (P01.00=0), set P01.30 to a non-zero value to enter short-circuit braking.	0.0%	○
P01.30	Short-circuit braking hold time at start	During stop, when the running frequency is lower than the starting frequency for braking at stop (P01.09), set P01.31 to a non-zero value to enter short-circuit braking at stop. and then carry out DC braking in the time set by P01.12. (Refer to the descriptions for P01.09–P01.12.)	0.00s	○
P01.31	Short-circuit braking hold time at stop	P01.29 setting range: 0.0–150.0% (of the VFD rated output current) P01.30 setting range: 0.0–50.0s P01.31 setting range: 0.0–50.0s	0.00s	○

Inverter function code	Name	Description	Default	Modify
P01.32	Pre-excitation time for jogging	Setting range: 0–10.000s	0.300s	○
P01.33	Starting frequency of braking at jog stop	Setting range: 0.00Hz–P00.03	0.00Hz	○
P01.34	Sleep entry delay time	Setting range: 0–3600.0s	0.0s	○
P01.35	Speed tracking method	Setting range: 0x000–0x112 Ones place: Speed tracking method selection 0: Track according to stop frequency 1: Track according to rated frequency 2: Track according to max. frequency Tens place: Tracking direction 0: Single (set) direction 1: Dual (forward and reverse) directions Hundreds place: Tracking current limit (PWM output is inhibited when the current exceeds this value) 0: 20% (relative to the larger of VFD current and motor current) 1: 10% (relative to the larger of VFD current and motor current)	0x000	○
P01.36	Speed tracking quick/slow selection	Setting range: 0–10000	300	○
P01.37	Speed tracking voltage coefficient	Setting range: 0–50	10	○

Group P02—Motor 1 parameters

Inverter function code	Name	Description	Default	Modify
P02.00	Motor 1 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	⊙
P02.01	AM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model	⊙
P02.02	AM 1 rated frequency	Setting range: 0.01 Hz–P00.03 (Max. output frequency)	50.00Hz	⊙
P02.03	AM 1 rated speed	Setting range: 1–60000rpm	Depends on model	⊙
P02.04	AM 1 rated voltage	Setting range: 0–1200V		⊙
P02.05	AM 1 rated current	Setting range: 0.8–6000.0A		⊙
P02.06	AM 1 stator resistance	Setting range: 0.001–65.535Ω		○
P02.07	AM 1 rotor resistance	Setting range: 0.001–65.535Ω		○
P02.08	AM 1 leakage inductance	Setting range: 0.1–6553.5mH		○
P02.09	AM 1 mutual inductance	Setting range: 0.1–6553.5mH		○
P02.10	AM 1 no-load current	Setting range: 0.1–6553.5A		○
P02.11	AM 1 core saturation coefficient 1	Setting range: 0.0–100.0%	80.0%	○

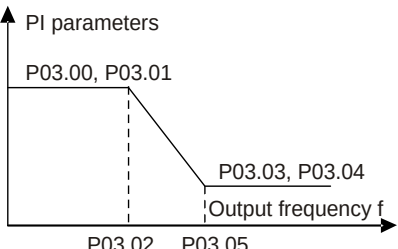
Inverter function code	Name	Description	Default	Modify
P02.12	AM 1 core saturation coefficient 2	Setting range: 0.0–100.0%	68.0%	○
P02.13	AM 1 core saturation coefficient 3	Setting range: 0.0–100.0%	57.0%	○
P02.14	AM 1 core saturation coefficient 4	Setting range: 0.0–100.0%	40.0%	○
P02.15	SM 1 rated power	Setting range: 0.1–3000.0kW	Depends on model	◎
P02.16	SM 1 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P02.17	SM 1 pole pair count	Setting range: 1–128	2	◎
P02.18	SM 1 rated voltage	Setting range: 0–1200V	Depends on model	◎
P02.19	SM 1 rated current	Setting range: 0.8–6000.0A		◎
P02.20	SM 1 stator resistance	Setting range: 0.001–65.535Ω		○
P02.21	SM 1 direct-axis inductance	Setting range: 0.01–655.35mH		○
P02.22	SM 1 quadrature-axis inductance	Setting range: 0.01–655.35mH		○
P02.23	SM 1 back-EMF	Setting range: 0–10000V	300V	○
P02.24	SM 1 initial pole position	Setting range: 0x0000–0xFFFF	0x0000	●
P02.25	SM back-EMF identification rotation frequency	Setting range: 5.0–100.0%	60.0%	◎
P02.26	Motor 1 overload protection selection	0: No protection 1: Common motor protection (with low-speed compensation). As the cooling effect of a common motor is degraded at low speed running, the corresponding electronic thermal protection value needs to be adjusted properly. The low compensation indicates lowering the overload protection threshold of the motor whose running frequency is lower than 30Hz. 2: Variable-frequency motor protection (without low speed compensation). Because the heat dissipation function for a variable-frequency motor is not impacted by the rotation speed, it is not necessary to adjust the protection value at low speed running.	2	◎
P02.27	Motor 1 overload protection coefficient	Motor overload multiplication $M = I_{out}/(I_n * K)$ I_n indicates the rated motor current, I_{out} indicates the inverter unit output current, and K indicates the motor overload protection coefficient. As "K" decreases, "M" increases, resulting in easier protection triggering. when $M=116\%$, protection is performed after motor overload lasts for 1 hour;	100.0%	○

Inverter function code	Name	Description	Default	Modify
		when M=150%, protection is performed after motor overload lasts for 12 minutes; When M=180%, motor overload protection is triggered after the motor overload lasts for 5 minutes. When M=200%, motor overload protection is triggered after the motor overload lasts for 60 seconds. When M≥400%, overload protection is triggered immediately. Setting range: 20.0%–150.0%		
P02.28	Motor 1 power display calibration coefficient	The function code can be used to adjust the power display value of motor 1. However, it does not affect the control performance of the inverter unit. Setting range: 0.00–3.00	1.00	☐
P02.29	Motor 1 parameter display selection	0: Display by motor type. In this mode, only parameters related to the present motor type are displayed. 1: Display all. In this mode, all the motor parameters are displayed.	0	☐
P02.30	Motor 1 system inertia	Setting range: 0.001–30.000kg.m ²	0.001 kg.m ²	☐
P02.31	Motor parameter model calculation	0: Disable 1: Enable Note: Before enabling this function, set P02.32 according to the motor nameplate.	0	☒
P02.32	AM 1 power factor setting	Setting range: 0.00–1.00	0.85	☐
P02.33	AM 1 rated speed high word	Setting range: 0–30 (10kRPM)	0	☒
P02.34	AM 1 core saturation coefficient 1	Setting range: 0.0–200.0%	125.0%	☐
P02.35	AM 1 core saturation coefficient 2	Setting range: 0.0–200.0%	125.0%	☐
P02.36	AM 1 mutual inductance saturation coefficient 1	Setting range: 0.0–200.0%	88.0%	☐
P02.37	AM 1 mutual inductance saturation coefficient 2	Setting range: 0.0–200.0%	88.0%	☐

Inverter function code	Name	Description	Default	Modify
P02.38	AM 1 mutual inductance flux weakening coefficient 1	Setting range: 0.0–200.0%	112.5%	○
P02.39	AM 1 mutual inductance flux weakening coefficient 2	Setting range: 0.0–200.0%	117.6%	○
P02.40	AM 1 mutual inductance flux weakening coefficient 3	Setting range: 0.0–200.0%	122.8%	○
P02.41	AM 1 mutual inductance flux weakening coefficient 4	Setting range: 0.0–200.0%	125.0%	○
P02.42	SM 1 direct-axis inductance saturation coefficient 1	Setting range: 100–10000	4096	○
P02.43	SM 1 direct-axis inductance saturation coefficient 2	Setting range: 100–10000	4096	○
P02.44	SM 1 direct-axis inductance saturation coefficient 3	Setting range: 100–10000	4096	○
P02.45	SM 1 direct-axis inductance saturation coefficient 4	Setting range: 100–10000	3686	○
P02.46	SM 1 direct-axis inductance saturation coefficient 5	Setting range: 100–10000	3277	○
P02.47	SM 1 direct-axis inductance saturation coefficient 6	Setting range: 100–10000	2867	○
P02.48	SM 1 direct-axis inductance saturation coefficient 7	Setting range: 100–10000	2458	○
P02.49	SM 1 direct-axis inductance saturation coefficient 8	Setting range: 100–10000	2048	○
P02.50	SM 1 quadrature-axis inductance saturation coefficient 1	Setting range: 100–10000	4096	○
P02.51	SM 1 quadrature-axis inductance saturation coefficient 2	Setting range: 100–10000	4096	○
P02.52	SM 1 quadrature-axis inductance saturation coefficient 3	Setting range: 100–10000	4096	○

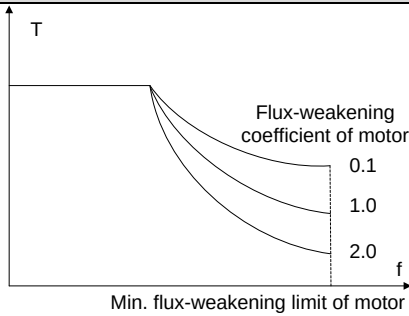
Inverter function code	Name	Description	Default	Modify
P02.53	SM 1 quadrature-axis inductance saturation coefficient 4	Setting range: 100–10000	3686	○
P02.54	SM 1 quadrature-axis inductance saturation coefficient 5	Setting range: 100–10000	3277	○
P02.55	SM 1 quadrature-axis inductance saturation coefficient 6	Setting range: 100–10000	2867	○
P02.56	SM 1 quadrature-axis inductance saturation coefficient 7	Setting range: 100–10000	2458	○
P02.57	SM 1 quadrature-axis inductance saturation coefficient 8	Setting range: 100–10000	2048	○
P02.58	SM 1 back-EMF identification value	Setting range: 0–10000V	0V	○

Group P03—Motor 1 vector control

Inverter function code	Name	Description	Default	Modify
P03.00	Motor 1 speed-loop proportional gain 1	The parameters P03.00–P03.05 are applicable only to vector control mode. Below the switching frequency 1 (P03.02), the speed-loop PI parameters are: P03.00 and P03.01. Above the switching frequency 2 (P03.05), the speed-loop PI parameters are: P03.03 and P03.04. PI parameters are obtained according to the linear change of two groups of parameters. See the following figure: 	20.0	○
P03.01	Motor 1 speed-loop integral time 1		0.200s	○
P03.02	Motor 1 speed-loop switching low-point frequency		5.00Hz	○
P03.03	Motor 1 speed-loop proportional gain 2		20.0	○
P03.04	Motor 1 speed-loop integral time 2		0.200s	○
P03.05	Motor 1 speed-loop switching high-point frequency	The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur; if	10.00Hz	○

Inverter function code	Name	Description	Default	Modify
		proportional gain is too small, stable oscillation or speed offset may occur. PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. P03.00 setting range: 0.0–200.0 P03.01 setting range: 0.000–10.000s P03.02 setting range: 0.00Hz–P03.05 P03.03 setting range: 0.0–200.0 P03.04 setting range: 0.000–10.000s P03.05 setting range: P03.02–P00.03		
P03.06	Motor 1 speed-loop output filter	Setting range: 0–8 (corresponding to 0–2 ⁸ /10ms)	0	○
P03.07	Motor 1 vector control slip compensation coefficient (Motoring)	Slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error.	100%	○
P03.08	Motor 1 vector control slip compensation coefficient (Generating)	Setting range: 50%–200%	100%	○
P03.09–P03.10	Reserved	/	/	/
P03.11	Torque setting method	0–1: Keypad (P03.12) 2: AI1 3: AI2 4: AI3 5: Reserved 6: Multi-step torque 7: Modbus communication 8: CANopen communication 9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET communication 12: PLC card 13: PROFIBUS-DP communication 14: Tension setting Note: 100% corresponds to the motor rated current.	0	○
P03.12	Torque set through keypad	Setting range: -300.0%–300.0% (of the motor rated current)	20.0%	○
P03.13	Torque reference filter time	Setting range: 0.000–10.000s	0.010s	○
P03.14	Setting source of forward rotation upper-limit frequency in torque control	0: Keypad (P03.16) 1: AI1 (100% corresponds to the max. frequency) 2: AI2 3: AI3	0	○

Inverter function code	Name	Description	Default	Modify
		4: Reserved 5: Multi-step setting 6: Modbus communication 7: CANopen communication 8: Ethernet communication 9: Reserved 10: EtherCAT/PROFINET communication 11: PLC card 12: PROFIBUS-DP communication 13: Tension setting Note: 100% corresponds to the max. output frequency (P00.03).		
P03.15	Setting source of reverse rotation upper-limit frequency in torque control	0: Keypad (P03.17) 1–13: Same as those for P03.14	0	○
P03.16	Forward rotation upper-limit frequency set through keypad in torque control	Used to set the frequency upper limits. 100% corresponds to the max. frequency P03.16 sets the value when P03.14=1; P03.17 sets the value when P03.15=1. Setting range: 0.00Hz–P00.03 (Max. output frequency)	50.00Hz	○
P03.17	Reverse rotation upper-limit frequency set through keypad in torque control		50.00Hz	○
P03.18	Setting source of motoring torque upper limit	0: Keypad (P03.20) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Modbus communication 6: CANopen communication 7: Ethernet communication 8: Reserved 9: EtherCAT/PROFINET communication 10: PLC card 11: PROFIBUS-DP communication Note: 100% corresponds to the motor rated current.	0	○
P03.19	Setting source of braking torque upper limit	0: Keypad (P03.21) 1–11: Same as those for P03.18	0	○
P03.20	Motoring torque upper limit set through keypad	Used to set torque limits. Setting range: 0.0–300.0% (of the motor rated current)	180.0%	○
P03.21	Braking torque upper limit set through keypad		180.0%	○
P03.22	Flux weakening coefficient in constant power zone	Used when the AM is in flux-weakening control.	1.0	○

Inverter function code	Name	Description	Default	Modify
P03.23	Min. flux weakening point in constant power zone	 The function codes P03.22 and P03.23 are valid at constant power. The motor enters the flux-weakening state when the motor runs above the rated speed. Change the flux-weakening curvature by modifying the flux-weakening control coefficient. The larger the coefficient, the steeper the curve, the smaller the coefficient, the smoother the curve. P03.22 setting range: 0.1–2.0 P03.23 setting range: 5–100%	10%	○
P03.24	Max. voltage limit	P03.24 sets the max. output voltage of the inverter unit, which is a percentage of the motor rated voltage. Set the value according to onsite conditions. Setting range: 0.0–120.0%	100.0%	○
P03.25	Pre-excitation time	Pre-exciting is performed for the motor when the inverter unit starts. A magnetic field is built inside the motor to improve the torque performance during the start process. Setting range: 0.000–10.000s	0.300s	○
P03.26	Flux-weakening proportional gain	Setting range: 0–8000	1000	○
P03.27	Speed display selection in vector control	0: Display the actual value 1: Display the set value	0	○
P03.28	Static friction compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P03.29	Static friction corresponding frequency point	Setting range: 0.00Hz–P03.31	1.00Hz	○
P03.30	High speed friction torque compensation coefficient	Setting range: 0.0–100.0%	0.0%	○
P03.31	Corresponding frequency of high speed friction torque	Setting range: P03.29–400.00Hz	50.00Hz	○
P03.32	Torque control enable	0: Disable 1: Enable	0	⊙
P03.33	Flux weakening integral gain	Setting range: 0.0–300.0%	100.0%	○

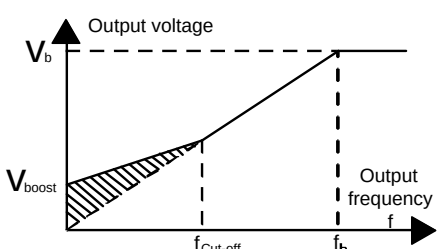
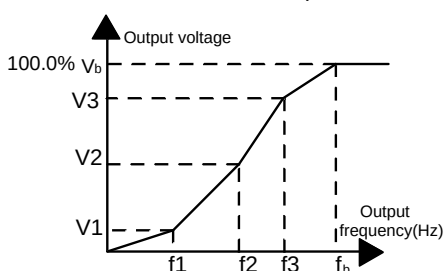
Inverter function code	Name	Description	Default	Modify
P03.34	Reserved	/	/	/
P03.35	Control mode optimization selection	Setting range: 0x0000–0x1111 Ones place: Torque command selection 0: Torque reference 1: Torque current reference Tens place: Reserved Hundreds place: Indicates whether to enable speed-loop integral separation 0: Disable 1: Enable Thousands place: Reserved	0x0000	○
P03.36	Motor 1 speed-loop differential gain	Setting range: 0.00–10.00s	0.00s	○
P03.37–P03.39	Reserved	/	/	/
P03.40	Inertia compensation enable	0: Disable 1: Enable	0	○
P03.41	Inertia compensation torque upper limit	The max. inertia compensation torque is limited to prevent inertia compensation torque from being too large. Setting range: 0.0–150.0% (of the motor rated torque)	10.0%	○
P03.42	Inertia compensation filter count	Filter times of inertia compensation torque, used to smooth inertia compensation torque. Setting range: 0–10	7	○
P03.43	Inertia identification torque	Due to friction force, certain identification torque needs to be set for the inertia identification to be performed properly. Setting range: 0.0–100.0% (of the motor rated torque)	10.0%	○
P03.44	Inertia identification enable	0: No operation 1: Enable	0	◎
P03.45	Reserved	/	/	/
P03.46	Max. torque current	0.0%–200.0% (Active only when P03.47 ones place is set to Enable)	100.0%	○
P03.47	Flux-weakening region constant-torque control enable and torque current limiting enable	0x0000–0x0011 Ones place: Flux-weakening region constant-torque mode enable 0: Disable 1: Enable Tens place: P03.46 function enable 0: Disable 1: Enable	0x0000	○
P03.48	Speed-loop overshoot suppression gain	Setting range: 0–400	0	◎
P03.49	Closed-loop speed observer bandwidth	Setting range: 1.0–200.0	10.0	○

Inverter function code	Name	Description	Default	Modify
P03.50	AM vector energy-saving mode selection	0: Invalid 1: Max. efficiency 2: Optimal power factor 3: MTPA Note: This parameter is shared by motor 1 and motor 2.	0	⊙
P03.51	AM vector energy-saving optimization parameter	Setting range: 25.0–400.0% Note: This parameter is shared by motor 1 and motor 2.	100.0%	○
P03.52	Motor parameter online identification selection	0: No operation 1: Enable	0	○
P03.53	Motor parameter online identification integral gain	Setting range: 0.0–10.0	1.0	○
P03.54	Motor 1 current-loop band width	Setting range: 0–2000	400	○
P03.55	SM max. flux weakening current	Setting range: 0.0–200.0%	50.0%	⊙
P03.56	Vector control loop optimization parameter	Setting range: 0x000–0xFFFF Bit0: Voltage feedforward compensation enable (valid in FVC) Bit1: Direct-axis voltage cross decoupling enable (valid in FVC) Bit2: Quadrature-axis voltage cross decoupling enable (valid in FVC) Bit3: Closed-loop disturbance feedforward compensation enable Bit4: Quadrature-axis voltage restriction selection 0: Limit to 1.2 times the rated motor voltage 1: Limit to direct-axis voltage Bit5: Reserved Bit6: Enable direct-axis inductance saturation (valid in vector control mode) Bit7: Enable quadrature-axis inductance saturation (valid in vector control mode) Bit8: Torque current (tension) optimization enable Bit9: Current loop optimization enable Bit10: Speed loop optimization enable Bit11: Limit voltage coefficient min. value to 1 Bit12–Bit15: Reserved	0x137	⊙
P03.57	FVC and SVC 0/1 switching selection	Setting range: 0x00–0x11 Ones place: Enable switchover 0: Disable 1: Enable Tens place: Target running mode after	0x00	⊙

Inverter function code	Name	Description	Default	Modify
		switching 0: Switch to SVC0 1: Switch to SVC1		
P03.58	Quick excitation current	Setting range: 0.0–200.0%	0.0%	⊙
P03.59	Reserved	/	/	/
P03.60	Min. slip coefficient	Setting range: 0.1–50.0	1.5	○

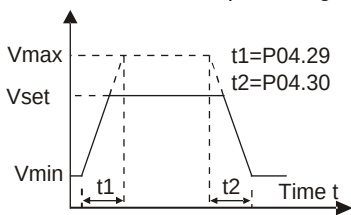
Group P04—V/F control

Inverter function code	Name	Description	Default	Modify
P04.00	Motor 1 V/F curve setting	0: Straight-line V/F curve, applicable to constant torque loads 1: Multi-point V/F curve 2: 1.3-power reduced-torque V/F curve 3: 1.7-power reduced-torque V/F curve 4: 2.0-power reduced-torque V/F curve Curves 2 – 4 are applicable to the torque loads such as fans and water pumps. You can adjust according to the characteristics of the loads to achieve best performance. 5: Customized V/F (V/F separation). In this mode, V and f are separated. The frequency f can be adjusted through the frequency reference channel set by P00.06 to change the curve characteristics, and the voltage V can be adjusted through the voltage reference channel set by P04.27 to change the curve characteristics. Note: In the following figure, V_b is the motor rated voltage and f_b is the motor rated frequency.	0	⊙
P04.01	Motor 1 torque boost	In order to compensate for low-frequency torque characteristics, you can make some boost compensation for the output voltage. P04.01 is relative to the max. output voltage V_b .	0.0%	○
P04.02	Motor 1 torque boost cut-off	P04.02 defines the percentage of cut-off frequency of manual torque boost to the rated	20.0%	○

Inverter function code	Name	Description	Default	Modify
		motor frequency f_b. Torque boost can improve the low-frequency torque characteristics of V/F. You need to select torque boost based on the load. For example, larger load requires larger torque boost, however, if the torque boost is too large, the motor will run at over-excitation, which may cause increased output current and motor overheating, thus decreasing the efficiency. When torque boost is set to 0.0%, the inverter unit uses automatic torque boost. Torque boost cut-off threshold: Below this frequency threshold, torque boost is valid; exceeding this threshold will invalidate torque boost.  P04.01 setting range: 0.0 (Automatic)–10.0% Setting range of P04.02: 0.0%–50.0% Note: 100.0% corresponds to the motor rated voltage.		
P04.03	Motor 1 V/F frequency point 1	When P04.00=1 (multi-dot V/F curve), you can set the V/F curve through P04.03–P04.08.	0.00Hz	○
P04.04	Motor 1 V/F voltage point 1	The V/F curve is generally set according to the load characteristics of the motor.	0.0%	○
P04.05	Motor 1 V/F frequency point 2	Note: $V_1 < V_2 < V_3$, $f_1 < f_2 < f_3$. Too high voltage for low frequency will cause motor overheat or damage and cause VFD overcurrent stall or overcurrent protection.	0.00Hz	○
P04.06	Motor 1 V/F voltage point 2		0.0%	○
P04.07	Motor 1 V/F frequency point 3		0.00Hz	○
P04.08	Motor 1 V/F voltage point 3	 P04.03 setting range: 0.00Hz–P04.05 P04.04 setting range: 0.0%–110.0% (of motor 1 rated voltage) P04.05 setting range: P04.03–P04.07	0.0%	○

Inverter function code	Name	Description	Default	Modify
		P04.06 setting range: 0.0%–110.0% (of motor 1 rated voltage) P04.07 setting range: P04.05–P02.02 (AM 1 rated frequency) or P04.05–P02.16 (SM 1 rated frequency) P04.08 setting range: 0.0%–110.0% (motor 1 rated voltage)		
P04.09	Motor 1 V/F slip compensation gain	Used to compensate for the motor rotating speed change caused by load change in the space voltage vector mode, and thus improve the rigidity of the mechanical characteristics of the motor. The formula used to calculate the motor rated slip frequency is as follows: $\Delta f = f_b - n \cdot p / 60$ Of which, f_b is the rated frequency of motor 1, corresponding to function code P02.02. n is the rated rotating speed of motor 1, corresponding to function code P02.03. p is the number of motor pole pairs. 100.0% corresponds to the motor rated slip frequency Δf . Setting range: 0.0–200.0%	100.0%	○
P04.10	Motor 1 low-frequency oscillation suppression factor	In space voltage vector control mode, the motor, especially the large-power motor, may experience current oscillation at certain frequencies, which may cause unstable motor running, or even inverter unit overcurrent. You can adjust the function codes properly to eliminate such phenomenon. P04.10 setting range: 0–100 P04.11 setting range: 0–100 P04.12 setting range: 0.00Hz–P00.03	10	○
P04.11	Motor 1 high-frequency oscillation suppression factor		10	○
P04.12	Motor 1 oscillation suppression threshold frequency		30.00Hz	○
P04.13	Motor 2 V/F curve setting	0: Straight V/F curve 1: Multi-point V/F curve 2: 1.3-power reduced-torque V/F curve 3: 1.7-power reduced-torque V/F curve 4: 2.0-power reduced-torque V/F curve 5: Custom V/F (V/F separation)	0	◎
P04.14	Motor 2 torque boost	Setting range: 0.0(Automatic)–10.0%	0.0%	○
P04.15	Motor 2 torque boost cut-off	Setting range: 0.0%–50.0% (of the rated frequency of motor 2)	20.0%	○
P04.16	Motor 2 V/F frequency point 1	Setting range: 0.00Hz–P04.18	0.00Hz	○
P04.17	Motor 2 V/F voltage point 1	Setting range: 0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.18	Motor 2 V/F frequency point 2	Setting range: P04.16–P04.20	0.00Hz	○

Inverter function code	Name	Description	Default	Modify
P04.19	Motor 2 V/F voltage point 2	Setting range: 0.0%–110.0% (of the rated voltage of motor 2)	0.0%	○
P04.20	Motor 2 V/F frequency point 3	Setting range: P04.18–P12.02 (of AM 2 rated frequency) or P04.18–P12.16 (of SM 2 rated frequency)	0.00Hz	○
P04.21	Motor 2 V/F voltage point 3	Setting range: 0.0%–110.0% (of the motor rated voltage)	0.0%	○
P04.22	Motor 2 V/F slip compensation gain	Setting range: 0.0–200.0%	0.0%	○
P04.23	Motor 2 low-frequency oscillation suppression factor	Setting range: 0–100	10	○
P04.24	Motor 2 high-frequency oscillation suppression factor	Setting range: 0–100	10	○
P04.25	Motor 2 oscillation suppression threshold frequency	Setting range: 0.00Hz–P00.03 (Max. output frequency)	30.00Hz	○
P04.26	Reserved	/	/	/
P04.27	Voltage setting channel	0: Keypad (specified by P04.28.) 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step speed running (The setting is determined by related parameters in group P10.) 6: PID 7: Modbus communication 8: CANopen communication 9: Ethernet communication 10: Reserved 11: EtherCAT/PROFINET communication 12: PLC card 13: PROFIBUS-DP communication	0	○
P04.28	Voltage set through keypad	The function code is the voltage digital setting when "keypad" is selected as the voltage setting channel. Setting range: 0.0–100.0% (of the motor rated voltage)	100.0%	○
P04.29	Voltage increase time	Voltage increase time means the time needed for the inverter unit to accelerate from min. output voltage to the max. output voltage.	5.0s	○
P04.30	Voltage decrease time	Voltage decrease time means the time needed for the inverter unit to decelerate from the max. output frequency to min. output voltage. Setting range: 0.0–3600.0s	5.0s	○

Inverter function code	Name	Description	Default	Modify
P04.31	Max. output voltage	The function codes are used to set the upper and lower limits of output voltage.  P04.31 setting range: P04.32–100.0% P04.32 setting range: 0.00Hz–P04.31 Note: 100.0% corresponds to the motor rated voltage.	100.0%	⊙
P04.32	Min. output voltage		0.0%	⊙
P04.33	Flux weakening coefficient in constant power zone	Setting range: 1.00–1.30	1.03	○
P04.34	Pull-in current 1 in SM VF control	Setting range: -100.0%–100.0% (of the motor rated current)	30.0%	○
P04.35	Pull-in current 2 in SM VF control	Setting range: -100.0%–100.0% (of the motor rated current)	10.0%	○
P04.36	Pull-in current switching frequency threshold in SM VF control	Setting range: 0.0–200.0% (of the motor rated frequency)	20.0%	○
P04.37	Reactive current closed-loop proportional coefficient in SM VF control	Setting range: 0–500	50	○
P04.38	Reactive current closed-loop integral time in SM V/F control	Setting range: 0–300	30	○
P04.39	Reactive current closed-loop output limit in SM VF control	Setting range: 0–16000	8000	○
P04.40	AM 1 I/F mode enable	0: Disable 1: Enable	0	○
P04.41	AM 1 I/F current setting	Setting range: 0.0–200.0%	120.0%	○
P04.42	AM 1 I/F mode proportional coefficient	Setting range: 0–5000	350	○
P04.43	AM 1 I/F mode integral coefficient	Setting range: 0–5000	150	○
P04.44	AM 1 I/F mode cut-in frequency	Setting range: 0.00Hz–P04.50	10.00Hz	○
P04.45	AM 2 I/F mode enable	0: Disable 1: Enable	0	○
P04.46	AM 2 I/F mode current setting	Setting range: 0.0–200.0%	120.0%	○
P04.47	AM 2 I/F mode proportional coefficient	Setting range: 0–5000	350	○

Inverter function code	Name	Description	Default	Modify
P04.48	AM 2 I/F mode integral coefficient	Setting range: 0–5000	150	○
P04.49	AM 2 I/F mode cut-in frequency	Setting range: 0.00Hz–P04.51	10.00Hz	○
P04.50	AM 1 I/F cut-out frequency	Setting range: P04.44–P00.03	25.00Hz	○
P04.51	AM 2 I/F cut-out frequency	Setting range: P04.49–P00.03	25.00Hz	○
P04.52	SM 2 V/F pull-in current 1	Setting range: -100.0%–100.0%	30.0%	○
P04.53	SM 2 V/F pull-in current 2	Setting range: -100.0%–100.0%	10.0%	○
P04.54	SM 2 V/F pull-in current switching frequency threshold	Setting range: 0.0–200.0%	20.0%	○
P04.55	SM 2 V/F reactive current closed-loop proportional coefficient	Setting range: 0–500	50	○
P04.56	SM 2 V/F reactive current closed-loop integral time	Setting range: 0–300	30	○
P04.57	AM 1 V/F energy-saving mode selection	0: Invalid 1: Max. efficiency 2: Optimal power factor 3: MTPA	0	◎
P04.58	AM 1 V/F energy-saving optimization coefficient	Setting range: 25.0%–400.0%	100.0%	○
P04.59	AM 2 V/F energy-saving mode selection	0: Invalid 1: Max. efficiency 2: Optimal power factor 3: MTPA	0	◎
P04.60	AM 2 V/F energy-saving optimization coefficient	Setting range: 25.0%–400.0%	100.0%	○

Group P05—Input terminal functions

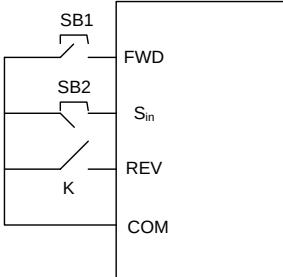
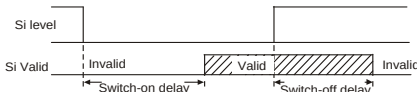
Inverter function code	Name	Description	Default	Modify
P05.00	Reserved	/	/	/
P05.01	S1 function	0: No function 1: Forward run 2: Reverse run 3: Three-wire running control 4: Forward jog 5: Reverse jog 6: Coast to stop	1	◎
P05.02	S2 function		2	◎
P05.03	S3 function		7	◎
P05.04	S4 function		0	◎

Inverter function code	Name	Description	Default	Modify
		7: Fault reset 8: Run pause 9: External fault input 10: Increase frequency setting (UP) 11: Decrease frequency setting (DOWN) 12: Clear the frequency increase/decrease setting 13: Switch between A setting and B setting 14: Switch between combination setting and A setting 15: Switch between combination setting and B setting 16: Multi-step speed terminal 1 17: Multi-step speed terminal 2 18: Multi-step speed terminal 3 19: Multi-step speed terminal 4 20: Multi-step speed pause 21: ACC/DEC time selection 1 22: ACC/DEC time selection 2 23: Simple PLC stop and reset 24: Simple PLC pause 25: PID control pause 26: Wobble frequency pause 27: Wobble frequency reset 28: Counter reset 29: Switch between speed control and torque control 30: ACC/DEC disable 31: Counter trigger 32: Reserved 33: Clear the frequency increase/decrease setting temporarily 34: DC braking 35: Switch from motor 1 to motor 2 36: Switch the run command channel to keypad 37: Switch the run command channel to terminal 38: Switch the run command channel to communication 39: Pre-excitation command 40: Clear energy consumption 41: Keep energy consumption 42: Switch the setting source of torque upper limit to keypad 43: Position reference point input (only valid for S2, S3 and S4)		

Inverter function code	Name	Description	Default	Modify
		44: Spindle orientation inhibit 45: Spindle zeroing/local positioning zeroing 46: Spindle zeroing position selection 1 47: Spindle zeroing position selection 2 48: Spindle indexing selection 1 49: Spindle indexing selection 2 50: Spindle indexing selection 3 51: Position/speed control switching terminal 52: Disable pulse input 53: Clear position deviation 54: Switch position proportional gains 55: Enable cyclic digital positioning 56: Emergency stop 57: Motor overtemperature fault input 58: Enable rigid tapping 59: Switch to V/F control 60: Switch to FVC control 61: Switch PID polarities 62: Reserved 63: Enable servo 64: Forward limit 65: Reverse limit 66: Encoder count reset 67: Pulse increment 68: Pulse superposition enable 69: Decrease pulses 70: Select electronic gear 71: Switch to the master 72: Switch to the slave 73: Roll diameter reset 74: Winding/unwinding switchover 75: Tension control pre-driving 76: Disable roll diameter calculation 77: Clear alarm display 78: Manual braking in tension control 79: Forcible material feeding interrupt signal trigger 80: Initial roll diameter selection 1 81: Initial roll diameter selection 2 82: Reserved 83: Tension PID switching 84: PID pause flag 85: Thickness switchover 0 86: Thickness switchover 1 87: Length clearing terminal 88: Reserved 89: Tension mode switchover (open-loop		

Inverter function code	Name	Description	Default	Modify															
		torque/closed-loop speed) 90: Reserved 91: Brake feedback signal 92–100: Reserved 101: Brake detection 102–105: Reserved 106: Enable anti-sway 107: Switch from master/slave mode to a non master/slave mode																	
P05.05–P05.07	Reserved	/	/	/															
P05.08	Input terminal polarity selection	Used to set the polarity of input terminals. When a bit is 0, the input terminal is positive. When a bit is 1, the input terminal is negative. Setting range: 0x0–0xF <table><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table>	Bit3	Bit2	Bit1	Bit0	S4	S3	S2	S1	0x0	○							
Bit3	Bit2	Bit1	Bit0																
S4	S3	S2	S1																
P05.09	Digital input filter time	Used to specify the filter time of S1–S4 terminal sampling. In strong interference cases, increase the value to avoid maloperation. Setting range: 0.000–1.000s	0.010s	○															
P05.10	Virtual terminal setting	Setting range: 0x0–0xF (0: disable; 1: enable) Bit0: S1 virtual terminal Bit1: S2 virtual terminal Bit2: S3 virtual terminal Bit3: S4 virtual terminal	0x0	◎															
P05.11	Terminal control mode	The function code is used to set the mode of terminal control. 0: Two-wire control 1, the enabling consistent with the direction. This mode is widely used. The defined FWD/REV terminal command determines the motor rotation direction. K1 K2 FWD REV COM <table><tr><td>FWD</td><td>REV</td><td>Run command</td></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td></tr><tr><td>ON</td><td>OFF</td><td>Forward run</td></tr><tr><td>OFF</td><td>ON</td><td>Reverse run</td></tr><tr><td>ON</td><td>ON</td><td>Hold</td></tr></table> 1: Two-wire control 2. Independent Enable and Direction mode. In this mode, FWD is the enabling terminal. The direction depends on the defined REV state.	FWD	REV	Run command	OFF	OFF	Stop	ON	OFF	Forward run	OFF	ON	Reverse run	ON	ON	Hold	0	◎
FWD	REV	Run command																	
OFF	OFF	Stop																	
ON	OFF	Forward run																	
OFF	ON	Reverse run																	
ON	ON	Hold																	

Inverter function code	Name	Description	Default	Modify																																				
		K1 FWD K2 REV COM <table><tr><td>FWD</td><td>REV</td><td>Run command</td></tr><tr><td>OFF</td><td>OFF</td><td>Stop</td></tr><tr><td>ON</td><td>OFF</td><td>Forward run</td></tr><tr><td>OFF</td><td>ON</td><td>Stop</td></tr><tr><td>ON</td><td>ON</td><td>Reverse run</td></tr></table> 2: Three-wire control 1. This mode defines S_{in} as the enabling terminal, and the running command is generated by FWD, while the direction is controlled by REV. To run the inverter unit, the S_{in} terminal circuit must be closed. A rising-edge signal at the FWD terminal starts the inverter unit, and the state of the REV terminal determines the running direction. To stop the inverter unit, open the S_{in} terminal circuit. SB1 FWD SB2 S_{in} K REV COM The direction control is as follows during running: <table><tr><th>S_{in}</th><th>REV</th><th>Previous running direction</th><th>Actual running direction</th></tr><tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>FWD run</td><td>REV run</td></tr><tr><td>REV run</td><td>FWD run</td></tr><tr><td rowspan="2">ON</td><td rowspan="2">ON→OFF</td><td>REV run</td><td>FWD run</td></tr><tr><td>FWD run</td><td>REV run</td></tr><tr><td rowspan="2">ON→OFF</td><td>ON</td><td colspan="2" rowspan="2">Decelerate to stop</td></tr><tr><td>OFF</td></tr></table> S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running 3: Three-wire control 2. This mode defines S_{in} as the enable terminal, and the running command is generated by FWD or REV, but the direction is controlled by both FWD and REV. To run the inverter unit, the S_{in} terminal circuit must be closed, and a rising-edge signal must be applied to the FWD or REV terminal to start the inverter unit and determine the running direction. To stop the inverter unit,	FWD	REV	Run command	OFF	OFF	Stop	ON	OFF	Forward run	OFF	ON	Stop	ON	ON	Reverse run	S_{in}	REV	Previous running direction	Actual running direction	ON	OFF→ON	FWD run	REV run	REV run	FWD run	ON	ON→OFF	REV run	FWD run	FWD run	REV run	ON→OFF	ON	Decelerate to stop		OFF		
FWD	REV	Run command																																						
OFF	OFF	Stop																																						
ON	OFF	Forward run																																						
OFF	ON	Stop																																						
ON	ON	Reverse run																																						
S_{in}	REV	Previous running direction	Actual running direction																																					
ON	OFF→ON	FWD run	REV run																																					
		REV run	FWD run																																					
ON	ON→OFF	REV run	FWD run																																					
		FWD run	REV run																																					
ON→OFF	ON	Decelerate to stop																																						
	OFF																																							

Inverter function code	Name	Description	Default	Modify																						
		open the S_{in} terminal circuit.  <table><thead><tr><th>S_{in}</th><th>FWD</th><th>REV</th><th>Running direction</th></tr></thead><tbody><tr><td rowspan="2">ON</td><td rowspan="2">OFF→ON</td><td>ON</td><td>FWD run</td></tr><tr><td>OFF</td><td>FWD run</td></tr><tr><td rowspan="2">ON</td><td>ON</td><td rowspan="2">OFF→ON</td><td>REV run</td></tr><tr><td>OFF</td><td>REV run</td></tr><tr><td rowspan="2">ON→OFF</td><td>/</td><td>/</td><td rowspan="2">Decelerate to stop</td></tr><tr><td>/</td><td>/</td></tr></tbody></table> S_{in}: Three-wire control; FWD: Forward running; REV: Reverse running Note: For two-wire controlled running mode, when the FWD/REV terminal is valid, if the inverter unit stops due to a stop command given by another source, the inverter unit does not run again after the stop command disappears even if the control terminal FWD/REV is still valid. To make the inverter unit run, you need to trigger FWD/REV again.	S _{in}	FWD	REV	Running direction	ON	OFF→ON	ON	FWD run	OFF	FWD run	ON	ON	OFF→ON	REV run	OFF	REV run	ON→OFF	/	/	Decelerate to stop	/	/		
S _{in}	FWD	REV	Running direction																							
ON	OFF→ON	ON	FWD run																							
		OFF	FWD run																							
ON	ON	OFF→ON	REV run																							
	OFF		REV run																							
ON→OFF	/	/	Decelerate to stop																							
	/	/																								
P05.12	S1 switch-on delay	The function codes specify the delay time corresponding to the level changes of the programmable input terminals during switch-on or switch-off. 	0.000s	☐																						
P05.13	S1 switch-off delay		0.000s	☐																						
P05.14	S2 switch-on delay		0.000s	☐																						
P05.15	S2 switch-off delay		0.000s	☐																						
P05.16	S3 switch-on delay		0.000s	☐																						
P05.17	S3 switch-off delay		0.000s	☐																						
P05.18	S4 switch-on delay		0.000s	☐																						
P05.19	S4 switch-off delay		Setting range: 0.000–50.000s	0.000s	☐																					
P05.20–P05.23	Reserved	/	/	/																						
P05.24	AI1 lower limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used.	0.00V	☐																						
P05.25	Corresponding setting of AI1 lower limit		0.0%	☐																						
P05.26	AI1 upper limit		10.00V	☐																						
P05.27	Corresponding setting of AI1 upper limit		100.0%	☐																						
P05.28	AI1 input filter time	When the analog input is current input, 0–20mA current corresponds to 0–10V voltage.	0.030s	☐																						
P05.29	AI2 lower limit		-10.00V	☐																						
P05.30	Corresponding setting of AI2 lower limit		In different applications, 100.0% of the analog setting corresponds to different nominal	-100.0%	☐																					

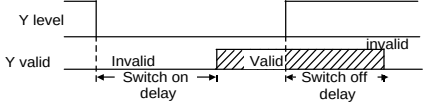
Inverter function code	Name	Description	Default	Modify
P05.31	AI2 middle value 1	values. See the description in each application section for details. The following figure illustrates the cases of several settings:	0.00V	○
P05.32	Corresponding setting of AI2 middle value 1		0.0%	○
P05.33	AI2 middle value 2		0.00V	○
P05.34	Corresponding setting of AI2 middle value 2		0.0%	○
P05.35	AI2 upper limit		10.00V	○
P05.36	Corresponding setting of AI2 upper limit		100.0%	○
P05.37	AI2 input filter time	Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. Note: AI1 supports the 0(2)–10V/0(4)–20mA input. When AI1 selects the 0–20mA input, the corresponding voltage of 20mA is 10V. AI2 supports the -10–+10V input. P05.24 setting range: 0.00V–P05.26 P05.25 setting range: -300.0%–300.0% P05.26 setting range: P05.24–10.00V P05.27 setting range: -300.0%–300.0% P05.28 setting range: 0.000s–10.000s P05.29 setting range: -10.00V–P05.31 P05.30 setting range: -300.0%–300.0% P05.31 setting range: P05.29–P05.33 P05.32 setting range: -300.0%–300.0% P05.33 setting range: P05.31–P05.35 P05.34 setting range: -300.0%–300.0% P05.35 setting range: P05.33–10.00V P05.36 setting range: -300.0%–300.0% Setting range of P05.37: 0.000s–10.000s	0.030s	○
P05.38–P05.49	Reserved	/	/	/
P05.50	AI1 input signal type	0: Voltage type 1: Current type	0	◎
P05.51	Type of sensor for AI/AO to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84	0	◎
P05.52	AI/AO detected motor OH protection threshold	Setting range: -20.0–200.0°C	110.0°C	○

Inverter function code	Name	Description	Default	Modify
P05.53	AI/AO detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C	○
P05.54	KTY84 resistance offset (AI/AO temperature detection)	Setting range: -1000–1000	0	○
P05.55	PT100/PT1000 resistance offset (AI/AO temperature detection)	Setting range: -300.00–300.00	0.00	○
P05.56	Signal source for AI to detect motor temperature	0: Do not detect 1: AI1 2: AI2	0	◎

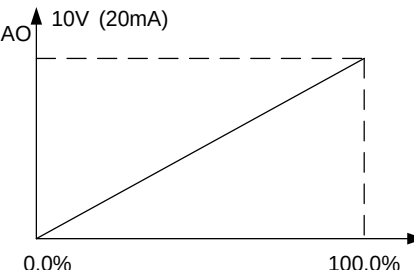
Group P06—Output terminal functions

Inverter function code	Name	Description	Default	Modify
P06.00	Reserved	/	/	/
P06.01	Y1 output	0: Invalid	0	○
P06.02	Reserved	1: Running	/	/
P06.03	RO1 output selection	2: Running forward	1	○
P06.04	RO2 output selection	3: Running in reverse 4: Jogging 5: VFD in fault 6: Frequency level detection FDT1 7: Frequency level detection FDT2 8: Frequency reached 9: Running in zero speed 10: Frequency upper limit reached 11: Frequency lower limit reached 12: Ready for running 13: Pre-exciting 14: Overload alarm 15: Underload alarm 16: Simple PLC stage completed 17: Simple PLC cycle completed 18: Set counting value reached 19: Designated counting value reached 20: External fault is valid 21: Reserved 22: Run time reached 23: Modbus communication virtual terminal output (RO2/RO1/Y1) 24: PROFIBUS communication virtual terminal output (RO2/RO1/Y1) 25: Ethernet communication virtual terminal output (RO2/RO1/Y1)	5	○

Inverter function code	Name	Description	Default	Modify						
		26: DC bus voltage established 27: Z pulse output 28: Pulse superposition in progress 29: STO active 30: Positioning completed 31: Spindle homing completed 32: Spindle indexing completed 33: Speed limiting active 34: EtherCAT/PROFINET communication virtual terminal output (RO2/RO1/Y1) 35: CANopen communication virtual terminal output (RO2/RO1/Y1) 36: Speed/position control switching completed 37: Any frequency reached 38–40: Reserved 41: Y1 from the PLC card 42–43: Reserved 44: RO1 from the PLC card 45: RO2 from the PLC card 46–47: Reserved 48: EC PT100 detected OT alarm 49: Reserved 50: AIAO detected OT alarm 51: Stopped or running in zero speed 52: Control for tension disconnection 53: Specified roll diameter reached 54: Roll diameter of stop reached 55: Length reached 56: Reserved 57: Brake output 58: Ready to release the brake 59: Ready to close the brake 60: Upper limit reached 61: Lower limit reached 62: Precharge complete 63–64: Reserved 65: Brake failure alarm 66–81: Reserved								
P06.05	Output terminal polarity selection	The function code is used to set the output terminal polarity. When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. <table border="1"><tr><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>Y1</td></tr></table> Setting range: 0x0–0x7	Bit2	Bit1	Bit0	RO2	RO1	Y1	0x0	○
Bit2	Bit1	Bit0								
RO2	RO1	Y1								
P06.06	Y1 switch-on delay	Used to specify the delay time corresponding	0.000s	○						

Inverter function code	Name	Description	Default	Modify
P06.07	Y1 switch-off delay	to the level changes when the programmable output terminals switch on or switch off. 	0.000s	○
P06.08–P06.09	Reserved		/	/
P06.10	RO1 switch-on delay		0.000s	○
P06.11	RO1 switch-off delay		0.000s	○
P06.12	RO2 switch-on delay		0.000s	○
P06.13	RO2 switch-off delay		0.000s	○
P06.14	AO1 output	0: Running frequency 1: Set frequency 2: Ramp reference frequency 3: Rotational speed (100% corresponds to the speed corresponding to the max. output frequency) 4: Output current (100% corresponds to twice the VFD rated current) 5: Output current (100% corresponds to twice the motor rated current) 6: Output voltage (100% corresponds to 1.5 times the VFD rated voltage) 7: Output power (100% corresponds to twice the motor rated power) 8: Set torque (100% corresponds to twice the motor rated torque) 9: Output torque (Absolute value, 100% corresponds to twice the motor rated torque) 10: AI1 input 11: AI2 input 12: AI3 input 13: Reserved 14: AO1 value 1 set through Modbus communication 15: AO2 value 1 set through Modbus communication 16: AO1 value 1 set through PROFIBUS communication (1000 corresponds to 100.0%) 17: AO2 value 1 set through PROFIBUS communication (1000 corresponds to 100.0%) 18: Value 1 set through Ethernet communication 19: Value 2 set through Ethernet communication 20: AO1 value 1 set through EtherCAT/PROFINET communication (1000 corresponds to 100.0%) 21: AO1 value 2 set through EtherCAT/PROFINET communication (10000 corresponds to 100.00%)	0	○
P06.15–P06.16	Reserved		/	/

Inverter function code	Name	Description	Default	Modify
		22: Torque current (100% corresponds to the motor rated current) 23: Exciting current (100% corresponds to the motor rated current) 24: Set frequency (bipolar) 25: Ramp reference frequency (bipolar) 26: Rotational speed of running (bipolar) 27: AO2 value 1 set through EtherCAT/PROFINET communication (1000 corresponds to 100.0%) 28: AO1 from the PLC card 29: AO2 from the PLC card 30: Rotational speed of running (100% corresponds to the speed at twice the motor rated frequency) 31: Output torque (Actual value, 100% corresponds to twice the motor rated torque) 32: AO1 value 1 set through CANopen communication (1000 corresponds to 100.0%) 33: AO2 value 1 set through CANopen communication (1000 corresponds to 100.0%) 34: AO1 value 2 set through CANopen communication (10000 corresponds to 100.00%) 35: AO2 value 2 set through CANopen communication (10000 corresponds to 100.00%) 36: AO2 value 2 set through EtherCAT/PROFINET communication (10000 corresponds to 100.00%) 37: Final tension reference value 38: AO1 value 2 set through PROFIBUS-DP communication (10000 corresponds to 100.00%) 39: AO2 value 2 set through PROFIBUS-DP communication (10000 corresponds to 100.00%) 40: AIAO detected temperature output 41–42: Reserved 43: Hook rope length (for anti-sway) 44–63: Reserved Note: AO2 requires an optional IO expansion card. For details, see function parameter group P26.		
P06.17	Voltage-type AO1 output lower limit	Used to define the relationship between the output value and analog output. When the output value exceeds the allowed range, the	0.0%	○

Inverter function code	Name	Description	Default	Modify
P06.18	AO1 output corresponding to lower limit	output uses the lower limit or upper limit. When the analog output is current output, 1mA equals 0.5V.	0.00V	○
P06.19	Voltage-type AO1 output upper limit	In different cases, the corresponding analog output of 100% of the output value is different.	100.0%	○
P06.20	AO1 output corresponding to upper limit		10.00V	○
P06.21	AO1 output filter time		0.000s	○
P06.22	Current-type AO1 output lower limit	Setting range: -300.0%—P06.24	0.0%	○
P06.23	AO1 output corresponding to lower limit (Current type)	Setting range: 0.00—20.00mA	0.00mA	○
P06.24	Current-type AO1 output upper limit	Setting range: P06.22—300.0%	100.0%	○
P06.25	AO1 output corresponding to upper limit (Current type)	Setting range: 0.00—20.00mA	20.00mA	○
P06.26—P06.31	Reserved	/	/	/
P06.32	AO1 output signal type	0: Voltage type 1: Current type	0	◎
P06.33	Frequency reached detection value	Setting range: 0.00Hz—P00.03	1.00Hz	○
P06.34	Frequency reached detection time	Setting range: 0.0—3600.0s	0.5s	○

Group P07—HMI

Inverter function code	Name	Description	Default	Modify
P07.00	User password	Setting range: 0—65535 When you set the function code to a non-zero number, password protection is enabled. If you set the function code to 00000, the previous user password is cleared and	0	○

Inverter function code	Name	Description	Default	Modify
		password protection is disabled. After the user password is set and takes effect, you cannot enter the parameter menu if you enter an incorrect password. Please remember your password and save it in a secure place. After you exit the function code editing interface, the password protection function is enabled within 1 minute. If password protection is enabled, "0.0.0.0" is displayed when you press the PRG/ESC key again to enter the function code editing interface. You need to enter the correct user password to enter the interface. Note: Restoring default settings can clear the user password.		
P07.01	Function parameter copy	0: No operation 1: Upload parameters to keypad 2: Download all parameters (including motor parameters) 3: Download non-motor-group parameters 4: Download motor-group parameters Note: Valid only for the externally connected LCD keypad.	0	⊙
P07.02	QUICK/JOG function selection	Setting range: 0x00–0x27 Ones place: Function of QUICK/JOG 0: No function 1: Jog 2: Reserved 3: Switch between FWD and REV rotating 4: Clear the UP/DOWN setting 5: Coast to stop 6: Switch command channels in sequence 7: Quick commissioning mode (based on non-factory parameter settings) Tens place: Reserved Note: Valid only for the externally connected LCD keypad.	0x01	⊙
P07.03	Channel switching by QUICK	0: Keypad→Terminal→Communication 1: Keypad←→Terminal 2: Keypad←→Communication 3: Terminal←→Communication Note: Valid only for the externally connected LCD keypad.	0	○
P07.04	Stop function validity of STOP/RST	0: Valid only for keypad control 1: Valid both for keypad and terminal control 2: Valid both for keypad and communication	0	○

Inverter function code	Name	Description	Default	Modify
		control 3: Valid for all control modes Note: Valid only for the externally connected LCD keypad.		
P07.05	Selection 1 of parameters to be displayed in the running state	Setting range: 0x0000–0xFFFF Bit0: Running frequency (Hz on) Bit1: Set frequency (Hz flashing) Bit2: Bus voltage (V on) Bit3: Output voltage (V on) Bit4: Output current (A on) Bit5: Running speed (rpm on) Bit6: Output power (% on) Bit7: Output torque (% on) Bit8: PID reference value (% flashing) Bit9: PID feedback value (% on) Bit10: Input terminal state Bit11: Output terminal state Bit12: Set torque (% on) Bit13: Pulse count value Bit14: Motor overload percentage (% on) Bit15: PLC and actual step of multi-step speed	0x03FF	○
P07.06	Selection 2 of parameters to be displayed in the running state	Setting range: 0x0000–0xFFFF Bit0: AI1 value (V on) Bit1: AI2 value (V on) Bit2: AI3 value (V on) Bit3–bit4: Reserved Bit5: Inverter unit overload percentage (% on) Bit6: Ramp frequency reference (Hz on) Bit7: Linear speed Bit8–Bit15: Reserved	0x0000	
P07.07	Selection of parameters displayed in stopped state	Setting range: 0x0000–0xFFFF Bit0: Set frequency (Hz on, flashing slowly) Bit1: Bus voltage (V on) Bit2: Input terminal state Bit3: Output terminal state Bit4: PID reference value (% flashing) Bit5: PID feedback value (% on) Bit6: Set torque (% on) Bit7: AI1 value (V on) Bit8: AI2 value (V on) Bit9: AI3 value (V on) Bit10–bit11: Reserved Bit 12: Counting value Bit 13: PLC and current step number of multi-step speed Bit 14: Frequency upper limit Bit15: Reserved	0x00FF	○

Inverter function code	Name	Description	Default	Modify
P07.08	Frequency display coefficient	Setting range: 0.01–10.00 Display frequency = Running frequency × P07.08	1.00	○
P07.09	Rotation speed display coefficient	Setting range: 0.1–999.9% Mechanical rotation speed = 120 × (Displayed running frequency) × P07.09 / (Number of motor pole pairs)	100.0%	○
P07.10	Line speed display coefficient	Setting range: 0.1–999.9% Linear speed = (Mechanical rotation speed) × P07.10	1.0%	○
P07.11	Reserved	/	/	/
P07.12	Inverter module temperature	Range: -20.0–120.0°C	0.0°C	●
P07.13	Control board software version	Range: 1.00–655.35	Depends on version	●
P07.14	Accumulated operating time	Range: 0–65535h	0h	●
P07.15	Inverter unit energy consumption high word	Displays the energy consumption of the inverter unit.	0kWh	●
P07.16	Inverter unit energy consumption low word	Inverter unit energy consumption = P07.15 × 1000 + P07.16 P07.15 range: 0–65535kWh (×1000) P07.16 range: 0.0–999.9kWh	0.0kWh	●
P07.17	VFD Type	Range: 0x0000–0xF000 Bit0–bit11: Reserved Bit12–bit15: VFD series 0x0: GD600A 0x1: GD600 0x2–0xF: Reserved	Depends on model	●
P07.18	Inverter unit rated power	Range: 0.4–3000.0kW	Depends on model	●
P07.19	Inverter unit rated voltage	Range: 50–1200V	Depends on model	●
P07.20	Inverter unit rated current	Range: 0.1–6000.0A	Depends on model	●
P07.21	Factory barcode 1	Range: 0x0000–0xFFFF	0xFFFF	●
P07.22	Factory barcode 2	Range: 0x0000–0xFFFF	0xFFFF	●
P07.23	Factory barcode 3	Range: 0x0000–0xFFFF	0xFFFF	●
P07.24	Factory barcode 4	Range: 0x0000–0xFFFF	0xFFFF	●
P07.25	Factory barcode 5	Range: 0x0000–0xFFFF	0xFFFF	●
P07.26	Factory barcode 6	Range: 0x0000–0xFFFF	0xFFFF	●
P07.27	Present fault type	0: No fault	0	●
P07.28	Last fault type	1: Inverter unit U-phase protection (E001)	0	●
P07.29	2nd-last fault type	2: Inverter unit V-phase protection (E002)	0	●
P07.30	3rd-last fault type	3: Inverter unit W-phase protection (E003)	0	●
P07.31	4th-last fault type	4: Overcurrent during acceleration (E004)	0	●

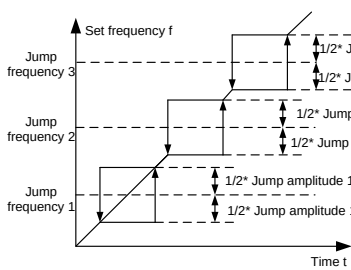
Inverter function code	Name	Description	Default	Modify
P07.32	5th-last fault type	5: Overcurrent during deceleration (E005) 6: Overcurrent during constant speed running (E006) 7: Overvoltage during acceleration (E007) 8: Overvoltage during deceleration (E008) 9: Overvoltage during constant speed running (E009) 10: Bus undervoltage fault (E010) 11: Motor overload (E011) 12: VFD overload (E012) 13: Rectifier phase loss (E013) 14: Output phase loss (E014) 15: Rectifier module overheat (E015) 16: Inverter module overheat (E016) 17: External fault (E017) 18: Modbus communication fault (E018) 19: Current detection fault (E019) 20: Motor autotuning fault (E020) 21: EEPROM operation error (E021) 22: PID feedback disconnection fault (E022) 23: Rectifier braking unit fault (E023) 24: Run time reached (E024) 25: Electronic overload (E025) 26: Keypad communication error (E026) 27: Parameter upload error (E027) 28: Parameter download error (E028) 29: PROFIBUS communication fault (E029) 30: CAN broadcast fault (E030) 31: CANOpen communication fault (E031) 32: To-ground short-circuit fault 1 (E032) 33: To-ground short-circuit fault 2 (E033) 34: Speed deviation fault (E034) 35: Offset fault (E035) 36: Underload fault (E036) 37: Encoder disconnection fault (E037) 38: Encoder reversal fault (E038) 39: Encoder Z-pulse disconnection fault (E039) 40: Safe torque off (E040) 41: Channel 1 safety circuit exception (E041) 42: Channel 2 safety circuit exception (E042) 43: Exception in both channels 1 and 2 (E043) 44: Safety code FLASH CRC fault (E044) 45: PLC card customized fault 1 (E045) 46: PLC card customized fault 2 (E046) 47: PLC card customized fault 3 (E047) 48: PLC card customized fault 4 (E048)	0	●

Inverter function code	Name	Description	Default	Modify
		49: PLC card customized fault 5 (E049) 50: PLC card customized fault 6 (E050) 51: PLC card customized fault 7 (E051) 52: PLC card customized fault 8 (E052) 53: PLC card customized fault 9 (E053) 54: PLC card customized fault 10 (E054) 55: Duplicate expansion card type fault (E055) 56: Encoder UVW loss fault (E056) 57: PROFINET communication timeout fault (E057) 58: CAN master/slave fault (E058) 59: Motor overtemperature fault (E059) 60: Slot 1 card identification failure (E060) 61: Slot 2 card identification failure (E061) 62: Reserved 63: Slot 1 card communication timeout fault (E063) 64: Slot 2 card communication timeout fault (E064) 65: Reserved 66: EtherCAT communication timeout fault (E066) 67–68: Reserved 69: CAN slave fault in master/slave synchronization (E069) 70–71: Reserved 72: Brake feedback fault (E072) 73: Torque verification fault (E073) 74–75: Reserved 76: Abnormal terminal command protection (E076) 77–78: Reserved 79: Brake failure fault (E079) 80–91: Reserved 92: AI1 disconnection fault (E092) 93: AI2 disconnection fault (E093) 94: AI3 disconnection fault (E094) 95: Reserved 96: No upgrade bootloader (E096) 97–108: Reserved 109: Tension control feedback disconnection (E109) 110: PG card detected motor overtemperature fault (E110) 111: IO card detected motor overtemperature fault (E111) 112: AI detected motor overtemperature fault		

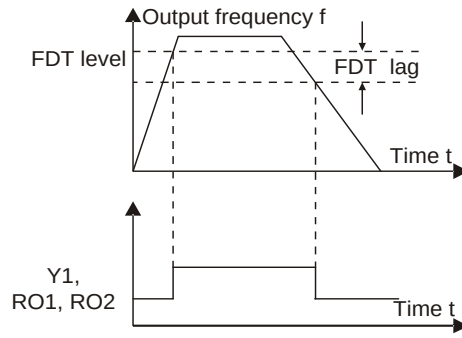
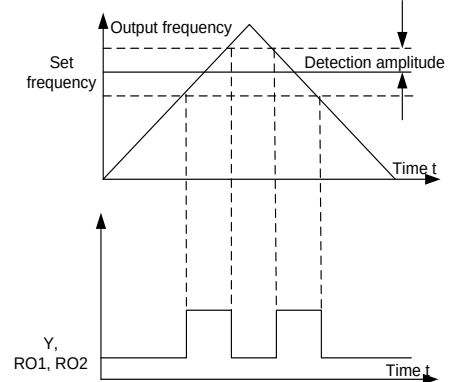
Inverter function code	Name	Description	Default	Modify
		(E112) 113–128: Reserved 129: Slave offline fault (E129) 130–590: Reserved 591: Full-closed-loop position encoder disconnection (E591) 592: SSI position deviation fault (E592) 593: SSI position forward limit (E593) 594: SSI position reverse limit (E594) 595: SSI positioning disconnection fault (E595) 596: SSI positioning initialization fault (E596) 597: SSI positioning timeout fault (E597) 598: Reserved 599: Invalid SSI position reference fault (E599)		
P07.33	Running frequency at present fault		0.00Hz	●
P07.34	Ramp reference frequency at present fault		0.00Hz	●
P07.35	Output voltage at present fault		0V	●
P07.36	Output current at present fault		0.0A	●
P07.37	Bus voltage at present fault		0.0V	●
P07.38	Temperature at present fault		0.0°C	●
P07.39	Input terminal state at present fault		0x0000	●
P07.40	Output terminal state at present fault		0x0000	●
P07.41	Running frequency at last fault		0.00Hz	●
P07.42	Ramp reference frequency at last fault		0.00Hz	●
P07.43	Output voltage at last fault		0V	●
P07.44	Output current at last fault		0.0A	●
P07.45	Bus voltage at last fault		0.0V	●
P07.46	Temperature at last fault		0.0°C	●
P07.47	Input terminal state at last fault		0x0000	●
P07.48	Output terminal state at last fault		0x0000	●
P07.49	Running frequency at 2nd-last fault		0.00Hz	●
P07.50	Ramp reference frequency at 2nd-last fault		0.00Hz	●
P07.51	Output voltage at 2nd-last fault		0V	●
P07.52	Output current at 2nd-last fault		0.0A	●
P07.53	Bus voltage at 2nd-last fault		0.0V	●
P07.54	Temperature at 2nd-last fault		0.0°C	●
P07.55	Input terminal state at 2nd-last fault		0x0000	●
P07.56	Output terminal state at 2nd-last fault		0x0000	●

Group P08—Enhanced functions

Inverter function code	Name	Description	Default	Modify
P08.00	ACC time 2	For details, see P00.11 and P00.12. The inverter unit has four groups of ACC/DEC	Depends on model	○
P08.01	DEC time 2			○

Inverter function code	Name	Description	Default	Modify
P08.02	ACC time 3	time, which can be selected by P05. The default ACC/DEC time of the inverter unit is the first group. Setting range: 0.0–3600.0s		☐
P08.03	DEC time 3			☐
P08.04	ACC time 4			☐
P08.05	DEC time 4			☐
P08.06	Running frequency of jog	Used to define the reference frequency of the inverter unit during jogging. Setting range: 0.00Hz–P00.03 (Max. output frequency)	5.00Hz	☐
P08.07	ACC time for jog	Jog acceleration (ACC) time refers to the time required for the inverter unit to accelerate from 0 Hz to the ACC/DEC time base frequency (P08.21). Jog deceleration (DEC) time refers to the time required for the inverter unit to decelerate from the ACC/DEC time base frequency (P08.21) to 0 Hz. Setting range: 0.0–3600.0s	Depends on model	☐
P08.08	DEC time for jog			☐
P08.09	Jump frequency 1	When the set frequency is within the range of jump frequency, the inverter unit runs at the boundary of jump frequency. The inverter unit can avoid mechanical resonance points by setting jump frequencies. The inverter unit supports the setting of three jump frequencies. If the jump frequency points are set to 0, this function is invalid.	0.00Hz	☐
P08.10	Jump frequency amplitude 1		0.00Hz	☐
P08.11	Jump frequency 2		0.00Hz	☐
P08.12	Jump frequency amplitude 2		0.00Hz	☐
P08.13	Jump frequency 3		0.00Hz	☐
P08.14	Jump frequency amplitude 3	 Setting range: 0.00Hz–P00.03 (Max. output frequency)	0.00Hz	☐
P08.15	Amplitude of wobble frequency	Setting range: 0.0–100.0% (of the set frequency)	0.0%	☐
P08.16	Amplitude of sudden jump frequency	Setting range: 0.0–50.0% (of the amplitude of wobble frequency)	0.0%	☐
P08.17	Rise time of wobble frequency	Setting range: 0.1–3600.0s	5.0s	☐
P08.18	Fall time of wobble frequency	Setting range: 0.1–3600.0s	5.0s	☐
P08.19	Switching frequency of ACC/DEC time	Setting range: 0.00Hz–P00.03 (Max. output frequency) 0.00Hz: no switchover. If the running frequency is greater than P08.19, switch to ACC/DEC time 2.	0.00Hz	☐
P08.20	Droop control start	Setting range: 0.00–50.00Hz	2.00Hz	☐

Inverter function code	Name	Description	Default	Modify
	frequency			
P08.21	Base frequency of ACC/DEC time	0: Max. output frequency 1: Set frequency 2: 100Hz Note: Valid only for straight-line ACC/DEC	0	⊙
P08.22	Output torque display selection	0: Based on torque current 1: Based on output power	0	○
P08.23	Number of decimal points of frequency	0: Two 1: One	0	○
P08.24	Number of decimal places of linear speed	0: No decimal point 1: One decimal place 2: Two decimal places 3: Three	0	○
P08.25	Preset count value	Setting range: P08.26–65535	0	○
P08.26	Specified count value	Setting range: 0–P08.25	0	○
P08.27	Preset run time	Setting range: 0–65535min	0min	○
P08.28	Auto fault reset count	Auto fault reset count: When the inverter unit uses automatic fault reset, the function parameter is used to set the number of automatic fault reset times. When the number of continuous reset times exceeds the value, the inverter unit reports a fault and stops.	0	○
P08.29	Auto fault reset interval	Auto fault reset interval: Time interval from when a fault occurred to when automatic fault reset takes effect. If no fault occurred within 60s after the inverter unit starts, the number of automatic fault reset times is cleared. Setting range of P08.28: 0–10 Setting range of P08.29: 0.1–3600.0s	1.0s	○
P08.30	Frequency decrease ratio in drop control	This parameter indicates the variation of the inverter unit output frequency with load. It is mainly used for power balancing when multiple motors drive the same load simultaneously in speed mode. Setting range: 0.00–50.00Hz	0.00Hz	○
P08.31	Channel for switching between motor 1 and motor 2	Setting range: 0x00–0x15 LED Ones place: Switchover channel 0: Terminal 1: Modbus communication 2: CANopen communication 3: Ethernet communication 4: EtherCAT/PROFINET communication 5: PROFIBUS-DP communication LED tens place: indicates whether to enable switchover during running 0: Disable	0x00	⊙

Inverter function code	Name	Description	Default	Modify
		1: Enable		
P08.32	FDT1 level detection value	When the output frequency exceeds the corresponding frequency of FDT level, the multifunction digital output terminal continuously outputs the signal of "Frequency level detection FDT". The signal is invalid only when the output frequency decreases to a value lower than the frequency corresponding to (FDT level—FDT lagging detection value).	50.00Hz	○
P08.33	FDT1 lagging detection value		5.0%	○
P08.34	FDT2 level detection value		50.00Hz	○
P08.35	FDT2 lagging detection value	 Setting range of P08.32: 0.00Hz–P00.03 Setting range of P08.33: 0.0–100.0% (FDT1 level) P08.34 setting range: 0.00Hz–P00.03 Setting range of P08.35: 0.0–100.0% (FDT2 level)	5.0%	○
P08.36	Frequency reached detection value	When the output frequency is within the detection range, the multifunction digital output terminal outputs the signal of "Frequency reached".  Setting range: 0.00Hz–P00.03	0.00Hz	○
P08.37–P08.38	Reserved	/	/	/
P08.39	Cooling fan operating mode	0: Normal mode 1: The fan keeps running after power-on 2: Run mode 2 Note: If option 0 is selected, the fan keeps running after the inverter unit starts running. If	0	○

Inverter function code	Name	Description	Default	Modify
		option 1 is selected, the fan keeps running after the inverter unit is powered on. If option 2 is selected, the fan keeps running when the inverter unit is running and the frequency reference is not 0.		
P08.40	PWM selection	Setting range: 0x0000–0x1223 Tens place: PWM mode selection 0: Switch from SVPWM to DPWM-U overmodulation 1: SVPWM overmodulation throughout the entire process 2: Low harmonic SVPWM modulation (valid when the thousands place is 0) 3: Switch from SVPWM to DPWM-I (valid when the thousands place is 0) Tens place: PWM low-speed carrier frequency limit 0: Low-speed carrier frequency limit mode 1 1: Low-speed carrier frequency limit mode 2 2: No limit on low-speed carrier Hundreds place: Deadzone compensation method 0: Compensation method 1 1: Compensation method 2 (only for vector control) 2: Compensation method 3 (only for vector control) Thousands place: SVPWM mode selection 0: Third harmonics injected into SVPWM 1: Traditional SVPWM	0x1101	⊙
P08.41	Overmodulation selection	Setting range: 0x0000–0x1111 Ones place: 0: Overmodulation disabled 1: Overmodulation enabled Tens place: 0: Mild overmodulation 1: Deepened overmodulation Hundreds place: Carrier frequency limit selection 0: Limit enabled 1: Limit disabled Thousands place: Reserved 0–1: Reserved	0x0001	⊙
P08.42	LED keypad control setting	Setting range: 0x0000–0x1223 Ones place: Frequency setting selection 0–1: Keypad UP/DOWN adjustment is enabled.	0x0003	○

Inverter function code	Name	Description	Default	Modify
		2: Reserved 3: Keypad UP/DOWN adjustment is disabled. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received Thousands place: Panel UP/DOWN key 0: The integral function is valid 1: The integral function is invalid		
P08.43	Reserved	/	/	/
P08.44	UP/DOWN terminal control setting	Setting range: 0x000–0x221 Ones place: Frequency setting selection 0: The setting made through UP/DOWN is valid. 1: The setting made through UP/DOWN is invalid. Tens place: Frequency control selection 0: Valid only when P00.06=0 or P00.07=0 1: Valid for all frequency setting methods 2: Invalid for multi-step speed running when multi-step speed running has the priority Hundreds place: Action selection for stop 0: Setting is valid. 1: Valid during running, cleared after stop 2: Valid during running, cleared after a stop command is received	0x000	○
P08.45	UP terminal frequency adjustment resolution	Setting range: 0.01–50.00Hz	0.50Hz	○
P08.46	DOWN terminal frequency adjustment resolution	Setting range: 0.01–50.00Hz	0.50Hz	○
P08.47	Action selection at power-down during frequency setting	Setting range: 0x000–0x111 Ones place: Action selection at power-down during frequency adjusting through digitals. 0: Save the setting at power-down. 1: Clear the setting at power-down. Tens place: Action selection at power-down during frequency adjusting through Modbus communication 0: Save the setting at power-down. 1: Clear the setting at power-down.	0x000	○

Inverter function code	Name	Description	Default	Modify
		Hundreds place: Action selection at power-down during frequency adjusting through CANOpen communication 0: Save the setting at power-down. 1: Clear the setting at power-down.		
P08.48	Initial energy consumption high word	Used to set the initial energy consumption. Initial energy consumption =	0kWh	○
P08.49	Initial energy consumption low word	P08.48×1000+P08.49(kWh) P08.48 setting range: 0–59999kWh Setting range of P08.49: 0.0–999.9 kWh	0.0kWh	○
P08.50	Magnetic flux braking	The function code is used to enable magnetic flux braking. 0: Invalid 100–150: A larger coefficient indicates stronger braking. The inverter unit can quickly slow down the motor by increasing the magnetic flux. The energy generated by the motor during braking can be transformed into heat energy by increasing the magnetic flux. The inverter unit monitors the state of the motor continuously even during the magnetic flux period. Magnetic flux braking can be used for motor stop, as well as for motor rotation speed change. The other advantages include: Braking is performed immediately after the stop command is given. The braking can be started without waiting for magnetic flux weakening. The cooling is better. The current of the stator other than the rotor increases during magnetic flux braking, while the cooling of the stator is more effective than the rotor.	0	○
P08.51	Reserved	/	/	/
P08.52	STO alarm latching selection	Setting range: 0x00–0x11 Tens place: STO alarm latching selection 0: STO alarm latching enabled STO alarm latching enabled: indicates that reset is required after the safety status recovers. 1: STO alarm latching disabled STO alarm latching disabled: Indicates that the STO alarm will automatically clear once the status returns to normal. Tens place: STL alarm reset selection 0: Reset not supported 1: Reset supported	0x00	○

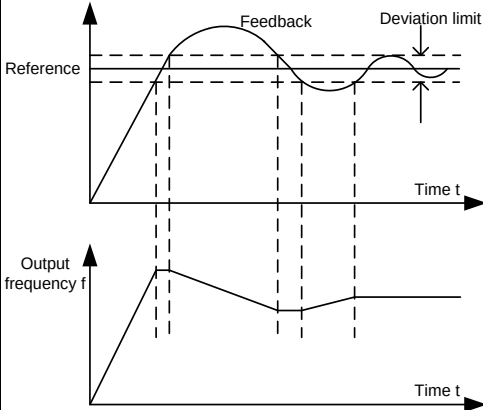
Inverter function code	Name	Description	Default	Modify
P08.53	Frequency upper limit bias value in torque control	Setting range: 0.00 Hz–P00.03 (Max. output frequency)	0.00Hz	○
P08.54	Frequency upper limit ACC/DEC selection in torque control	0: No limit on acceleration or deceleration 1: ACC/DEC time 1 2: ACC/DEC time 2 3: ACC/DEC time 3 4: ACC/DEC time 4	0	○
P08.55	Enabling auto carrier frequency reduction	0: Disable 1: Enable Note: Automatic carrier frequency reduction indicates that the VFD automatically reduces the carrier frequency when detecting the heat sink temperature exceeds the rated temperature. When the temperature decreases to a specified value, the carrier frequency restores to the setting. This function can reduce the VFD overheat alarm reporting chances.	0	○
P08.56	Min. carrier frequency	Range: 1.0–15.0kHz	Depends on model	●
P08.57	Automatic carrier frequency reduction temperature threshold	Setting range: 40.0–85.0°C	70.0°C	○
P08.58	Carrier frequency reduction interval	Setting range: 0–30min	10min	○
P08.59	AI1 disconnection detection threshold	Setting range: 0.00–10.00V	0.00V	○
P08.60	AI2 disconnection detection threshold	Setting range: 0.00–10.00V	0.00V	○
P08.61	AI3 disconnection detection threshold	Setting range: 0.00–10.00V	0.00V	○
P08.62	Output current filter time	Setting range: 0.000–10.000s	0.000s	○
P08.63	Output torque display filter count	Setting range: 0–8	8	○
P08.64	Function extension 1 selection	Setting range: 0x0000–0x1111 Ones place: 0: Rotor frequency 1: Stator frequency Tens place: 0: Report pre-excitation status 1: Do not report pre-excitation status Hundreds place: 0: CAN sampling rate according to TI specification 1: CAN sampling rate according to industrial specifications	0x0000	○

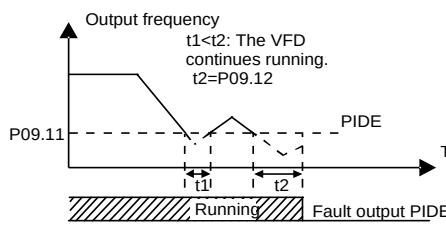
Inverter function code	Name	Description	Default	Modify
		Thousands place: 0: Reserved 1: Reserved		
P08.65– P08.66	Reserved	/	/	/
P08.67	DPWM switching frequency threshold	Setting range: 0.0–100.0%	25.0%	○
P08.68	Random PWM modulation depth	Setting range: 0.0–100.0%	0.0%	○
P08.69	Deadzone compensation max current	Setting range: 0–4096	0	○
P08.70	Deadzone compensation current segments	Setting range: 0–64	0	○
P08.71	Bus voltage sampling delay compensation	Setting range: 0–2000	0	○

Group P09—PID control

Inverter function code	Name	Description	Default	Modify
P09.00	PID reference source	When the frequency command selection (P00.06, P00.07) is 7 or the voltage setting channel selection (P04.27) is 6, the inverter unit is process PID controlled. The function code determines the target reference channel during the PID process. 0: Setting through P09.01 1: AI1 2: AI2 3: AI3 4: Reserved 5: Multi-step running 6: Modbus communication 7: CANopen communication 8: Ethernet communication 9: Reserved 10: EtherCAT/PROFINET communication 11: PLC card 12: PROFIBUS-DP communication The set target of process PID is a relative value, for which 100% equals 100% of the feedback signal of the controlled system. The system always performs calculation by using a relative value (0–100.0%).	0	○

Inverter function code	Name	Description	Default	Modify
P09.01	PID digital setting	The function code is mandatory when P09.00=0. The base value of The function code is the feedback of the system. Setting range: -100.0%–100.0%	0.0%	○
P09.02	PID feedback source	The function code is used to select the PID feedback channel. 0: AI1 1: AI2 2: AI3 3: Reserved 4: Modbus communication 5: CANopen communication 6: Ethernet communication 7: Reserved 8: EtherCAT/PROFINET communication 9: PLC card 10: MAX(AI1, AI2) 11: PROFIBUS-DP communication Note: The reference channel and feedback channel cannot be duplicated. Otherwise, effective PID control cannot be achieved.	0	○
P09.03	PID output characteristic selection	0: PID output is positive. When the feedback signal is greater than the PID reference value, the output frequency of the inverter unit will decrease to balance the PID. Example: PID control on strain during unwinding. 1: PID output is negative. When the feedback signal is greater than the PID reference value, the output frequency of the inverter unit will increase to balance the PID. Example: PID control on strain during unwinding.	0	○
P09.04	Proportional gain (Kp)	The function is applied to the proportional gain P of PID input. P determines the strength of the whole PID adjuster. The larger the value of P, the stronger the adjustment intensity. The value 100 indicates that when the difference between the PID feedback value and given value is 100%, the range within which the PID regulator can regulate the output frequency command is the max. frequency (ignoring integral function and differential function). Setting range: 0.00–100.00	1.80	○
P09.05	Integral time (Ti)	Used to determine the speed of the integral adjustment on the deviation of PID feedback and reference from the PID regulator. When the deviation of PID feedback and reference is 100%, the integral regulator	0.90s	○

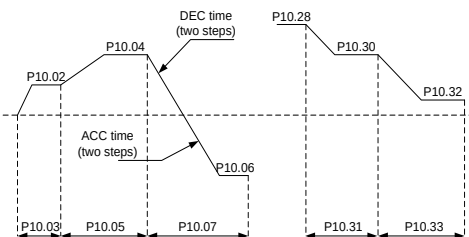
Inverter function code	Name	Description	Default	Modify
		works continuously during the time (ignoring proportional and differential function) to achieve the max. output frequency (P00.03) or the max. voltage (P04.31). Shorter integral time indicates stronger adjustment. Setting range: 0.00–10.00s		
P09.06	Differential time (Td)	Used to determine the strength of the change ratio adjustment on the deviation of PID feedback and reference from the PID regulator. If the PID feedback changes 100% during the time, the adjustment of the differential regulator (ignoring proportional and integral function) is the max. output frequency (P00.03) or the max. voltage (P04.31). (Ignore proportional and integral functions.) Longer differential time indicates stronger adjustment. Setting range: 0.00–10.00s	0.00s	○
P09.07	Sampling cycle (T)	Used to indicate the sampling cycle of feedback. The regulator calculates in each sampling cycle. A longer sampling cycle indicates slower response. Setting range: 0.001–1.000s	0.001s	○
P09.08	PID control deviation limit	The output of the PID system is relative to the max. deviation of the closed loop reference. As shown in the following figure, the PID regulator stops regulating in the range of deviation limit. Set the function parameter properly to adjust the accuracy and stability of the PID system.  Setting range: 0.0–100.0%	0.0%	○
P09.09	PID output upper limit	The function codes are used to set the upper and lower limits of PID regulator output values. 100.0% corresponds to the max. output frequency (P00.03) or max. voltage (P04.31). P09.09 setting range: P09.10–100.0%	100.0%	○
P09.10	PID output lower limit		0.0%	○

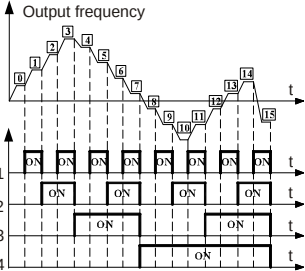
Inverter function code	Name	Description	Default	Modify
		Setting range of P09.10: -100.0%~P09.09		
P09.11	Feedback disconnection detection value	If the feedback value is smaller than or equal to the feedback disconnection detection value, and this condition lasts longer than the time specified by P09.12, the inverter unit reports E022 "PID feedback disconnection fault".	0.0%	○
P09.12	Feedback disconnection detection time	 Setting range of P09.11: 0.0~100.0% Setting range of P09.12: 0.0~3600.0s	1.0s	○
P09.13	PID control selection	Setting range: 0x0000~0x1111 Ones place: 0: Continue integral control after the frequency reaches upper/lower limit 1: Stop integral control after the frequency reaches upper/lower limit Tens place: 0: Same as the main reference direction. 1: Contrary to the main reference direction. Hundreds place: 0: Limit according to max. frequency 1: Limit according to A frequency Thousands place: 0: A+B frequency. ACC/DEC buffering for main frequency reference A does not take effect. 1: A+B frequency. ACC/DEC buffering for main frequency reference A takes effect. The ACC/DEC time corresponding to the thousands place is determined by ACC time P08.04.	0x0001	○
P09.14	Low frequency proportional gain (Kp)	Setting range: 0.00~100.00	1.00	○
P09.15	PID command ACC/DEC time	Setting range: 0.0~1000.0s	0.0s	○
P09.16	PID output filter time	Setting range: 0.000~10.000s	0.000s	○
P09.17	Reserved	/	/	/
P09.18	Low frequency integral time (Ti)	Setting range: 0.00~10.00s	0.90s	○
P09.19	Low frequency differential time (Td)	Setting range: 0.00~10.00s	0.00s	○
P09.20	Low frequency point for	Setting range: 0.00Hz~P09.21	5.00Hz	○

Inverter function code	Name	Description	Default	Modify
	PID parameter switching			
P09.21	High frequency point for PID parameter switching	Setting range: P09.20–P00.03	10.00Hz	○
P09.22	PID cut-in frequency	Setting range: 0.00Hz–P00.03	0.00Hz	◎

Group P10—Simple PLC and multi-step speed control

Inverter function code	Name	Description	Default	Modify
P10.00	Simple PLC mode	0: Stop after running once The inverter unit stops automatically after running for one cycle, and it can be started only after receiving the running command. 1: Keep running with the final value after running once The inverter unit keeps the running frequency and direction of the last section after a single cycle. 2: Cyclic running The inverter unit enters the next cycle after completing one cycle until receiving the stop command.	0	○
P10.01	Simple PLC power-down memory	0: Disable 1: Memory after power-down. The PLC memories its running stage and running frequency before power-down.	0	○
P10.02	Multi-step speed 0	Frequency setting range for step 0 to step 15: -100.0%–100.0%. 100.0% corresponds to the max. output frequency P00.03. Running time setting range for steps from step 0 to step 15: 0.0–6553.5s(min). The time unit is specified by P10.37. When simple PLC operation is selected, you need to set P10.02–P10.33 to determine the running frequency and running time of each step. Note: The symbol of multi-step speed determines the running direction of simple PLC, and a negative value indicates reverse running.	0.0	○
P10.03	Step 0 run time		0.0	○
P10.04	Multi-step speed 1		0.0	○
P10.05	Step 1 run time		0.0	○
P10.06	Multi-step speed 2		0.0	○
P10.07	Step 2 run time		0.0	○
P10.08	Multi-step speed 3		0.0	○
P10.09	Step 3 run time		0.0	○
P10.10	Multi-step speed 4		0.0	○
P10.11	Step 4 run time		0.0	○
P10.12	Multi-step speed 5		0.0	○
P10.13	Step 5 run time		0.0	○
P10.14	Multi-step speed 6		0.0	○
P10.15	Step 6 run time		0.0	○
P10.16	Multi-step speed 7		0.0	○
P10.17	Step 7 run time		0.0	○
P10.18	Multi-step speed 8		0.0	○
P10.19	Step 8 run time		0.0	○

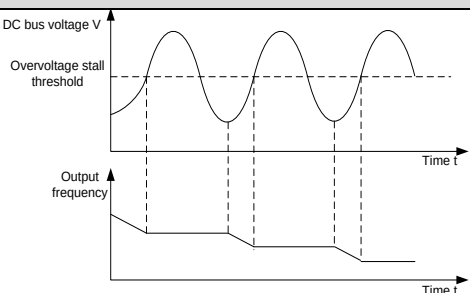


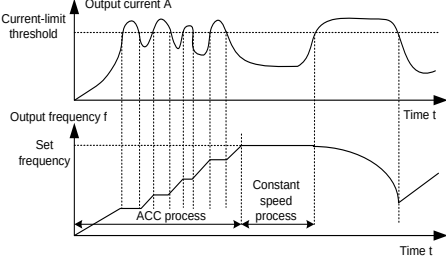
Inverter function code	Name	Description	Default	Modify																																																																																										
P10.20	Multi-step speed 9	When selecting multi-step speed running, the multi-step speed is within the range of $-f_{\max}$–$f_{\max}$, and it can be set continuously. The start-up and stop of multi-step speed running is determined by P00.01. The inverter unit supports the setting of 16-step speeds, selected via combinations of multi-step terminals 1–4 (configured via DI function codes P05.01–P05.04). These combinations correspond to multi-step speeds 0 through 15.  When terminal 1, terminal 2, terminal 3, and terminal 4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3 and terminal 4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings. The relation between terminal 1, terminal 2, terminal 3 and terminal 4 are shown in the following table (Trml indicates terminal). <table><tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Trml 4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Trml 4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr></table>	Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	Trml 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Step	0	1	2	3	4	5	6	7	Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	Trml 4	ON	ON	ON	ON	ON	ON	ON	ON	Step	8	9	10	11	12	13	14	15	0.0	☐
Trml 1	OFF		ON	OFF	ON	OFF	ON	OFF	ON																																																																																					
Trml 2	OFF		OFF	ON	ON	OFF	OFF	ON	ON																																																																																					
Trml 3	OFF		OFF	OFF	OFF	ON	ON	ON	ON																																																																																					
Trml 4	OFF		OFF	OFF	OFF	OFF	OFF	OFF	OFF																																																																																					
Step	0		1	2	3	4	5	6	7																																																																																					
Trml 1	OFF		ON	OFF	ON	OFF	ON	OFF	ON																																																																																					
Trml 2	OFF		OFF	ON	ON	OFF	OFF	ON	ON																																																																																					
Trml 3	OFF		OFF	OFF	OFF	ON	ON	ON	ON																																																																																					
Trml 4	ON		ON	ON	ON	ON	ON	ON	ON																																																																																					
Step	8		9	10	11	12	13	14	15																																																																																					
P10.21	Step 9 run time		0.0	☐																																																																																										
P10.22	Multi-step speed 10		0.0	☐																																																																																										
P10.23	Step 10 run time	0.0	☐																																																																																											
P10.24	Multi-step speed 11	0.0	☐																																																																																											
P10.25	Step 11 run time	0.0	☐																																																																																											
P10.26	Multi-step speed 12	0.0	☐																																																																																											
P10.27	Step 12 run time	0.0	☐																																																																																											
P10.28	Multi-step speed 13	0.0	☐																																																																																											
P10.29	Step 13 run time	0.0	☐																																																																																											
P10.30	Multi-step speed 14	0.0	☐																																																																																											
P10.31	Step 14 run time	0.0	☐																																																																																											
P10.32	Multi-step speed 15	0.0	☐																																																																																											
P10.33	Step 15 run time	When terminal 1, terminal 2, terminal 3, and terminal 4 are OFF, the frequency input mode is set by P00.06 or P00.07. When terminal 1, terminal 2, terminal 3 and terminal 4 are not all OFF, the frequency set by multi-step speed will prevail, and the priority of multi-step setting is higher than that of the keypad, analog, high-speed pulse, PID, and communication settings. The relation between terminal 1, terminal 2, terminal 3 and terminal 4 are shown in the following table (Trml indicates terminal). <table><tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Trml 4</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td></tr><tr><td>Step</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>Trml 1</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td></tr><tr><td>Trml 2</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr><tr><td>Trml 3</td><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Trml 4</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>ON</td></tr><tr><td>Step</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td></tr></table>	Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	Trml 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	Step	0	1	2	3	4	5	6	7	Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	Trml 4	ON	ON	ON	ON	ON	ON	ON	ON	Step	8	9	10	11	12	13	14	15	0.0	☐
Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON																																																																																						
Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON																																																																																						
Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON																																																																																						
Trml 4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF																																																																																						
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Trml 1	OFF	ON	OFF	ON	OFF	ON	OFF	ON																																																																																						
Trml 2	OFF	OFF	ON	ON	OFF	OFF	ON	ON																																																																																						
Trml 3	OFF	OFF	OFF	OFF	ON	ON	ON	ON																																																																																						
Trml 4	ON	ON	ON	ON	ON	ON	ON	ON																																																																																						
Step	8	9	10	11	12	13	14	15																																																																																						
P10.34	ACC/DEC time selection for simple PLC steps 0–7	The description is as follows: <table><tr><th>Function code</th><th>Binary</th><th>Step</th><th>ACC/DEC time 1</th><th>ACC/DEC time 2</th><th>ACC/DEC time 3</th><th>ACC/DEC time 4</th></tr><tr><td rowspan="8">P10.34</td><td>Bit1 Bit0</td><td>0</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit3 Bit2</td><td>1</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit5 Bit4</td><td>2</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit7 Bit6</td><td>3</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit9 Bit8</td><td>4</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit11 Bit10</td><td>5</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit13 Bit12</td><td>6</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit15 Bit14</td><td>7</td><td>00</td><td>01</td><td>10</td><td>11</td></tr></table>	Function code	Binary	Step	ACC/DEC time 1	ACC/DEC time 2	ACC/DEC time 3	ACC/DEC time 4	P10.34	Bit1 Bit0	0	00	01	10	11	Bit3 Bit2	1	00	01	10	11	Bit5 Bit4	2	00	01	10	11	Bit7 Bit6	3	00	01	10	11	Bit9 Bit8	4	00	01	10	11	Bit11 Bit10	5	00	01	10	11	Bit13 Bit12	6	00	01	10	11	Bit15 Bit14	7	00	01	10	11	0x0000	☐																																		
Function code	Binary	Step	ACC/DEC time 1	ACC/DEC time 2	ACC/DEC time 3	ACC/DEC time 4																																																																																								
P10.34	Bit1 Bit0	0	00	01	10	11																																																																																								
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P10.35	ACC/DEC time selection for simple PLC steps 8–15		0x0000	☐																																																																																										

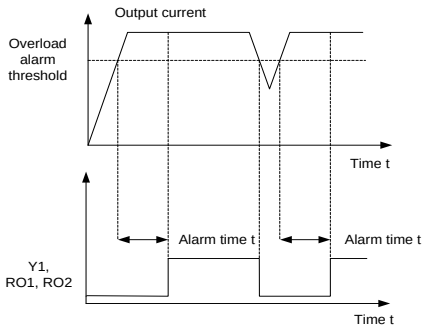
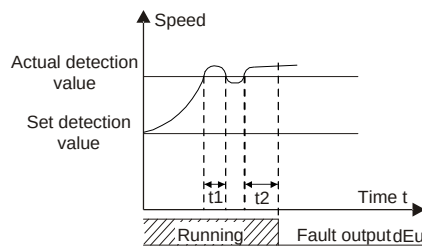
Inverter function code	Name	Description	Default	Modify																																																									
		<table><tr><td rowspan="8">P10.35</td><td>Bit1</td><td>Bit0</td><td>8</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit3</td><td>Bit2</td><td>9</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit5</td><td>Bit4</td><td>10</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit7</td><td>Bit6</td><td>11</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit9</td><td>Bit8</td><td>12</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit11</td><td>Bit10</td><td>13</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit13</td><td>Bit12</td><td>14</td><td>00</td><td>01</td><td>10</td><td>11</td></tr><tr><td>Bit15</td><td>Bit14</td><td>15</td><td>00</td><td>01</td><td>10</td><td>11</td></tr></table> Select corresponding acceleration/deceleration time, and then convert 16-bit binary number into hexadecimal number, finally, and then set corresponding function codes. ACC/DEC time 1 is set by P00.11 and P00.12; ACC/DEC time 2 is set by P08.00 and P08.01; ACC/DEC time 3 is set by P08.02 and P08.03; ACC/DEC time 4 is set by P08.04 and P08.05. Setting range: 0x0000–0xFFFF	P10.35	Bit1	Bit0	8	00	01	10	11	Bit3	Bit2	9	00	01	10	11	Bit5	Bit4	10	00	01	10	11	Bit7	Bit6	11	00	01	10	11	Bit9	Bit8	12	00	01	10	11	Bit11	Bit10	13	00	01	10	11	Bit13	Bit12	14	00	01	10	11	Bit15	Bit14	15	00	01	10	11		
P10.35	Bit1	Bit0		8	00	01	10	11																																																					
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	Bit13	Bit12		14	00	01	10	11																																																					
	Bit15	Bit14	15	00	01	10	11																																																						
P10.36	PLC restart mode	0: Restart from the first step, namely if the VFD stops during running (caused by stop command, fault or power down), it will run from the first step after restart. 1: Continue running from the step frequency when interruption occurred, namely if the VFD stops during running (caused by stop command or fault), it will record the running time of current step, and enters this step automatically after restart, then continue running at the frequency defined by this step in the remaining time.	0	⊙																																																									
P10.37	Multi-step run time unit	0: Second 1: Minute	0	⊙																																																									

Group P11—Protection parameters

Inverter function code	Name	Description	Default	Modify
P11.00	Phase loss protection	Setting range: 0x000–0x111 Ones place: Reserved Tens place: Output phase loss protection selection 0: Disable output phase loss protection 1: Enable output phase loss protection Hundreds place: Reserved	0x010	○
P11.01	Frequency decrease at sudden power loss	0: Disable 1: Enable	0	○
P11.02	Reserved	/	/	/
P11.03	Overvoltage stall protection	0: Disable 1: Enable	1	○

Inverter function code	Name	Description	Default	Modify
				
P11.04	Overvoltage stall protection voltage	Setting range for 380V: 120%–150% (of standard bus voltage)	136%	○
		Setting range for 220V: 120%–150% (of standard bus voltage)	120%	
P11.05	Current limit selection	During accelerated running, as the load is too large, the actual acceleration rate of motor is lower than that of output frequency, if no measures are taken, the inverter unit may trip due to overcurrent during acceleration. Setting range: 0x000–0x111 Ones place: Asynchronous motor current limit action selection 0: Invalid 1: Always valid Tens place: Hardware current limit overload alarm 0: Valid 1: Invalid Hundreds place: Synchronous motor hardware current limit action enable 0: Disable 1: Enable	0x001	◎
P11.06	Automatic current limit level	The current limit protection function detects output current during running, and compares it	160.0%	◎
P11.07	Frequency decrease rate during current limiting	with the current-limit level defined by P11.06. If it exceeds the current-limit level, the inverter unit will run at stable frequency during accelerated running, or run at a decreased frequency during constant-speed running; if it exceeds the current-limit level continuously, the inverter unit output frequency will drop continuously until reaching frequency lower limit. When the output current is detected to be lower than the current-limit level again, it will continue accelerated running.	10.00Hz/s	◎

Inverter function code	Name	Description	Default	Modify
		 P11.06 setting range: 50.0–200.0% (of inverter unit rated output current) Setting range of P11.07: 0.00–50.00Hz/s		
P11.08	Alarm selection for inverter unit/motor overload/underload	Setting range: 0x0000–0x1132 Ones place: 0: Motor overload/underload alarm, relative to the motor rated current. 1: Inverter unit overload/underload alarm, relative to rated inverter unit current. 2: Motor output torque OL/UL alarm, relative to motor rated torque. Tens place: 0: The inverter unit continues running after overload/underload alarm. 1: The inverter unit continues running after underload alarm, and stops running after overload fault. 2: The inverter unit continues running after overload alarm, and stops running after underload fault. 3: The inverter unit stops running after overload/underload fault. Hundreds place: 0: Always detect 1: Detect during constant-speed running Thousands place: Inverter unit overload current reference selection 0: Related to current calibration coefficient 1: Not related to the current correction coefficient	0x0000	○
P11.09	Overload alarm detection level	If the inverter unit or motor output current exceeds the overload alarm detection level (P11.09), and this condition lasts longer than the overload alarm detection time (P11.10), an overload alarm signal is output.	150%	○
P11.10	Overload alarm detection time		1.0s	○

Inverter function code	Name	Description	Default	Modify
		 P11.09 setting range: P11.11–200% (P11.08 ones place determines the relative value.) Setting range of P11.10: 0.1–3600.0s		
P11.11	Underload alarm detection level	If the VFD or motor output current is lower than the underload alarm detection level (P11.11), and this condition lasts longer than the underload alarm detection time (P11.12), an underload alarm signal is output. P11.11 setting range: 0–P11.09 (P11.08 ones place determines the relative value.) Setting range of P11.12: 0.1–3600.0s	50%	○
P11.12	Underload alarm detection time		1.0s	○
P11.13	Fault output terminal action on fault	Used to set the action of fault output terminals at undervoltage and fault reset. Setting range: 0x00–0x11 Ones place: 0: Act at undervoltage 1: Do not act at undervoltage Tens place: 0: Act during automatic reset 1: Do not act during automatic reset	0x00	○
P11.14	Speed deviation detection value	Setting range: 0.0–50.0% Used to set the speed deviation detection value.	10.0%	○
P11.15	Speed deviation detection time	Setting range: 0.0–10.0s Used to set the speed deviation detection time. Note: Speed deviation protection is invalid when P11.15=0.0.  t1<t2: The VFD continues running t2=P11.15	2.0s	○
P11.16	Voltage drop auto frequency reduction	0: Disable 1: Enable	0	○

Inverter function code	Name	Description	Default	Modify
	selection			
P11.17	Proportional coefficient of voltage regulator during undervoltage stall	Setting range: 0–127	30	○
P11.18	Integral coefficient of voltage regulator during undervoltage stall	Setting range: 0–1000	40	○
P11.19	Proportional coefficient of current regulator during undervoltage stall	Setting range: 0–1000	25	○
P11.20	Integral coefficient of current regulator during undervoltage stall	Setting range: 0–2000	150	○
P11.21	Proportional coefficient of voltage regulator during overvoltage stall	Setting range: 0–127	60	○
P11.22	Integral coefficient of voltage regulator during overvoltage stall	Setting range: 0–1000	5	○
P11.23	Proportional coefficient of current regulator during overvoltage stall	Setting range: 0–1000	60	○
P11.24	Integral coefficient of current regulator during overvoltage stall	Setting range: 0–2000	250	○
P11.25	Inverter unit overload integration enable	0: Disable 1: Enable	0	⊙
P11.26– P11.27	Reserved	/	/	/
P11.28	SPO detection delay after startup	Setting range: 0.0–60.0s Note: SPO (output phase loss) detection starts only after the inverter unit has been running for the delay time specified by P11.28, to avoid false alarms caused by unstable output frequency during startup. It is invalid in asynchronous motor (AM) sensorless vector control (SVC) mode 0 or 1.	5.0s	○
P11.29	SPO imbalance factor	Setting range: 1–10	6	○
P11.30	Reserved	/	/	/
P11.31	Fault selection 1	Setting range: 11–9000	11	○
P11.32	Fault selection 2	Setting range: 11–9000	12	○
P11.33	Fault selection 3	Setting range: 11–9000	13	○
P11.34	Fault selection 4	Setting range: 11–9000	14	○
P11.35	Fault level processing group 1	Setting range: 0x0000–0x4444 Ones place (P11.31 Fault selection 1):	0x0000	○

Inverter function code	Name	Description	Default	Modify
		Tens place (P11.32 Fault selection 2): Hundreds place (P11.33 Fault selection 3): Thousands place (P11.34 Fault selection 4): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved		
P11.36	Fault selection 5	Setting range: 11–9000	17	○
P11.37	Fault selection 6	Setting range: 11–9000	18	○
P11.38	Fault selection 7	Setting range: 11–9000	22	○
P11.39	Fault selection 8	Setting range: 11–9000	23	○
P11.40	Fault level processing group 2	Setting range: 0x0000–0x4444 Ones place (P11.36 Fault selection 5): Tens place (P11.37 Fault selection 6): Hundreds place (P11.38 Fault selection 7): Thousands place (P11.39 Fault selection 8): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved	0x0000	○
P11.41	Fault selection 9	Setting range: 11–9000	25	○
P11.42	Fault selection 10	Setting range: 11–9000	26	○
P11.43	Fault selection 11	Setting range: 11–9000	29	○
P11.44	Fault selection 12	Setting range: 11–9000	30	○
P11.45	Fault level processing group 3	Setting range: 0x0000–0x4444 Ones place (P11.41 Fault selection 9): Tens place (P11.42 Fault selection 10): Hundreds place (P11.43 Fault selection 11): Thousands place (P11.44 Fault selection 12): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved	0x0000	○
P11.46	Fault selection 13	Setting range: 11–9000	31	○
P11.47	Fault selection 14	Setting range: 11–9000	34	○

Inverter function code	Name	Description	Default	Modify
P11.48	Fault selection 15	Setting range: 11–9000	35	○
P11.49	Fault selection 16	Setting range: 11–9000	36	○
P11.50	Fault level processing group 4	Setting range: 0x0000–0x4444 Ones place (P11.51 Fault selection 13): Tens place (P11.52 Fault selection 14): Hundreds place (P11.53 Fault selection 15): Thousands place (P11.54 Fault selection 16): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved	0x0000	○
P11.51	Fault selection 17	Setting range: 11–9000	37	○
P11.52	Fault selection 18	Setting range: 11–9000	38	○
P11.53	Fault selection 19	Setting range: 11–9000	39	○
P11.54	Fault selection 20	Setting range: 11–9000	56	○
P11.55	Fault level processing group 5	Setting range: 0x0000–0x4444 Ones place (P11.51 Fault selection 17): Tens place (P11.52 Fault selection 18): Hundreds place (P11.53 Fault selection 19): Thousands place (P11.54 Fault selection 20): 0: Report a fault 1: Report a fault after deceleration to stop 2: Alarm, with the action executed according to P11.56 3: Screen out faults 4: Report a fault after deceleration to stop in emergency 5–15: Reserved	0x0000	○
P11.56	Fault and alarm action selection	Setting range: 0–4 0: Run at the set frequency 1: Run at output frequency at fault time 2: Run at frequency upper limit 3: Run at the frequency lower limit 4: Run at fallback frequency upon exceptions	0	○
P11.57	Fallback frequency upon exceptions	Setting range: 0.00Hz–P00.03	0.00Hz	○
P11.58	CBC current limiting coefficient	Setting range: 0.0–100.0%	100.0%	○
P11.59	SSI position lower limit low word	Setting range: 0–65535	0	○
P11.60	SSI position lower limit high word	Setting range: 0–65535	0	○
P11.61	SSI position upper limit	Setting range: 0–65535	0	○

Inverter function code	Name	Description	Default	Modify
	low word			
P11.62	SSI position upper limit high word	Setting range: 0–65535	0	○
P11.63	Communication timeout masking selection	Setting range: 0x00–0x12 Ones place: 0: Masked when the communication timeout time is 0. 1: Automatically masked in non communication command channel. 2: Automatically masked in non communication command channel, and the timeout fault is reset when switched to a non communication command channel. Tens place: 0–1: Reserved	0x00	○
P11.64	Short-circuit-to-ground detection at power-up	Setting range: 0x00–0x13 Ones place: 0: No detection 1: Detection at power-up 2: Detect before running 3: Detect at power up and before running Tens place: 0: Detect once only before the first run 1: Detect before every run Hundreds place: 0: Do not perform Hall sensor and driver self-tests during short-circuit-to-ground detection 1: Perform Hall sensor and driver self-tests during short-circuit-to-ground detection Thousands place: 0: Enable CBC 1: Disable CBC	0x02	◎

Group P12—Motor 2 parameters

Inverter function code	Name	Description	Default	Modify
P12.00	Motor 2 type	0: Asynchronous motor (AM) 1: Synchronous motor (SM)	0	◎
P12.01	AM 2 rated power	Setting range: 0.1–3000.0kW	Depends on model	◎
P12.02	AM 2 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	◎
P12.03	AM 2 rated speed	Setting range: 1–6000rpm	Depends on model	◎
P12.04	AM 2 rated voltage	Setting range: 0–1200V	on model	◎

Inverter function code	Name	Description	Default	Modify
P12.05	AM 2 rated current	Setting range: 0.8–6000.0A		⊙
P12.06	AM 2 stator resistance	Setting range: 0.001–65.535Ω		○
P12.07	AM 2 rotor resistance	Setting range: 0.001–65.535Ω		○
P12.08	AM 2 leakage inductance	Setting range: 0.1–6553.5mH		○
P12.09	AM 2 mutual inductance	Setting range: 0.1–6553.5mH		○
P12.10	AM 2 no-load current	Setting range: 0.1–6553.5A		○
P12.11	AM 2 core saturation coefficient 1	Setting range: 0.0–100.0%	80.0%	○
P12.12	AM 2 core saturation coefficient 2	Setting range: 0.0–100.0%	68.0%	○
P12.13	AM 2 core saturation coefficient 3	Setting range: 0.0–100.0%	57.0%	○
P12.14	AM 2 core saturation coefficient 4	Setting range: 0.0–100.0%	40.0%	○
P12.15	SM 2 rated power	Setting range: 0.1–3000.0kW	Depends on model	⊙
P12.16	SM 2 rated frequency	Setting range: 0.01Hz–P00.03 (Max. output frequency)	50.00Hz	⊙
P12.17	SM 2 pole pair count	Setting range: 1–128	2	⊙
P12.18	SM 2 rated voltage	Setting range: 0–1200V	Depends on model	⊙
P12.19	SM 2 rated current	Setting range: 0.8–6000.0A		⊙
P12.20	SM 2 stator resistance	Setting range: 0.001–65.535Ω		○
P12.21	SM 2 direct-axis inductance	Setting range: 0.01–655.35mH		○
P12.22	SM 2 quadrature-axis inductance	Setting range: 0.01–655.35mH		○
P12.23	SM 2 back-EMF constant	Setting range: 0–10000V	300V	○
P12.24	SM 2 initial magnetic pole position	Range: 0x0000–0xFFFF	0x0000	●
P12.25	SM 2 identification current	Range: 0%–50% (of motor rated current)	10%	●
P12.26	Motor 2 overload protection selection	0: No protection 1: Common motor (with low-speed compensation) 2: Variable-frequency motor (without low-speed compensation)	2	⊙
P12.27	Motor 2 overload protection coefficient	Motor overload multiplication $M = I_{out}/(I_n * K)$ I_n indicates the rated motor current, I_{out} indicates the inverter unit output current, and K indicates the motor overload protection coefficient. As "K" decreases, "M" increases, resulting in easier protection triggering. when M=116%, protection is performed after	100.0%	○

Inverter function code	Name	Description	Default	Modify
		motor overload lasts for 1 hour; when M=150%, protection is performed after motor overload lasts for 12 minutes; When M=180%, motor overload protection is triggered after the motor overload lasts for 5 minutes. When M=200%, motor overload protection is triggered after the motor overload lasts for 60 seconds. When M≥400%, overload protection is triggered immediately. Setting range: 20.0%–150.0%		
P12.28	Motor 2 power display calibration coefficient	Setting range: 0.00–3.00	1.00	○
P12.29	Motor 2 parameter display selection	0: Display by motor type. In this mode, only parameters related to the present motor type are displayed. 1: Display all. In this mode, all the motor parameters are displayed.	0	○
P12.30	Motor 2 system inertia	Setting range: 0.001–65.535kg·m ²	0.001 kg·m ²	○
P12.31	Reserved	/	/	/
P12.32	AM 2 power factor	Setting range: 0.00–1.00	0.85	○
P12.33	AM 2 rated speed high word	Setting range: 0–30 (10kRPM)	0	◎
P12.34	AM 2 core saturation coefficient 1	Setting range: 0.0–200.0%	125.0%	○
P12.35	AM 2 core saturation coefficient 2		125.0%	○
P12.36	AM 2 mutual inductance saturation coefficient 1		88.0%	○
P12.37	AM 2 mutual inductance saturation coefficient 2		88.0%	○
P12.38	AM 2 mutual inductance flux weakening coefficient 1		112.5%	○
P12.39	AM 2 mutual inductance flux weakening		117.6%	○

Inverter function code	Name	Description	Default	Modify
	coefficient 2			
P12.40	AM 2 mutual inductance flux weakening coefficient 3		122.8%	○
P12.41	AM 2 mutual inductance flux weakening coefficient 4		125.0%	○
P12.42	SM 2 direct-axis inductance saturation coefficient 1	Setting range: 100–10000	4096	○
P12.43	SM 2 direct-axis inductance saturation coefficient 2		4096	○
P12.44	SM 2 direct-axis inductance saturation coefficient 3		4096	○
P12.45	SM 2 direct-axis inductance saturation coefficient 4		3686	○
P12.46	SM 2 direct-axis inductance saturation coefficient 5		3277	○
P12.47	SM 2 direct-axis inductance saturation coefficient 6		2867	○
P12.48	SM 2 direct-axis inductance saturation coefficient 7		2458	○
P12.49	SM 2 direct-axis inductance saturation coefficient 8		2048	○
P12.50	SM 2 quadrature-axis inductance saturation coefficient 1		4096	○
P12.51	SM 2 quadrature-axis inductance saturation coefficient 2		4096	○
P12.52	SM 1 quadrature-axis inductance saturation coefficient 3		4096	○
P12.53	SM 2 quadrature-axis inductance saturation coefficient 4		3686	○
P12.54	SM 2 quadrature-axis inductance saturation coefficient 5		3277	○

Inverter function code	Name	Description	Default	Modify
P12.55	SM 2 quadrature-axis inductance saturation coefficient 6		2867	○
P12.56	SM 2 quadrature-axis inductance saturation coefficient 7		2458	○
P12.57	SM 2 quadrature-axis inductance saturation coefficient 8		2048	○
P12.58	SM 2 back-EMF identification value	Setting range: 0–10000V	0V	○

Group P13—SM control

Inverter function code	Name	Description	Default	Modify
P13.00	SM injection current fall rate	Used to set the reduction rate of the input reactive current. When the active current of the synchronous motor increases to some extent, the input reactive current can be reduced to improve the power factor of the motor. Setting range: 0.0%–100.0% (of the motor rated current)	80.0%	○
P13.01	Initial magnetic pole detection method	0: Do not detect 1: High-frequency superposition 2: Pulse superposition	0	◎
P13.02	Pull-in current 1	Pull-in current is the pole position orientation current; pull-in current 1 is valid within the lower limit of pull-in current switch-over frequency threshold. If you need to increase the start torque, increase the value of this function parameter properly. Setting range: -100.0%–100.0% (of the motor rated current)	20.0%	○
P13.03	Pull-in current 2	Pull-in current is the pole position orientation current; pull-in current 2 is valid within the upper limit of pull-in current switch-over frequency threshold. You do not need to change the value in most cases. Setting range: -100.0%–100.0% (of the motor rated current)	10.0%	○
P13.04	Pull-in current switching frequency	Setting range: 0.0–200.0% (of motor rated frequency)	20.0%	○
P13.05	Reserved	/	/	/
P13.06	Pulse current setting	Used to set the pulse current threshold when	100.0%	◎

Inverter function code	Name	Description	Default	Modify
		the initial magnetic pole position is detected in the pulse mode, The value is a percentage in relative to the rated current of the motor. Setting range: 0.0–300.0% (of the motor rated voltage)		
P13.07	Control parameter 0	Setting range: 0.0–400.0	0.0	○
P13.08	Vector control optimization mode	Setting range: 0x0000–0xFFFF Bit 0: Back-EMF self-adaptation (only for synchronous motor SVC 0) Bit 1: Enable SM weakening flux optimization (working with P03.22 to adjust the compensation) Bit 2: Enable current loop parameter optimization Bit 3: Enable SM Back-EMF identifying optimization Bit 4: Enable SM MTPA Bit5: Reserved Bit 6: Stator resistance online regulation Bit 7: Initial position identifying optimization Bits 8–15: Reserved	0x0000	○
P13.09	Reserved	/	/	/
P13.10	SM initial compensation angle	Setting range: 0.0–359.9	0.0	○
P13.11	Mal-adjustment detection time	Used to adjust the responsiveness of anti-maladjustment function. If the load inertia is large, increase the value of this parameter properly, however, the responsiveness may slow down accordingly. Setting range: 0.0–10.0s	0.5s	○
P13.12	Reserved	/	/	/
P13.13	High-frequency injection current	Setting range: 0.0–300.0% (of inverter unit rated output current)	20.0%	◎
P13.14	SVC speed feedback bandwidth	Setting range: 10.0–200.0rad/s	62.5rad/s	◎
P13.15	SM back-EMF adaptation bandwidth	Setting range: 0.1–10.0	0.1	○
P13.16	SRM flux linkage estimation proportional coefficient	Setting range: 5.0–200.0%	100.0%	○
P13.17	SRM optimization parameter	Setting range: 0x0–0x2	0x0	○
P13.18	SRM current vector angle	Setting range: -90.0–90.0°	45.0°	○
P13.19	Observer adaptive coefficient 1	Setting range: 0–200	2	○

Inverter function code	Name	Description	Default	Modify
P13.20	Observer adaptive coefficient 2	Setting range: 0–200	8	○
P13.21	Observer adaptive coefficient 3	Setting range: 0.0–20.0	0.1	○
P13.22	Observer adaptive coefficient 4	Setting range: 0.0–500.0	0.0	○
P13.23	Vector control IF starting enable	Setting range: 0x00–0x12	0x00	◎
P13.24	Vector control IF current setting	Setting range: 0.0–130.0%	100.0%	○
P13.25	Vector control IF or high-frequency injection cut-off frequency	Setting range: 0.0–100.0%	15.0%	○

Group P14—Communication

Inverter function code	Name	Description	Default	Modify
P14.00	Terminal RS485 communication address	Setting range: 1–127 If the slave communication address in the message frame sent from the master is set to 0, it serves as a broadcast communication address. All slaves on the Modbus bus will receive the frame, but the slaves will not respond to it. The communication addresses on the communication network are unique, which is the basis of the point-to-point communication between the host controller and the VFD. Note: The slave address cannot be set to 0.	1	○
P14.01	Terminal RS485 communication baud rate setting	Used to set the data transmission speed between the host controller and the inverter unit. 0: 1200bps 1: 2400bps 2: 4800bps 3: 9600bps 4: 19200bps 5: 38400bps 6: 57600bps 7: 115200bps Note: The baud rate set on the host controller must be the same as that set on the inverter unit; otherwise, communication cannot be established. A greater baud rate indicates faster communication.	4	○

Inverter function code	Name	Description	Default	Modify
P14.02	Terminal RS485 data bit parity setting	The data format set on the host controller must be the same as that set on the inverter unit; otherwise, communication cannot be established. 0: No parity (N, 8, 1) for RTU 1: Even parity (E, 8, 1) for RTU 2: Odd parity (O, 8, 1) for RTU 3: No parity (N, 8, 2) for RTU 4: Even parity (E, 8, 2) for RTU 5: Odd parity (O, 8, 2) for RTU	1	○
P14.03	Communication response delay	Setting range: 0–200ms Used to indicate the communication response delay, that is, the interval from when the inverter unit completes receiving data to when it sends response data to the host controller. If the response delay is shorter than the rectifier processing time, the rectifier sends response data to the host controller after processing data. If the delay is longer than the rectifier processing time, the rectifier does not send response data to the host controller until the delay is reached although data has been processed.	5ms	○
P14.04	Communication timeout fault time	Setting range: 0.0 (invalid)–60.0s When the function code is set to 0.0, the communication timeout time is invalid. When the function code is set a non-zero value, the rectifier reports the "485 communication fault" (E_485) if the communication interval exceeds the value. In general, the function code is set to 0.0. When continuous communication is required, you can set the function code to monitor communication status.	0.0s	○
P14.05	Transmission fault handling	0: Report an alarm and coast to stop 1: Keep running without reporting an alarm 2: Stop in enabled stop mode without reporting an alarm (applicable only to communication mode) 3: Stop in enabled stop mode without reporting an alarm (applicable to any mode)	0	○
P14.06	Communication handling action selection	Setting range: 0x000–0x111 Ones place: 0: Respond to write operations 1: Do not respond to write operations Tens place:	0x000	○

Inverter function code	Name	Description	Default	Modify
		0: Communication password protection is invalid. 1: Communication password protection is valid. Hundreds place: 0: P14.38 and P14.39 user-defined addresses are invalid. 1: P14.38 and P14.39 user-defined addresses are valid.		
P14.07	CANopen communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	0.0s	○
P14.08	CANopen communication address	Setting range: 1–32	2	◎
P14.09	CANopen communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4	◎
P14.10	PZD2 receive	Used for CANopen networking communication. 0: Invalid 1: Set frequency (0–Fmax, unit: 0.01Hz) 2: PID reference (-1000–1000, 1000 corresponds to 100.0%) 3: PID feedback (-1000–1000, 1000 corresponds to 100.0%) 4: Torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current) 5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz) 6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz) 7: Upper limit of motoring torque (0–3000, 1000 corresponds to 100.0% of the motor rated current) 8: Upper limit of braking torque (0–3000, 1000 corresponds to 100.0% of motor rated current) 9: Virtual input terminal command. Range: 0x00–0xFF (Bit 0–Bit 7 correspond to S1/S2/S3/S4/Reserved/Reserved/S5/S6) 10: Virtual output terminal command. Range: 0x00–0x1F (Bit 0–Bit 4 correspond to Y1/Reserved/RO1/RO2/RO3)	0	○
P14.11	PZD3 receive		0	○
P14.12	PZD4 receive		0	○
P14.13	PZD5 receive		0	○
P14.14	PZD6 receive		0	○
P14.15	PZD7 receive		0	○
P14.16	PZD8 receive		0	○
P14.17	PZD9 receive		0	○
P14.18	PZD10 receive		0	○
P14.19	PZD11 receive		0	○
P14.20	PZD12 receive		0	○

Inverter function code	Name	Description	Default	Modify
		11: Voltage setting (special for V/F separation) (0–1000, 1000 corresponds to 100.0% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, 1000 corresponds to 100.0%) 13: AO2 output setting 2 (-1000–+1000, 1000 corresponds to 100.0%) 14: Position reference high word (signed) 15: Position reference low word (unsigned) 16: Position feedback high word (signed) 17: Position feedback low word (unsigned) 18: Position feedback setting flag (Reserved) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20: Signed 32-bit set frequency, high word (signed) 21: Signed 32-bit set frequency, low word (unsigned) 22: AO1 output setting 2 (-10000–10000, 10000 corresponds to 100.00%) 23: AO2 output setting 2 (-10000–10000, 10000 corresponds to 100.00%) 24: Tension control: Linear speed reference (0.0–3000.0m/min) 25: Tension control: Tension reference (0–30000N) 26: Tension control: Tension taper (0.00–100.00) 27: Tension control: Tension PID reference (0.00–100.00%) 28: Tension control: Tension PID feedback (0.00–100.00%) 29: Pre torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current) 30: Set frequency (-327.67–327.67; unit: 0.01Hz) 31–47: Reserved		
P14.21	PZD2 transmit	Used for CANopen networking communication.	0	○
P14.22	PZD3 transmit		0	○
P14.23	PZD4 transmit		0	○
P14.24	PZD5 transmit		0	○
P14.25	PZD6 transmit		0	○
P14.26	PZD7 transmit		0	○
P14.27	PZD8 transmit		0	○
P14.28	PZD9 transmit		0	○
P14.29	PZD10 transmit		0	○

Inverter function code	Name	Description	Default	Modify
P14.30	PZD11 transmit	7: Actual output power (×10, %)	0	○
P14.31	PZD12 transmit	8: Rotation speed of running (×1, RPM) 9: Linear speed of running (×1, m/s) 10: Ramp reference frequency 11: Fault code 12: AI1 value (0–1000 corresponds to 0–10.00V) 13: AI2 value (0–1000 corresponds to 0–10.00V) 14: AI3 value (0–1000 corresponds to 0–10.00V) 15: Reserved 16: Terminal input status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: Position reference high word (signed) 22: Position reference low word (unsigned) 23: Position feedback high word (signed) 24: Position feedback low word (unsigned) 25: Status word 26: Reserved 27: PG card pulse feedback count high word 28: PG card pulse feedback count low word 29: PG card pulse reference count high word 30: PG card pulse reference count low word 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70) 32: AI1 value (0–10000 corresponds to 0–10.000V) 33: AI2 value (0–10000 corresponds to 0–10.000V) 34: AI3 value (0–10000 corresponds to 0–10.000V) 35: Reserved 36: Running frequency (×1000, Hz) 37: Set frequency (×1000, Hz) 38: Brake status 39: Encoder feedback frequency (-Fmax–Fmax, 0.1Hz) 40–47: Reserved Note: After networking with a communication expansion card, PZD12 transmit is not available.	0	○
P14.32	Reserved	/	/	/

Inverter function code	Name	Description	Default	Modify
P14.33	Communication card control and status word format selection	0: Decimal system 1: Binary system Note: The setting of rectifier unit function parameter P01.16 must be the same as that of this inverter unit function parameter.	0	⊙
P14.34	Reserved	/	/	/
P14.35	RS485 communication manual reset	0: Disable 1: Enable Note: When set to 1, it automatically returns to 0 after reset.	0	⊙
P14.36	RS485 communication automatic reset timeout	Setting range: 0.0 (invalid)–60.0s	0.0s	○
P14.37	RS485 communication mode	0: Standard mode 1: Communication mode 1 2: Communication mode 2	0	○
P14.38	User-defined running command address	Setting range: 0x0000–0xFFFF	0x2000	○
P14.39	User-defined frequency setting address	Setting range: 0x0000–0xFFFF	0x2001	○
P14.40	Bootloader upgrade function setting	0x00–0x01 Ones place: No upgrade bootloader program fault display 0: Display 1: Do not display Tens place: Reserved	0x01	○
P14.41	Reserved	/	/	/
P14.42	PKW byte length selection	0: 8 bytes (PKW1–4) 1: 6 bytes (PKW1/2/4) Note: This setting must be consistent with that of the rectifier function parameter P22.28.	1	○
P14.43	CW mode selection	0: Simplified CANOpen mode (CW sent via broadcast message) 1: Standard CANOpen mode (CW sent via CANOpen message)	1	⊙
P14.44	Digital position reference low word	Setting range: 0–65535	0	○
P14.45	Digital position reference high word	Setting range: 0–65535	0	○
P14.46	PN/EtherCAT communication gateway configuration selection	0: PKW1–PZD8 1: PKW1–PZD12 Note: This setting must be consistent with that of the rectifier function parameter P21.53.	1	⊙
P14.47	PZD display selection	Setting range: 0x00–0xCC Ones place: Received PZD 0–1: P19.15 displays CW 2: P19.15 displays PZD2 3: P19.15 displays PZD3	0x00	⊙

Inverter function code	Name	Description	Default	Modify
		4: P19.15 displays PZD4 5: P19.15 displays PZD5 6: P19.15 displays PZD6 7: P19.15 displays PZD7 8: P19.15 displays PZD8 9: P19.15 displays PZD9 A: P19.15 displays PZD10 B: P19.15 displays PZD11 C: P19.15 displays PZD12 Tens place: Send PZD 0-1: P19.16 displays SW 2: P19.16 displays PZD2 3: P19.16 displays PZD3 4: P19.16 displays PZD4 5: P19.16 displays PZD5 6: P19.16 displays PZD6 7: P19.16 displays PZD7 8: P19.16 displays PZD8 9: P19.16 displays PZD9 A: P19.16 displays PZD10 B: P19.16 displays PZD11 C: P19.16 displays PZD12		
P14.48	Mapping channel selection	Setting range: 0x00-0x13 Ones place: 0: Invalid 1: CANopen 2: PROFIBUS-DP 3: PROFINET Tens place: 0: Save only to RAM 1: Save to both RAM and EEPROM	0x01	⊙
P14.49	Receive PZD2 function code address	Valid when P14.48 is not 0x00. After the corresponding channel is selected by P14.48, this PZD is used to replace the original channel PZD. The PZD can be mapped to a function code. Set the value in hexadecimal format. The high byte indicates the function code group, and the low byte indicates the function code number. For example, 0x1011 indicates P16.17.	0x0000	○
P14.50	Receive PZD3 function code address		0x0000	○
P14.51	Receive PZD4 function code address		0x0000	○
P14.52	Receive PZD5 function code address		0x0000	○
P14.53	Receive PZD6 function code address		0x0000	○
P14.54	Receive PZD7 function code address		0x0000	○
P14.55	Receive PZD8 function code address		0x0000	○
P14.56	Receive PZD9 function code address	Setting range: 0x0000-0xFFFF	0x0000	○

Inverter function code	Name	Description	Default	Modify
P14.57	Receive PZD10 function code address		0x0000	○
P14.58	Receive PZD11 function code address		0x0000	○
P14.59	Receive PZD12 function code address		0x0000	○
P14.60	Transmit PZD2 function code address	Valid when P14.48 is not 0x00. After the corresponding channel is selected by P14.48, this PZD is used to replace the original channel PZD. The PZD can be mapped to a function code. Set the value in hexadecimal format. The high byte indicates the function code group, and the low byte indicates the function code number. For example, 0x1011 indicates P16.17. Setting range: 0x0000–0xFFFF	0x0000	○
P14.61	Transmit PZD3 function code address		0x0000	○
P14.62	Transmit PZD4 function code address		0x0000	○
P14.63	Transmit PZD5 function code address		0x0000	○
P14.64	Transmit PZD6 function code address		0x0000	○
P14.65	Transmit PZD7 function code address		0x0000	○
P14.66	Transmit PZD8 function code address		0x0000	○
P14.67	Transmit PZD9 function code address		0x0000	○
P14.68	Transmit PZD10 function code address		0x0000	○
P14.69	Transmit PZD11 function code address		0x0000	○
P14.70	Transmit PZD12 function code address		0x0000	○
P14.71	CANopen slave count	Setting range: 0–31	0	○
P14.72	CANopen master/slave selection	0: Slave 1: Master	0	○
P14.73	PDO1 transmission cycle	Setting range: 5–3000ms	20ms	○
P14.74	PDO2 transmission cycle	Setting range: 5–3000ms	10ms	○
P14.75	PDO3 transmission cycle	Setting range: 5–3000ms	30ms	○
P14.76	PDO4 transmission cycle	Setting range: 5–3000ms	50ms	○
P14.77	TPDO1 trigger mode	Setting range: 254–255	255	○
P14.78	TPDO2 trigger mode	Setting range: 254–255	255	○
P14.79	TPDO3 trigger mode	Setting range: 254–255	255	○
P14.80	TPDO4 trigger mode	Setting range: 254–255	255	○
P14.81	CANopen heartbeat monitoring time	Setting range: 0–10000ms	500ms	○
P14.82	TPOO2 event timer	Setting range: 0–10000ms	0ms	○

Inverter function code	Name	Description	Default	Modify
P14.83	TPOO3 event timer	Setting range: 0–10000ms	0ms	○
P14.84	TPOO4 event timer	Setting range: 0–10000ms	0ms	○
P14.85	TPDO2 inhibit time	Setting range: 0–10000ms	500ms	○
P14.86	TPDO3 inhibit time	Setting range: 0–10000ms	500ms	○
P14.87	TPDO4 inhibit time	Setting range: 0–10000ms	500ms	○
P14.88	PDO receive enable	Setting range: 0x0–0xF	0x7	○
P14.89	PDO transmit enable	Setting range: 0x0–0xF	0x7	○
P14.90	Auto control on data interaction period	0: Manual adjustment mode for rectifier unit 1: Automatic adjustment mode for rectifier unit (based on CAN bus load) 2: Manual adjustment mode for inverter unit	0	○
P14.91	CAN extended frame enable	0: Enable 1: Disable	0	○
P14.92	PDO_CW broadcast transmission period	Setting range: 0 (Invalid)–10ms	0 ms	○

Group P15—Communication card 1 functions (PROFIBUS-DP)

Inverter function code	Name	Description	Default	Modify
P15.00	Reserved	/	/	/
P15.01	Module address	Setting range: 0–127	2	⊙
P15.02	PZD2 receive	0: Invalid	0	○
P15.03	PZD3 receive	1: Set frequency (0–Fmax, unit: 0.01Hz)		
P15.04	PZD4 receive	2: PID reference (-1000–1000, 1000 corresponds to 100.0%)		
P15.05	PZD5 receive	3: PID feedback (-1000–1000, 1000 corresponds to 100.0%)		
P15.06	PZD6 receive	4: Torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current)		
P15.07	PZD7 receive	5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz)		
P15.08	PZD8 receive	6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz)		
P15.09	PZD9 receive	7: Upper limit of motoring torque (0–3000, 1000 corresponds to 100.0% of the motor rated current)		
P15.10	PZD10 receive	8: Upper limit of braking torque (0–3000, 1000 corresponds to 100.0% of motor rated current)		
P15.11	PZD11 receive	9: Virtual input terminal command. Range: 0x00–0xFF (Bit 0–Bit 7 correspond to S1/S2/S3/S4/Reserved/Reserved/S5/S6)		
P15.12	PZD12 receive	10: Virtual output terminal command. Range: 0x00–0x1F (Bit 0–Bit 4 correspond to Y1/Reserved/RO1/RO2/RO3) 11: Voltage setting (special for V/F)		

Inverter function code	Name	Description	Default	Modify
		separation) (0–1000, 1000 corresponds to 100% of the motor rated voltage) 12: AO1 output setting 1 (-1000–+1000, 1000 corresponds to 100.0%) 13: AO2 output setting 1 (-1000–+1000, 1000 corresponds to 100.0%) 14: Position reference high word (signed) 15: Position reference low word (unsigned) 16: Position feedback high word (signed) 17: Position feedback low word (unsigned) 18: Position feedback setting flag (Reserved) 19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59) 20: Signed 32-bit set frequency, high word (signed) 21: Signed 32-bit set frequency, low word (unsigned) 22: AO1 output setting 2 (-10000–10000, 10000 corresponds to 100.00%) 23: AO2 output setting 2 (-10000–10000, 10000 corresponds to 100.00%) 24: Tension control: Linear speed reference (0.0–3000.0m/min) 25: Tension control: Tension reference (0–30000N) 26: Tension control: Tension taper (0.00–100.00) 27: Tension control: Tension PID reference (0.00–100.00%) 28: Tension control: Tension PID feedback (0.00–100.00%) 29: Pre torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current) 30: Set frequency (-327.67–327.67; unit: 0.01Hz) 31–47: Reserved		
P15.13	PZD2 transmit	0: Invalid	0	○
P15.14	PZD3 transmit	1: Running frequency (×100, Hz)		
P15.15	PZD4 transmit	2: Set frequency (×100, Hz)		
P15.16	PZD5 transmit	3: Bus voltage (×10, V)		
P15.17	PZD6 transmit	4: Output voltage (×1, V)		
P15.18	PZD7 transmit	5: Output current (×10, A)		
P15.19	PZD8 transmit	6: Actual output torque (×10, %)		
P15.20	PZD9 transmit	7: Actual output power (×10, %)		
P15.21	PZD10 transmit	8: Rotation speed of running (×1, RPM)		
P15.22	PZD11 transmit	9: Linear speed of running (×1, m/s)		

Inverter function code	Name	Description	Default	Modify
P15.23	PZD12 transmit	10: Ramp reference frequency 11: Fault code 12: AI1 value (0–1000 corresponds to 0–10.00V) 13: AI2 value (0–1000 corresponds to 0–10.00V) 14: AI3 value (0–1000 corresponds to 0–10.00V) 15: Reserved 16: Terminal input status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: Position reference high word (signed) 22: Position reference low word (unsigned) 23: Position feedback high word (signed) 24: Position feedback low word (unsigned) 25: Status word 26: Reserved 27: PG card pulse feedback count high word 28: PG card pulse feedback count low word 29: PG card pulse reference count high word 30: PG card pulse reference count low word 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70) 32: AI1 value (0–10000 corresponds to 0–10.000V) 33: AI2 value (0–10000 corresponds to 0–10.000V) 34: AI3 value (0–10000 corresponds to 0–10.000V) 35: Reserved 36: Running frequency (×1000, Hz) 37: Set frequency (×1000, Hz) 38: Brake status 39: Encoder feedback frequency (-Fmax–Fmax, 0.1Hz) 40–47: Reserved Note: After networking with a communication expansion card, PZD12 transmit is not available.		
P15.24	Reserved	/	/	/
P15.25	DP communication timeout time	Setting range: 0.0 (invalid), 0.1–60.0s	5.0	○

Group P16—Communication card 2 functions (Ethernet/PROFINET/EtherCAT)

Inverter function code	Name	Description	Default	Modify
P16.00–P16.01	Reserved	/	/	/
P16.02	Ethernet IP address 1	Setting range: 0–255	192	⊙
P16.03	Ethernet IP address 2	Setting range: 0–255	168	⊙
P16.04	Ethernet IP address 3	Setting range: 0–255	0	⊙
P16.05	Ethernet IP address 4	Setting range: 0–255	1	⊙
P16.06	Ethernet subnet mask 1	Setting range: 0–255	255	⊙
P16.07	Ethernet subnet mask 2	Setting range: 0–255	255	⊙
P16.08	Ethernet subnet mask 3	Setting range: 0–255	255	⊙
P16.09	Ethernet subnet mask 4	Setting range: 0–255	0	⊙
P16.10	Ethernet gateway 1	Setting range: 0–255	192	⊙
P16.11	Ethernet gateway 2	Setting range: 0–255	168	⊙
P16.12	Ethernet gateway 3	Setting range: 0–255	0	⊙
P16.13	Ethernet gateway 4	Setting range: 0–255	1	⊙
P16.14	Ethernet card monitoring variable address 1	Setting range: 0x0000–0xFFFF	0x0000	○
P16.15	Ethernet card monitoring variable address 2	Setting range: 0x0000–0xFFFF	0x0000	○
P16.16	Ethernet card monitoring variable address 3	Setting range: 0x0000–0xFFFF	0x0000	○
P16.17	Ethernet card monitoring variable address 4	Setting range: 0x0000–0xFFFF	0x0000	○
P16.18–P16.23	Reserved	/	/	/
P16.24	Time to identify expansion card 1	Setting range: 0.0–600.0s The value 0.0s indicates that identification faults are not detected.	0.0s	○
P16.25	Time to identify expansion card 2	Setting range: 0.0–600.0s The value 0.0s indicates that identification faults are not detected.	0.0s	○
P16.26	Reserved	/	/	/
P16.27	Communication timeout time of expansion card in card slot 1	Setting range: 0.0–600.0s The value 0.0s indicates that disconnection faults are not detected.	0.0s	○
P16.28	Communication timeout time of expansion card in card slot 2	Setting range: 0.0–600.0s The value 0.0s indicates that disconnection faults are not detected.	0.0s	○
P16.29	PN expansion card slot type	0: Multi-slot 1: Single-slot	0	⊙
P16.30	EtherCAT communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s	○
P16.31	PROFINET communication timeout time	Setting range: 0.0 (invalid)–60.0s	5.0s	○

Inverter function code	Name	Description	Default	Modify
P16.32	PZD2 receive	0: Invalid	0	○
P16.33	PZD3 receive	1: Set frequency (0–Fmax, unit: 0.01Hz)	0	○
P16.34	PZD4 receive	2: PID reference (-1000–1000, 1000 corresponds to 100.0%)	0	○
P16.35	PZD5 receive	3: PID feedback (-1000–1000, 1000 corresponds to 100.0%)	0	○
P16.36	PZD6 receive	4: Torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current)	0	○
P16.37	PZD7 receive	5: Setting of the upper limit of forward running frequency (0–Fmax, unit: 0.01Hz)	0	○
P16.38	PZD8 receive	6: Setting of the upper limit of reverse running frequency (0–Fmax, unit: 0.01Hz)	0	○
P16.39	PZD9 receive	7: Upper limit of motoring torque (0–3000, 1000 corresponds to 100.0% of the motor rated current)	0	○
P16.40	PZD10 receive	8: Upper limit of braking torque (0–3000, 1000 corresponds to 100.0% of motor rated current)	0	○
P16.41	PZD11 receive	9: Virtual input terminal command. Range: 0x00–0x7F (Bit 0–Bit 7 correspond to S1/S2/S3/S4/Reserved/Reserved/S5/S6)	0	○
P16.42	PZD12 receive	10: Virtual output terminal command. Range: 0x00–0x1F (Bit 0–Bit 4 correspond to Y1/Reserved/RO1/RO2/RO3)	0	○
		11: Voltage setting (used when V/F separation is implemented) (0–1000, 1000 corresponds to 100.0% of the motor rated voltage)		
		12: AO1 output setting 1 (-1000–+1000, 1000 corresponds to 100.0%)		
		13: AO2 output setting 1 (-1000–+1000, 1000 corresponds to 100.0%)		
		14: Position reference high word (signed)		
		15: Position reference low word (unsigned)		
		16: Position feedback high word (signed)		
		17: Position feedback low word (unsigned)		
		18: Position feedback setting flag (Reserved)		
		19: Function parameter mapping (PZD2–PZD12 correspond to P14.49–P14.59)		
		20: Signed 32-bit set frequency, high word (signed)		
		21: Signed 32-bit set frequency, low word (unsigned)		
		22: AO1 output setting 2 (-10000–10000, 10000 corresponds to 100.00%)		
		23: AO2 output setting 2 (-10000–10000, 10000 corresponds to 100.00%)		
		24: Tension control: Linear speed reference		

Inverter function code	Name	Description	Default	Modify
		(0.0–3000.0m/min) 25: Tension control: Tension reference (0–30000N) 26: Tension control: Tension taper (0.00–100.00) 27: Tension control: Tension PID reference (0.00–100.00%) 28: Tension control: Tension PID feedback (0.00–100.00%) 29: Pre torque setting (-3000–+3000, 1000 corresponds to 100.0% of the motor rated current) 30: Set frequency (-327.67–327.67; unit: 0.01Hz) 31–47: Reserved		
P16.43	PZD2 transmit	0: Invalid	0	○
P16.44	PZD3 transmit	1: Running frequency (×100, Hz)	0	○
P16.45	PZD4 transmit	2: Set frequency (×100, Hz)	0	○
P16.46	PZD5 transmit	3: Bus voltage (×10, V)	0	○
P16.47	PZD6 transmit	4: Output voltage (×1, V)	0	○
P16.48	PZD7 transmit	5: Output current (×10, A)	0	○
P16.49	PZD8 transmit	6: Actual output torque (×10, %)	0	○
P16.50	PZD9 transmit	7: Actual output power (×10, %)	0	○
P16.51	PZD10 transmit	8: Rotation speed of running (×1, RPM)	0	○
P16.52	PZD11 transmit	9: Linear speed of running (×1, m/s)	0	○
P16.53	PZD12 transmit	10: Ramp reference frequency 11: Fault code 12: AI1 value (0–1000 corresponds to 0–10.00V) 13: AI2 value (0–1000 corresponds to 0–10.00V) 14: AI3 value (0–1000 corresponds to 0–10.00V) 15: Reserved 16: Terminal input status 17: Terminal output status 18: PID reference (×100, %) 19: PID feedback (×100, %) 20: Motor rated torque 21: Position reference high word (signed) 22: Position reference low word (unsigned) 23: Position feedback high word (signed) 24: Position feedback low word (unsigned) 25: Status word 26: Reserved 27: PG card pulse feedback count high word 28: PG card pulse feedback count low word	0	○

Inverter function code	Name	Description	Default	Modify
		29: PG card pulse reference count high word 30: PG card pulse reference count low word 31: Function parameter mapping (PZD2–PZD12 correspond to P14.60–P14.70) 32: AI1 value (0–10000 corresponds to 0–10.000V) 33: AI2 value (0–10000 corresponds to 0–10.000V) 34: AI3 value (0–10000 corresponds to 0–10.000V) 35: Reserved 36: Running frequency (×1000, Hz) 37: Set frequency (×1000, Hz) 38: Brake status 39: Encoder feedback frequency (-Fmax–Fmax, 0.1Hz) 40–47: Reserved Note: After networking with a communication expansion card, PZD12 transmit is not available.		
P16.54–P16.57	Reserved	/	/	/
P16.58	Industrial Ethernet communication card IP address 1	Setting range: 0–255	192	⊙
P16.59	Industrial Ethernet communication card IP address 2	Setting range: 0–255	168	⊙
P16.60	Industrial Ethernet communication card IP address 3	Setting range: 0–255	0	⊙
P16.61	Industrial Ethernet communication card IP address 4	Setting range: 0–255	1	⊙
P16.62	Industrial Ethernet communication card subnet mask 1	Setting range: 0–255	255	⊙
P16.63	Industrial Ethernet communication card subnet mask 2	Setting range: 0–255	255	⊙
P16.64	Industrial Ethernet communication card subnet mask 3	Setting range: 0–255	255	⊙
P16.65	Industrial Ethernet communication card subnet mask 4	Setting range: 0–255	0	⊙

Inverter function code	Name	Description	Default	Modify
P16.66	Industrial Ethernet communication card gateway 1	Setting range: 0–255	192	☉
P16.67	Industrial Ethernet communication card gateway 2	Setting range: 0–255	168	☉
P16.68	Industrial Ethernet communication card gateway 3	Setting range: 0–255	0	☉
P16.69	Industrial Ethernet communication card gateway 4	Setting range: 0–255	1	☉

Group P17—Status viewing

Inverter function code	Name	Description	Default	Modify
P17.00	Set frequency	Displays the current set frequency of the inverter unit. Range: 0.00Hz–P00.03	50.00Hz	●
P17.01	Output frequency	Displays the current output frequency of the inverter unit. Range: 0.00Hz–P00.03	0.00Hz	●
P17.02	Ramp reference frequency	Displays the present ramp reference frequency of the inverter unit. Range: 0.00Hz–P00.03	0.00Hz	●
P17.03	Output voltage	Displays current output voltage of the inverter unit. Range: 0–1200V	0V	●
P17.04	Output current	Displays the valid value of current output current of the inverter unit. Range: 0.0–5000.0A	0.0A	●
P17.05	Motor speed	Displays the present motor rotation speed. Range: 0–65535RPM	0RPM	●
P17.06	Torque current	Displays the present torque current of the inverter unit. Range: -3000.0–3000.0A	0.0A	●
P17.07	Exciting current	Displays the present exciting current of the inverter unit. Range: -3000.0–3000.0A	0.0A	●
P17.08	Motor power	Displays the present motor power. 100.0% corresponds to the rated motor power. The positive value is the motoring state while the negative value is the generating state. Range: -300.0%–300.0%	0.0%	●
P17.09	Motor output torque	Displays the current output torque of the inverter unit; 100.0% is relative to the rated motor torque. During forward running, the	0.0%	●

Inverter function code	Name	Description	Default	Modify								
		positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state. Range: -250.0%–250.0%										
P17.10	Estimated motor rotor frequency	Displays the estimated motor rotor frequency under the open-loop vector condition. Range: 0.00–590.00Hz	0.00Hz	●								
P17.11	DC bus voltage	Displays current DC bus voltage of the inverter unit. Range: 0.0–2000.0V	0.0V	●								
P17.12	Digital input terminal state	Displays the present digital input terminal state of the inverter unit. Range: 0x0–0xF <table><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>S4</td><td>S3</td><td>S2</td><td>S1</td></tr></table>	Bit3	Bit2	Bit1	Bit0	S4	S3	S2	S1	0x0	●
Bit3	Bit2	Bit1	Bit0									
S4	S3	S2	S1									
P17.13	Digital output terminal state	Displays the present digital output terminal state of the inverter unit. Range: 0x0–0xF <table><tr><td>Bit3</td><td>Bit2</td><td>Bit1</td><td>Bit0</td></tr><tr><td>RO2</td><td>RO1</td><td>Reserved</td><td>Y1</td></tr></table>	Bit3	Bit2	Bit1	Bit0	RO2	RO1	Reserved	Y1	0x0	●
Bit3	Bit2	Bit1	Bit0									
RO2	RO1	Reserved	Y1									
P17.14	Frequency adjustment value	Displays the adjustment on the inverter unit through the <u>UP/DOWN</u> terminal. Range: 0.00Hz–590.00Hz	0.00Hz	●								
P17.15	Torque reference value	Range: -300.0%–300.0% (of the motor rated current)	0.0%	●								
P17.16	Linear speed	Range: 0–65535	0	●								
P17.17	Reserved	/	/	/								
P17.18	Count value	Range: 0–65535	0	●								
P17.19	AI1 input voltage	Displays the AI1 input signal. Range: 0.00–10.00V	0.00V	●								
P17.20	AI2 input voltage	Displays the AI2 input signal. Range: -10.00–10.00V	0.00V	●								
P17.21–P17.22	Reserved	/	/	/								
P17.23	PID reference value	Displays the PID reference value. Range: -100.0%–100.0%	0.0%	●								
P17.24	PID feedback value	Displays the PID feedback value. Range: -100.0%–100.0%	0.0%	●								
P17.25	Motor power factor	Displays the power factor of the present motor. Range: -1.00–1.00	1.00	●								
P17.26	Duration of this run	Displays the duration of this run of the inverter unit. Range: 0–65535min	0min	●								

Inverter function code	Name	Description	Default	Modify
P17.27	Present step of simple PLC	Displays the present step of the simple PLC function. Range: 0–15	0	●
P17.28	Motor ASR controller output	Displays the ASR controller output value under the vector control mode. Range: -300.0%–300.0% (of the motor rated current)	0.0%	●
P17.29	Open-loop SM magnetic pole angle	Displays synchronous motor initial identification angle. Range: 0.0–360.0	0.0	●
P17.30	SM phase compensation value	Displays synchronous motor phase compensation value. Range: -180.0–180.0	0.0	●
P17.31	High-frequency superposition current of SM	Range: 0.0%–200.0% (of the motor rated current)	0.0%	●
P17.32	Motor flux linkage	Range: 0.0%–200.0%	0.0%	●
P17.33	Exciting current reference	Displays the exciting current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.34	Torque current reference	Displays the torque current reference value under the vector control mode. Range: -3000.0–3000.0A	0.0A	●
P17.35	AC incoming current	Displays the valid value of incoming current on AC side. Range: 0.0–5000.0A	0.0A	●
P17.36	Output torque	Displays the output torque value. During forward running, the positive value is the motoring state while the negative value is generating state. During reverse running, the positive value is the generating state while the negative value is the motoring state. Range: -3000.0–3000.0Nm	0.0Nm	●
P17.37	Motor overload counting value	Range: 0–65535	0	●
P17.38	Process PID output	Range: -100.0%–100.0%	0.0%	●
P17.39	Function codes in parameter download error	Range: 0.00–99.99	0.00	●
P17.40	Motor control mode	Range: 0x000–0x123 Ones place: Control mode 0: Vector 0 1: Vector 1 2: V/F control 3: Closed-loop vector control Tens place: Control state 0: Speed control	0x000	●

Inverter function code	Name	Description	Default	Modify
		1: Torque control 2: Position control Hundreds place: Motor number 0: Motor 1 1: Motor 2		
P17.41	Electromotive torque upper limit	Range: 0.0%–300.0% (of the motor rated current)	180.0%	●
P17.42	Braking torque upper limit	Range: 0.0%–300.0% (of the motor rated current)	180.0%	●
P17.43	Forward rotation upper-limit frequency in torque control	Range: 0.00–590.00Hz	50.00Hz	●
P17.44	Reverse rotation upper-limit frequency in torque control	Range: 0.00–590.00Hz	50.00Hz	●
P17.45	Inertia compensation torque	Range: -100.0%–100.0%	0.0%	●
P17.46	Friction compensation torque	Range: -100.0%–100.0%	0.0%	●
P17.47	Number of pole pairs	Range: 0–65535	0	●
P17.48	VFD overload count value	Range: 0–65535	0	●
P17.49	Frequency set by A source	Range: 0.00–590.00Hz	0.00Hz	●
P17.50	Frequency set by B source	Range: 0.00–590.00Hz	0.00Hz	●
P17.51	PID proportional output	Range: -100.0%–100.0%	0.0%	●
P17.52	PID integral output	Range: -100.0%–100.0%	0.0%	●
P17.53	PID differential output	Range: -100.0%–100.0%	0.0%	●
P17.54	PID present proportional gain	Range: 0.00–100.00	0.00	●
P17.55	PID present integral gain	Range: 0.00–10.00s	0.0s	●
P17.56	PID present differential time	Range: 0.00–10.00s	0.0s	●
P17.57	Reserved	/	/	/
P17.58	Actual carrier frequency	Range: 0.000–15.000kHz	0.000kHz	●
P17.59	SM signal-noise ratio	Range: 0.0–1000.0	0.0	●
P17.60	SM back-EMF	Range: 0–1200V	0V	●
P17.61	Motor actual speed display high word	Range: 0–30(10kRPM)	0	●
P17.62–P17.63	Reserved	/	/	/
P17.64	VFD SW 2	Range: 0x0000–0xFFFF Bit0: Ready for running 0: Bus voltage not established	0x0000	●

Inverter function code	Name	Description	Default	Modify
		1: Bus voltage established Bit1–bit2: Motor No. 00: Motor 1; 01: Motor 2; 10–11: Reserved Bit3: Motor type 0: Asynchronous motor (AM) 1: Synchronous motor (SM) Bit4: Overload alarm 0: Overload alarm disabled; 1: Overload alarm enabled Bit5–Bit6: Channel of running commands 00: Keypad; 01: Terminal 10: Communication; 11: Reserved Bit7: Reserved Bit8–bit9: Running mode 00: Speed mode; 01: Torque mode; 10–11: Position mode Bit10–bit11: Control mode 00: SVC0; 01: SVC1; 10: VF; 11: FVC Bit12: 0: Brake not applied; 1: Brake applied Bit13: 0: Positioning not reached; 1: Positioning reached Bit 14–Bit 15: Reserved		
P17.65	VFD SW 3	Range: 0x0000–0xFFFF Bit 0: Running protection flag Bit 1: Running Bit 2: Running direction (1=REV, 0=FWD) Bit 3: Jogging Bit 4: Alarming Bit 5: In fault Bit 6: Running paused Bit 7: In sleep Bit 8: In PoFF state Bit 9: Undervoltage due to transient power loss Bit 10: Overvoltage stall Bit 11: Pre-exciting Bit 12: DC braking Bit 13: Identifying parameters Bit 14: Reserved Bit 15: Fault alarm state	0x0000	●
P17.66	CPU load rate	Range: 0.0–100.0%	0.0%	●
P17.67	Reserved	/	/	/
P17.68	Bootload software version	Range: 0.00–655.35	0.00	●

Inverter function code	Name	Description	Default	Modify
P17.69	Present stator resistance	Range: 0.000–60.000Ω	0.000Ω	●
P17.70	FVC and SVC angle difference	Range: -360.0–360.0°	0.0°	●
P17.71	FVC and SVC speed difference	Range: -327.67–327.67Hz	0.00Hz	●
P17.72–P17.73	Reserved	/	/	/
P17.74	CAN bus load rate	Range: 0–1000	0	●
P17.75	Actual online slave nodes	Range: 0–31	0	●
P17.76	Slave online status 1	Displays the online status of slaves 2–17. Range: 0x0000–0xFFFF	0x0000	●
P17.77	Slave online status 2	Displays the online status of slaves 18–32. Range: 0x0000–0x7FFF	0x0000	●

Group P18—Status viewing in closed-loop control

Inverter function code	Name	Description	Default	Modify
P18.00	Measured encoder frequency	Used to indicate the actual-measured encoder frequency. The value of forward running is positive; the value of reverse running is negative. Range: -999.9–3276.7Hz	0.0Hz	●
P18.01	Encoder position count value	Encoder count value, quadruple frequency. Range: 0–65535	0	●
P18.02	Encoder Z pulse count value	Corresponding count value of encoder Z pulse. Range: 0–65535	0	●
P18.03	Position reference high word	It is cleared after stop. Range: 0–30000	0	●
P18.04	Position reference low word	It is cleared after stop. Range: 0–65535	0	●
P18.05	Position feedback high word	It is cleared after stop. Range: 0–30000	0	●
P18.06	Position feedback low word	It is cleared after stop. Range: 0–65535	0	●
P18.07	Position deviation	Deviation between the reference position and actual running position. Range: -32768–32767	0	●
P18.08	Position of position reference point	Position of reference point of Z pulse when the spindle stops accurately. Range: 0–65535	0	●
P18.09	Present position setting of spindle	Present position setup when the spindle stops accurately.	0.00	●

Inverter function code	Name	Description	Default	Modify
		Range: 0.00–359.99		
P18.10	Present position of spindle accurate stop	Present position when the spindle stops accurately. Range: 0–65535	0	●
P18.11	Encoder Z pulse direction	Z pulse direction display. When the spindle stops accurately, there may be a couple of pulses' error between the position of forward and reverse orientation, which can be eliminated by adjusting Z pulse direction of P20.02 or exchanging phase AB of encoder. 0: Forward 1: Reverse	0	●
P18.12	Encoder Z pulse angle	Reserved. Range: 0.00–359.99	0.00	●
P18.13	Encoder Z pulse error times	Reserved. Range: 0–65535	0	●
P18.14	Encoder pulse count high word	Encoder pulse count value. The count value is accumulated only if the VFD is powered on. Range: 0–65535	0	●
P18.15	Encoder pulse count low word		0	●
P18.16	Main control board measured speed	Range: -3276.8–3276.7Hz	0.0Hz	●
P18.17	Pulse command frequency	Pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.18	Pulse command feed-forward	Pulse command (A2/B2 terminal) is converted to the set frequency, and it is valid under the pulse position mode and pulse speed mode. Range: -3276.8–3276.7Hz	0.0Hz	●
P18.19	Position regulator output	Setting range: -327.68–327.67Hz	0.00Hz	●
P18.20	Resolver count value	Count value of the resolver. Range: 0–65535	0	●
P18.21	Resolver angle	Pole position angle read by the resolver-type encoder. Range: 0.00–359.99	0.00	●
P18.22	Closed-loop SM magnetic pole angle	Present pole position. Range: 0.00–359.99	0.00	●
P18.23	Reserved	/	/	/
P18.24	PG card pulse reference count high word	Pulse command (A2, B2) count value. The count value is accumulated only if the inverter unit is powered on. Range: 0–65535	0	●
P18.25	PG card pulse reference count low word		0	●
P18.26	PG card measured speed	Range: -3276.8–3276.7Hz	0.0Hz	●
P18.27	Encoder UVW sectors	Range: 0–7	0	●
P18.28	Encoder PPR display	Range: 0–65535	0	●

Inverter function code	Name	Description	Default	Modify
P18.29	SM angle compensation value	Range: -180.0–180.0°	0.0°	●
P18.30	SM Z-pulse angle	Range: 0–655.35°	0.00°	●
P18.31	Z pulse value of pulse reference	Range: 0–65535	0	●
P18.32	Main control board measured speed in pulse reference mode	Range: -3276.8–3276.7Hz	0.0Hz	●
P18.33	PG card measured speed in pulse reference mode	Range: -3276.8–3276.7Hz	0.0Hz	●
P18.34	Present encoder filter width	Range: 0–63	0	●
P18.35 P18.45	Reserved	/	/	/
P18.46	SSI encoder present position low word	Range: 0–65535	0	●
P18.47	SSI encoder present position high word	Range: 0–65535	0	●
P18.48	SSI position deviation during positioning	Range: -32767–32767	0	●
P18.49	Final SSI position deviation	Range: -32767–32767	0	●
P18.50	SSI locating initial position	Range: 0–65535	0	●
P18.51	SSI locating communication reference position	Range: 0–65535	0	●

Group P19—Expansion card status viewing

Inverter function code	Name	Description	Default	Modify
P19.00	Slot 1 expansion card type (Near relay terminals)	0: No card 1: PLC card 2: I/O card 3: Incremental PG card 4: Incremental PG card with UVW 5: Ethernet communication card 6: DP communication card	0	●

Inverter function code	Name	Description	Default	Modify
P19.01	Slot 2 expansion card type (Near AC output cable)	7: Reserved 8: Rotary PG card 9–10: Reserved 11: PROFINET communication card 12–16: Reserved 17: EtherCAT communication card 18–31: Reserved 32: SSI encoder card 33–50: Reserved	0	●
P19.02	Reserved	/	/	/
P19.03	Slot 1 expansion card software version	Range: 0.00–655.35	0.00	●
P19.04	Slot 2 expansion card software version	Range: 0.00–655.35	0.00	●
P19.05	Reserved	/	/	/
P19.06	I/O card terminal input Status	Range: 0x0–0x3 Bit0: S5 Bit1: S6	0x0	●
P19.07	I/O card terminal output Status	Range: 0x0–0x1 Bit3: RO3	0x0	●
P19.08	Reserved	/	/	/
P19.09	I/O card AI3 input voltage	Range: 0.00–10.00V	0.00V	●
P19.10	Offset-corrected resistance value for AI/AO temperature measurement	Range: 0–65535	0	●
P19.11	AI detected motor temperature	Range: -20.0–200.0°C	0.0°C	●
P19.12	PG card detected motor temperature	Range: -20.0–200.0°C	0.0°C	●
P19.13	IO card detected motor temperature	Range: -20.0–200.0°C	0.0°C	●
P19.14	Numerator of actual electronic-gear ratio	Range: 0–65535	0	●
P19.15	Communication PZD receive value	Range: 0x0000–0xFFFF	0x0000	●
P19.16	Communication PZD transmit value	Range: 0x0000–0xFFFF	0x0000	●
P19.17	Ethernet monitoring variable 1	Range: 0–65535	0	●
P19.18	Ethernet monitoring variable 2	Range: 0–65535	0	●
P19.19	Ethernet monitoring variable 3	Range: 0–65535	0	●

Inverter function code	Name	Description	Default	Modify
P19.20	Ethernet monitoring variable 4	Range: 0–65535	0	●
P19.21–P19.23	Reserved	/	/	/
P19.24	Function code version	Range: 0.00–655.35	0.00	●
P19.25	Performance version	Range: 0.00–655.35	0.00	●
P19.26	Uncontrolled rectifier CAN broadcast status	0: No CAN broadcast data received 1: CAN broadcast data received	0	●

Group P20—Motor 1 encoder parameters

Inverter function code	Name	Description	Default	Modify
P20.00	Encoder type display	0: Incremental encoder 1: Resolver 2: Sin/Cos encoder 3: SSI absolute encoder	0	●
P20.01	Encoder PPR	Number of pulses generated per encoder revolution. Setting range: 0–60000	1024	◎
P20.02	Encoder direction	Setting range: 0x000–0x111 Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (Reserved) 0: Forward 1: Reverse Hundreds place: CD/UWV pole signal direction 0: Forward 1: Reverse	0x000	◎
P20.03	Encoder disconnection detection time	Setting range: 0.0–10.0s	2.0s	○
P20.04	Encoder reversal detection time	Setting range: 0.0–100.0s	0.8s	○
P20.05	Encoder detection filter count	Setting range: 0x00–0x99 Ones place: Low-speed filter count, corresponding to $2^{(0-9)} \times 125\mu\text{s}$. Tens place: High-speed filter count, corresponding to $2^{(0-9)} \times 125\mu\text{s}$.	0x33	○
P20.06	Encoder-to-motor transmission ratio	When the encoder is not installed on the motor shaft and the drive ratio is not 1, you need to set this parameter. Setting range: 0.001–65.535	1.000	○
P20.07	Motor control optimization parameter	Setting range: 0x0000–0xFFFF Bit0: Enable Z pulse calibration	0x2003	○

Inverter function code	Name	Description	Default	Modify
		Bit1: Enable encoder angle calibration Bit2: Enable SVC speed measurement Bit3–Bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit12: Clear the Z pulse arrival signal after stop Bit13: Enable encoder direction identifying Bit14: Detect Z pulse after one rotation Bit15: Reserved		
P20.08	Enable Z pulse offline detection	Setting range: 0x00–0x11 Ones place: Z pulse 0: No detection 1: Enable Tens place: UVW pulses (for SMs) 0: No detection 1: Enable	0x10	○
P20.09	Z pulse initial angle	Relative electric angle of encoder Z pulse and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.10	Pole initial angle	Relative electric angle of encoder position and motor pole position. Setting range: 0.00–359.99	0.00	○
P20.11	Initial pole angle autotuning	1: Rotary autotuning (DC braking) 2: Static autotuning (applicable to resolver feedback and Sin/Cos feedback with CD signals) 3: Rotary autotuning (initial angle identification) The pole initial angle obtained through rotary autotuning 1 is accurate. Rotary autotuning is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.	0	◎
P20.12	Speed measurement optimization selection	0: Speed calculated by the PG card 1: PLL-based speed measurement 2: M-method speed measurement 3: Speed observer-based speed measurement (requires P03.56 to be enabled)	1	◎
P20.13	CD signal zero offset gain	Setting range: 0–65535	0	○

Inverter function code	Name	Description	Default	Modify
P20.14	Encoder type selection	Setting range: 0x00–0x11 Ones place: Incremental encoder 0: Without UVW 1: With UVW Tens place: Reserved	0x00	⊙
P20.15	Speed measurement method selection (Reserved)	0: PG card 1: Reserved	0	⊙
P20.16	Frequency division coefficient	Setting range: 0–255 When the function parameter is set to 0 or 1, the frequency division of 1:1 is implemented.	0	○
P20.17	Pulse filter handling selection	Setting range: 0x0000–0xFFFF Bit 0: Encoder P-channel (A1/B2/Z1) input filter enable 0: Do not filter 1: Filter Bit1: Encoder signal filter mode 0: Self-adaptive filter 1: Use P20.18 filter parameter Bit 2: Encoder P-channel (A1/B2/Z1) frequency-divided output filter enable 0: Do not filter 1: Filter Bit 3: Pulse reference F-channel (A2/B2/Z2) frequency-divided output filter enable 0: Do not filter 1: Filter Bit 4: Pulse reference F-channel (A2/B2/Z2) filter enable 0: Do not filter 1: Filter Bit 5: Pulse reference F-channel (A2/B2/Z2) filter mode 0: Self-adaptive filter 1: Use P20.19 filter parameter Bit6: Frequency-divided output source setting 0: Encoder signal 1: Pulse reference signal Bit7–bit15: Reserved	0x0033	○
P20.18	Encoder P-channel filter width	Setting range: 0–63 Filter width of the P-channel pulse (A1/B1/Z1). The filter time is $P20.18 \times 0.25 \mu s$, where both 0 and 1 indicate $0.25 \mu s$.	2	○
P20.19	Pulse reference F-channel filter width	Setting range: 0–63 Filter width of the F-channel pulse (A2/B2/Z2). The filter time is $P20.19 \times 0.25 \mu s$, where both 0 and 1 indicate $0.25 \mu s$.	2	○

Inverter function code	Name	Description	Default	Modify
P20.20	Pulse number of pulse reference	Setting range: 0–60000	1024	○
P20.21	SM angle compensation enable	0: Disable 1: Enable	1	○
P20.22	Frequency point of speed measurement mode switchover	Setting range: 0.00–590.00Hz Note: M-method based speed measurement is used when the ramp frequency is less than P20.22; otherwise, PG-card based speed measurement is used.	1.00Hz	○
P20.23	SM angle compensation coefficient	Setting range: -200.0–200.0%	100.0%	○
P20.24	Number of motor revolutions for initial magnetic pole angle autotuning	Setting range: 0–128	2	○
P20.25	SSI encoder resolution LSB	Setting range: 0–20	16	◎
P20.26	SSI encoder resolution MSB	Setting range: 0–20	8	◎
P20.27	SSI encoder 1 data format	Setting range: 0x000–0x111 Ones place: Reserved Tens place: Binary/Gray code selection for transmission type 0: Gray code parsing 1: Binary parsing Hundreds place: Position data direction 0: Default direction 1: Reverse direction	0x000	◎
P20.28	SSI encoder 1 data shift bits	Setting range: 0–63	0	◎
P20.29	Reserved	/	/	/
P20.30	SSI encoder 1 clock selection	Setting range: 0–6	4	◎
P20.31	SSI encoder 1 pulse resolution	Setting range: 0.000–10.000	0.100	◎
P20.32–P20.33	Reserved	/	/	/
P20.34	Resolver disconnection detection enable	0: Disable 1: Enable	0	○
P20.35	Resolver disconnection detection coefficient	Setting range: 0–10000	4000	○

Group P21—Position control

Inverter function code	Name	Description	Default	Modify
P21.00	Positioning mode	Setting range: 0x0000–0x7321 Ones place: Control mode selection 0: Speed control 1: Position control Tens place: Position command source 0: Pulse train 1: Digital position 2: Photoelectric switch stop positioning Hundred place: Position feedback source 0: P-channel pulses of PG1 (channel A1/B1/Z1) 1: F-channel pulses of PG1 (channel A2/B2/Z2) 2: Reserved 3: SSI absolute position Thousands place: Servo mode 0: Servo disabled, no position deviation 1: Servo disabled, position deviation present 2: Enable servo, without position deviation 3: Enable servo, with position deviation 4–7: Reserved	0x0000	○
P21.01	Pulse command mode	Setting range: 0x0000–0x3133 Ones place: Pulse mode 0: A/B quadrature pulse; A precedes B 1: A: PULSE, B: SIGN. If channel B is of low electric level, the edge counts up; if channel B is of high electric level, the edge counts down. 2: A: Positive PULSE Channel A is positive pulse; channel B needs no wiring 3: A/B dual-channel pulse. Channel A pulse edge counts up, but channel B pulse edge counts down. Tens place: Pulse direction selection 0: Consistent with the pulse train frequency direction 1: Opposite to the pulse train frequency direction 2: Pulse train frequency direction is set by P00.13 3: Reserved Hundreds place: Frequency-multiplication selection for pulse + direction (reserved) 0: No frequency-multiplication 1: Frequency-multiplication	0x0000	◎

Inverter function code	Name	Description	Default	Modify
		Thousands place: Pulse control selection 0: Position error filtering enabled; position-loop overspeed suppression disabled 1: Position error filtering disabled; position-loop overspeed suppression disabled 2: Position error filtering enabled; position-loop overspeed suppression enabled 3: Position error filtering disabled; position-loop overspeed suppression enabled		
P21.02	Position-loop gain 1	The two automatic position regulator (APR) gains are switched based on the switching mode set through P21.04. When the spindle orientation function is used, the gains are switched automatically, regardless of the setting of P21.04. P21.03 is used for dynamic running, and P21.02 is used for maintaining the locked state. Setting range: 0.0–400.0	20.0	○
P21.03	Position-loop gain 2		30.0	○
P21.04	Gain switching mode	Used to select the mode for switching between position loop gains. To use torque command-based switching, you need to set P21.05; and to use speed command-based switching, you need to set P21.06. 0: No switchover 1: Torque command 2: Speed command 3–5: Reserved	0	○
P21.05	Gain switching torque command level	Setting range: 0.0–100.0% (of the motor rated torque)	10.0%	○
P21.06	Gain switching speed command level	Setting range: 0.0–100.0% (of the motor rated speed)	10.0%	○
P21.07	Smooth filter coefficient for gain switchover	Smooth filter coefficient for APR gain switchover. Setting range: 0–15	5	○
P21.08	APR output limit	Position regulator output Value. When the APR output limit is 0, the APR is invalid, and no position control can be performed, however, speed control is valid. Setting range: 0.0–100.0% (of max. output frequency P00.03)	20.0%	○
P21.09	Positioning completion range	When the position deviation is less than P21.09, and the duration is greater than P21.10, positioning completion signal will be outputted. Setting range: 0–1000	10	○
P21.10	Positioning completion detection time	Setting range: 0.0–1000.0ms	10.0ms	○

Inverter function code	Name	Description	Default	Modify
P21.11	Numerator of position command ratio	Electronic gear ratio, used to adjust the corresponding relation between position command and actual running displacement. Setting range: 1–65535	1000	○
P21.12	Denominator of position command ratio	Setting range: 1–65535	1000	○
P21.13	Position feedforward gain	Setting range: 0.00–120.00% For pulse string reference only (position control)	100.00%	○
P21.14	Position feedforward filter time constant	Setting range: 0.0–3200.0ms For pulse string reference only (position control)	3.0ms	○
P21.15	Position command filter time constant	Position feedforward filter time constant during the pulse string positioning. Setting range: 0.0–3200.0ms	0.0ms	◎
P21.16	Digital positioning mode selection	Setting range: 0x0000–0xFFFF Bit0: Positioning mode selection 0: Relative position 1: Absolute position (home position)(Reserved) Bit1: Positioning cycle selection 0: Terminal-based cyclic positioning 1: Automatic cyclic positioning Bit2: Cyclic mode 0: Continuous 1: Reciprocating (supported only in automatic cyclic positioning) Bit3: P21.17 digital setting mode 0: Incremental 1: Position type (do not support the continuous mode) Bit 4: Home search mode 0: Search for home only once 1: Search for home at each run Bit 5: Home correction mode 0: Real-time correction 1: One-time correction Bit 6: Positioning completion signal selection 0: Active within the positioning completion signal hold time set by P21.25 1: Always active Bit 7: First positioning selection for terminal control 0: Disable (no rotation) 1: Enable Bit 8: Positioning enable signal type selection 0: Pulse signal	0x0000	○

Inverter function code	Name	Description	Default	Modify
		1: Level signal Bit 9: Position source 0: Digital setting of the target position (P21.17) 1: PROFIBUS/CANopen/EtherCAT communication Bit 10: Encoder pulse count retention after power loss 0: Not retained 1: Retained Bit 11: Incremental position retention after power loss 0: Not retained 1: Retained Bit 12: Positioning curve selection 0: Linear 1: S curve Bit13: Reserved 0–1: Reserved Bit 14: 0Hz hold within P21.25 after positioning 0: No 1: Yes Bit15: Calculation insertion/interrupt selection during positioning 0: No 1: Yes		
P21.17	Position set in digital mode	Used to set the position for digital positioning. Actual position= $P21.17 \times P21.11 / P21.12$ Setting range: 0–65535	0	○
P21.18	Positioning speed setting selection	0: Setting of P21.19 1: AI1 2: AI2 3: AI3	0	○
P21.19	Positioning speed digital setting	Setting range: 0–100.0% (of the max. output frequency)	20.0%	○
P21.20	Positioning ACC time	Used to set the ACC/DEC time in the positioning process. Positioning ACC time refers to the time required for the inverter unit to accelerate from 0 Hz to the max. output frequency (P00.03).	3.00s	○
P21.21	Positioning DEC time	Positioning DEC time refers to the time required for the inverter unit to decelerate from the max. output frequency (P00.03) to 0 Hz. P21.20 setting range: 0.01–300.00s	3.00s	○

Inverter function code	Name	Description	Default	Modify
		P21.21 setting range: 0.01–300.00s		
P21.22	Hold time of positioning reached	Used to set the holding time after the destination position is reached. Setting range: 0.000–60.000s	0.100s	○
P21.23	Home search speed	Setting range: 0.00–50.00Hz	2.00Hz	○
P21.24	Home position offset	Setting range: 0–65535	0	○
P21.25	Hold time of positioning completion signal	Time for holding the positioning completion signal. This parameter is also valid for the positioning in spindle orientation. Setting range: 0.000–60.000s	0.200s	○
P21.26	Pulse superposition	P21.26 setting range: 0–65535	0	○
P21.27	Pulse superposition speed	P21.27 setting range: 0.0–6553.5 pulse/ms Setting range of P21.28: 0.0–3000.0s	8.0 pulse/ms	○
P21.28	after pulse inhibit ACC/DEC time	The function is valid in the pulse speed reference (P00.06=12) or pulse position mode (P21.00=1). - Input terminal function 68 (Pulse superposition enable) When the rising edge of the terminal is detected, add the value set in P21.26 to the set pulse value, and compensate to the pulse reference channel based on the pulse superposition speed set in P21.27. - Input terminal function 67 (Pulse increment) When the terminal is valid, superpose the pulse value to the pulse reference channel based on the pulse superposition speed set in P21.27. Note: Terminal filter P05.09 may affect the actual superposed value. Example: P21.27=1.0 pulse/ms; P05.05=67. When the S5 terminal input signal lasts 0.5 s, the actual number of superimposed pulses is 500. - Input terminal function 69 (Pulse decrement) The timing sequence of this value is the same as that of the previous value, with the only difference that the number is negative. Note: The pulses mentioned above are superposed to A2 and B2 of pulse reference channel. Functions such as filtering and electronic gear are still valid for superposed pulses.	5.0s	○

Inverter function code	Name	Description	Default	Modify
		Output terminal function 28 (In pulse superposition) The output terminal is valid during pulse superposition, but it is invalid after pulse superposition is completed.		
P21.29	Speed feedforward filter time constant (pulse train speed mode)	Filter time constant detected by the pulse string when the speed reference source is set to the pulse string (P00.06=12 or P00.07=12). Setting range: 0–3200.0ms	10.0ms	○
P21.30	Numerator of 2nd command ratio	Setting range: 1–65535	1000	○
P21.31	Pulse reference speed measuring method	0: Main control board speed measurement (A2/B2/Z2 channel signal reference) 1: PG card 2: Combined speed measurement by main control board and PG card	0	○
P21.32	Pulse reference feedforward source	0: AI1 1: Encoder F-channel pulses	0x0	◎
P21.33	Encoder count reset value	Setting range: 0–65535 This function must be used together with S terminal function 66: Encoder count reset.	0	◎
P21.34	SSI signal function selection	Setting range: 0x0000–0x3111 Ones place to hundreds place: Reserved Thousands place: 0: SSI signal as position feedback, incremental signal as speed feedback 1–2: Reserved 3: SSI signal as speed feedback	0x0000	◎
P21.35	SSI positioning control polarity selection	Setting range: 0x0000–0x1111 Ones place: Feedforward control polarity selection 0: Positive 1: Negative Tens place: Absolute position polarity selection 0: Positive 1: Negative Hundreds place: Polarity selection in single-enable positioning mode 0: Positive 1: Negative Thousands place: Zero point selection for bidirectional and forward travel 0: Bidirectional travel zero point 1: Forward travel zero point	0x0000	◎
P21.36	Positioning full-speed frequency	Setting range: 0.00–590.00Hz	0.00Hz	◎

Inverter function code	Name	Description	Default	Modify
P21.37	Positioning ACC segment S curve time	Setting range: 0.00–300.00s	3.00s	○
P21.38	Positioning DEC segment S curve time	Setting range: 0.00–300.00s	3.00s	○
P21.39	Digital positioning extension control	Setting range: 0x0000–0x1111 Ones place: Positioning execution and position reference update selection 0: Not associated 1: Associated Tens place: Direct brake application selection for open-loop positioning 0: Brake not applied 1: Brake applied Hundreds place: Long-distance position gain switching selection 0: No switchover 1: Switching enabled Thousands place: Open-loop non-SSI encoder mechanical positioning mode 0: Invalid 1: Enable	0x0000	○
P21.40	Speed-to-position switching delay	Setting range: 0.000–8.000s	0.500s	○
P21.41	Communication positioning and SSI feedback position control selection	Setting range: 0x2010–0xF211 Ones place: Communication positioning mode selection 0: Enable + Running direction mode 1: Single-enable mode Tens place: SSI feedback position control filter 0: Invalid 1: Filter during positioning Hundreds place: Feedback position display filter 0: Do not filter 1: Filter 2: Reserved Thousands place: SSI sensor sampling cycle (ms) 0–F: 1–15ms Note: It is 1 ms regardless of whether the thousands place is 0 or 1.	0x2011	○
P21.42	Reserved	/	/	/
P21.43	SSI max. linear speed	Setting range: 6.0–6000.0m/min	300.0 m/min	○
P21.44	SSI static filter width	Setting range: 0.0–6000.0mm	5.0mm	○
P21.45	SSI dynamic filter width	Setting range: 0.0–6000.0mm	2000.0mm	○

Inverter function code	Name	Description	Default	Modify
P21.46	Position deviation timeout time	Setting range: 0.00–50.00s	1.00s	○
P21.47	Adaptive threshold for positioning ACC/DEC	Setting range: 0–60000mm When the positioning distance is less than the value set by P21.47, the current positioning ACC/DEC time is multiplied by 2.	2000mm	○
P21.48	SSI limit timeout time	Setting range: 0.00–10.00s	0.20s	○
P21.49	SSI position feedback filter time	Setting range: 0.000–5.000s	0.200s	○
P21.50	SSI positioning timeout time	Setting range: 0.000–8.000s	2.000s	○
P21.51	SSI positioning ACC coefficient	Setting range: 0.0–400.0%	200.0%	○
P21.52	SSI positioning reference frequency ACC coefficient	Setting range: 0.0–400.0%	100.0%	○
P21.53	SSI zero offset low word	Setting range: 0–65535	0	○
P21.54	SSI zero offset high word	Setting range: 0–65535	0	○

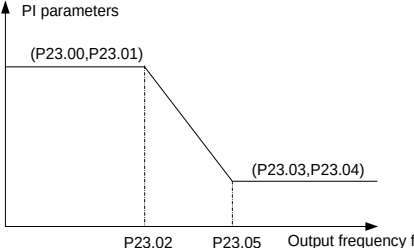
Group P22—Spindle positioning

Inverter function code	Name	Description	Default	Modify
P22.00	Spindle positioning mode selection	Setting range: 0x0000–0xFFFF Bit0: Indicates whether to enable spindle accurate stop when spindle positioning is enabled. 0: Disable 1: Enable Bit1: Spindle positioning reference point selection. Select the encoder Z pulse or the photoelectric switch (set to function 43) as the spindle accurate stop reference point. 0: Z pulse input 1: S2/S3/S4 terminal input Bit2: Search for reference point 0: Search only once 1: Search every time Bit3: Enable reference point calibration 0: Disable 1: Enable Bit4: Positioning mode selection 1 0: Set direction positioning 1: Nearest direction positioning Bit5: Positioning mode selection 2. It is valid	0x0000	○

Inverter function code	Name	Description	Default	Modify
		when bit4 is set to 0. 0: Forward positioning 1: Reverse positioning Bit6: Homing command selection 0: Electric level mode. The positioning (zeroing and indexing) command can be executed only when there is a run command. 1: Pulse mode. Executing the positioning (zeroing and indexing) command does not need a running command. If there is a run command, it will automatically switch back to the speed mode. Bit7: Reference point calibration mode 0: Calibration on first time 1: Real-time correction Bit8: Action selection after homing signal (electric level type) cancellation 0: Switch to speed mode 1: Position lock mode Bit9: Positioning completion signal selection 0: Level signal 1: Pulse signal Bit10: Z pulse signal source 0: Motor 1: Spindle Bit11–bit15: Reserved		
P22.01	Speed of spindle orientation	During spindle orientation, the speed of the position point of orientation will be searched, and then it will switch over to position control orientation. Setting range: 0.00–100.00Hz	10.00Hz	○
P22.02	DEC time of spindle orientation stop	The spindle orientation deceleration time is the time required for the inverter unit to decelerate from the max. output frequency (P00.03) to 0 Hz. Setting range: 0.1–100.0s	3.0s	○
P22.03	Spindle zeroing position 0	You can select four spindle zeroing positions by terminals (functions 46 and 47). Setting range: 0–65535	0	○
P22.04	Spindle zeroing position 1	Setting range: 0–65535	0	○
P22.05	Spindle zeroing position 2	Setting range: 0–65535	0	○
P22.06	Spindle zeroing position 3	Setting range: 0–65535	0	○
P22.07	Spindle indexing angle 1	You can select seven spindle indexing angles	15.00	○

Inverter function code	Name	Description	Default	Modify
		by terminals (functions 48, 49, and 50). Setting range: 0.00–359.99		
P22.08	Spindle indexing angle 2	Setting range: 0.00–359.99	30.00	○
P22.09	Spindle indexing angle 3	Setting range: 0.00–359.99	45.00	○
P22.10	Spindle indexing angle 4	Setting range: 0.00–359.99	60.00	○
P22.11	Spindle indexing angle 5	Setting range: 0.00–359.99	90.00	○
P22.12	Spindle indexing angle 6	Setting range: 0.00–359.99	120.00	○
P22.13	Spindle indexing angle 7	Setting range: 0.00–359.99	180.00	○
P22.14	Spindle drive ratio	Used to set the reduction ratio of the spindle and the mounting shaft of the encoder. Setting range: 0.000–30.000	1.000	○
P22.15	Spindle zero-point communication setting	P22.15 is used to set spindle zero-point offset. If the selected spindle zero point is P22.03, the final spindle zero point is the sum of P22.03 and P22.15. Setting range: 0–39999	0	○
P22.16–P22.17	Reserved	/	/	/
P22.18	Rigid tapping selection	Setting range: 0x00–0x31 Ones place: Enabling selection 0: Disable, but this function can be enabled through a terminal (configured with function 58). 1: Enable (Internal enabling) Tens place: Analog port selection 0: Invalid 1: AI1 2: AI2 3: AI3	0x00	◎
P22.19	Rigid tapping analog filter time	Setting range: 0.0–1000.0ms	1.0ms	○
P22.20	Max. frequency of rigid tapping	Setting range: 0.00–400.00Hz	50.00Hz	○
P22.21	Corresponding frequency of rigid tapping analog zero drift	Setting range: 0.00–10.00Hz	0.00Hz	○

Group P23—Motor 2 vector control

Inverter function code	Name	Description	Default	Modify
P23.00	Motor 2 speed-loop proportional gain 1	The parameters P23.00–P23.05 are applicable only to vector control mode. Below the switching frequency 1 (P23.02), the speed-loop PI parameters are: P23.00 and P23.01. Above the switching frequency 2 (P23.05), the speed-loop PI parameters are: P23.03 and P23.04. PI parameters are obtained according to the linear change of two groups of parameters. See the following figure:	20.0	○
P23.01	Motor 2 speed-loop integral time 1		0.200s	○
P23.02	Motor 2 switching low-point frequency		5.00Hz	○
P23.03	Motor 2 speed-loop proportional gain 2		20.0	○
P23.04	Motor 2 speed-loop integral time 2		0.200s	○
P23.05	Motor 2 switching high-point frequency	 The speed loop dynamic response characteristics of vector control can be adjusted by setting the proportional coefficient and integral time of speed regulator. Increasing proportional gain or reducing integral time can accelerate dynamic response of speed loop; however, if the proportional gain is too large or integral time is too small, system oscillation and overshoot may occur; if proportional gain is too small, stable oscillation or speed offset may occur. PI parameters have a close relationship with the inertia of the system. Adjust PI parameters depending on different loads to meet various demands. Setting range of P23.00: 0.0–200.0 Setting range of P23.01: 0.000–10.000s Setting range of P23.02: 0.00Hz–P23.05 Setting range of P23.03: 0.0–200.0 Setting range of P23.04: 0.000–10.000s Setting range of P23.05: P23.02–P00.03	10.00Hz	○
P23.06	Motor 2 speed-loop output filter	Setting range: 0–8 (corresponding to 0–2 ⁸ /10ms)	0	○
P23.07	Motor 2 vector control slip compensation coefficient (Motoring)	A slip compensation coefficient is used to adjust the slip frequency of the vector control and improve the speed control accuracy of the system. Adjusting the parameter properly can control the speed steady-state error.	100	○
P23.08	Motor 2 vector control slip compensation		100%	○

Inverter function code	Name	Description	Default	Modify
	coefficient (Generating)	Setting range: 50%–200%		
P23.09–P23.10	Reserved	/	/	/
P23.11	Motor 2 speed-loop differential gain	Setting range: 0.00–10.00s	0.00s	○
P23.12–P23.14	Reserved	/	/	/
P23.15	Motor 2 current-loop band width	Setting range: 0–2000	400	○

Group P24—Motor 2 encoder functions

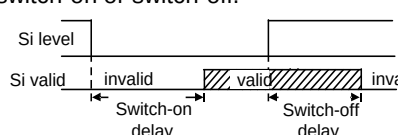
Inverter function code	Name	Description	Default	Modify
P24.00	Encoder type display	0: Incremental encoder 1: Resolver 2: Sin/Cos encoder 3: SSI absolute encoder	0	●
P24.01	Encoder PPR	Setting range: 0–60000	1024	◎
P24.02	Encoder direction	Setting range: 0x000–0x111 Ones place: AB direction 0: Forward 1: Reverse Tens place: Z pulse direction (Reserved) 0: Forward 1: Reverse Hundreds place: CD/UVW pole signal direction 0: Forward 1: Reverse	0x000	◎
P24.03	Encoder disconnection detection time	Setting range: 0.0–10.0s	2.0s	○
P24.04	Encoder reversal detection time	Setting range: 0.0–100.0s	0.8s	○
P24.05	Encoder detection filter count	Setting range: 0x00–0x99 Ones place: Low-speed filter count, corresponding to $2^{(0-9)} \times 125\mu\text{s}$. Tens place: High-speed filter count, corresponding to $2^{(0-9)} \times 125\mu\text{s}$.	0x33	○
P24.06	Encoder-to-motor transmission ratio	When the encoder is not installed on the motor shaft and the drive ratio is not 1, you need to set this parameter. Setting range: 0.001–65.535	1.000	○
P24.07	Motor control optimization parameter	Setting range: 0x0000–0xFFFF Bit0: Enable Z pulse calibration Bit1: Enable encoder angle calibration	0x0003	○

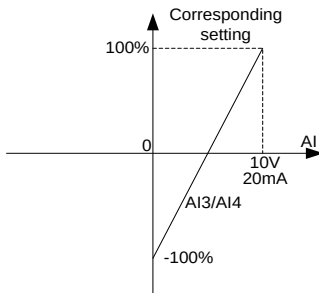
Inverter function code	Name	Description	Default	Modify
		Bit2: Enable SVC speed measurement Bit3–Bit5: Reserved Bit6: Enable the CD signal calibration Bit7: Reserved Bit8: Do not detect encoder faults during autotuning Bit9: Enable Z pulse detection optimization Bit10: Enable the initial Z pulse calibration optimization Bit11: Reserved Bit12: Clear the Z pulse arrival signal after stop Bit13: Reserved Bit 14: Detect Z pulse after one rotation Bit15: Reserved		
P24.08	Enable Z pulse offline detection	Setting range: 0x00–0x11 Ones place: Z pulse 0: Do not detect 1: Enable Tens place: UVW pulse 0: Do not detect 1: Enable	0x10	○
P24.09	Z pulse initial angle	Relative electric angle between the encoder Z pulse and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.10	Pole initial angle	Relative electric angle between the encoder position and the motor pole position. Setting range: 0.00–359.99	0.00	○
P24.11	Autotuning pole initial angle	1: Rotary autotuning (DC braking) 2: Static autotuning (applicable to resolver feedback and Sin/Cos feedback with CD signals) 3: Rotary autotuning 2 (initial angle identification) The pole initial angle obtained through "1: Rotary autotuning" is accurate. Rotary autotuning is recommended in most cases, in which the motor needs to be decoupled from the load or the motor load is light.	0	◎
P24.12	Speed measurement optimization selection	0: Speed calculated by the PG card 1: PLL-based speed measurement 2: M-method speed measurement 3: Speed observer-based speed measurement (requires P03.56 to be enabled)	1	◎
P24.13	CD signal zero offset gain	Setting range: 0–65535	0	○
P24.14	Encoder type selection	Setting range: 0x00–0x11	0x00	◎

Inverter function code	Name	Description	Default	Modify
		Ones place: Incremental encoder 0: Without UVW 1: With UVW Tens place: Reserved		
P24.15	Speed measurement method selection (Reserved)	0: PG card 1: Reserved	0	⊙
P24.16	Frequency division coefficient	Setting range: 0–255 When the function parameter is set to 0 or 1, the frequency division of 1:1 is implemented.	0	○
P24.17	Pulse filter handling selection	Setting range: 0x0000–0xFFFF Bit0: Enable/disable encoder input filter 0: No filter 1: Filter Bit1: Encoder signal filter mode 0: Self-adaptive filter 1: Use P24.18 as the filter parameter Bit2: Enable/disable encoder frequency-divided output filter 0: No filter 1: Filter Bit3: Enable/disable pulse reference frequency-divided output filter 0: No filter 1: Filter Bit4: Enable/disable pulse reference filter 0: No filter 1: Filter Bit5: Pulse reference filter mode (valid when Bit4 is set to 1) 0: Self-adaptive filter 1: Use P24.19 as the filter parameter Bit6: Frequency-divided output source setting 0: Encoder input channel 1: Pulse giving channel Bit 7–Bit 15: Reserved	0x0033	○
P24.18	Encoder pulse filter width	Setting range: 0–63 Filter width of the P-channel pulse (A1/B1/Z1). The filter time is $P20.18 \times 0.25 \mu s$, where both 0 and 1 indicate 0.25 μs .	2	○
P24.19	Pulse reference filter width	Setting range: 0–63 Filter width of the F-channel pulse (A2/B2/Z2). The filter time is $P20.19 \times 0.25 \mu s$, where both 0 and 1 indicate 0.25 μs .	2	○
P24.20	Pulse number of pulse reference	Setting range: 0–16000	1024	⊙

Inverter function code	Name	Description	Default	Modify
P24.21	SM angle compensation enable	Setting range: 0–1	1	○
P24.22	Frequency point of speed measurement mode switchover	Setting range: 0.00–590.00Hz	1.00Hz	○
P24.23	Angle compensation coefficient	Setting range: -200.0%–200.0%	100.0%	○
P24.24	Number of motor revolutions for initial magnetic pole angle autotuning	Setting range: 1–128	2	⊙
P24.25	SSI encoder 2 resolution LSB	Setting range: 0–20	16	○
P24.26	SSI encoder 2 resolution MSB	Setting range: 0–20	8	○

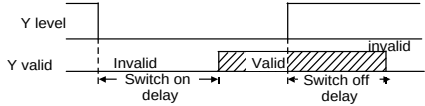
Group P25—I/O card input functions

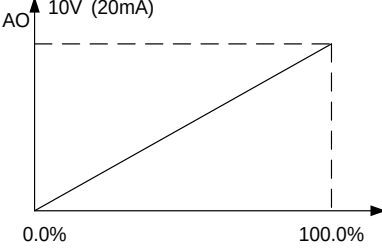
Inverter function code	Name	Description	Default	Modify
P25.00	Reserved	/	/	/
P25.01	S5 function	Same as P05	0	⊙
P25.02	S6 function		0	⊙
P25.03–P25.07	Reserved		/	/
P25.08	Expansion card input terminal polarity	Setting range: 0x0–0x3 Bit0: S5 virtual terminal Bit1: S6 virtual terminal	0x0	○
P25.09	Expansion card virtual terminal setting	Setting range: 0x0–0x3 (0: disable; 1: enable) Bit0: S5 virtual terminal Bit1: S6 virtual terminal	0x0	⊙
P25.10–P25.11	Reserved	/	/	/
P25.12	S5 switch-on delay	These function codes specify delay time corresponding to the level changes of programmable input terminals during switch-on or switch-off. 	0.000s	○
P25.13	S5 switch-off delay		0.000s	○
P25.14	S6 switch-on delay		0.000s	○
P25.15	S6 switch-off delay		0.000s	○
P25.16–P25.23	Reserved	/	/	/
P25.24	AI3 lower limit	The function codes define the relationship between the analog input voltage and its corresponding setting. When the analog input	0.00V	○
P25.25	Corresponding setting of AI3 lower limit		0.0%	○

Inverter function code	Name	Description	Default	Modify
P25.26	AI3 upper limit	voltage exceeds the range from the upper limit to the lower limit, the upper limit or lower limit is used.	10.00V	○
P25.27	Corresponding setting of AI3 upper limit		100.0%	○
P25.28	AI3 input filter time	When the analog input is current input, 0mA–20mA current corresponds to 0V–10V voltage. In different applications, 100.0% of the analog setting corresponds to different nominal values. See the description in each application section for details. The following figure illustrates the cases of several settings:  Input filter time: to adjust the sensitivity of analog input. Increasing the value properly can enhance analog input anti-interference but may reduce the sensitivity of analog input. Note: AI3 and AI4 can support 0(2)–10V/0(4)–20mA input. When AI3 and AI4 select 0–20mA input, the corresponding voltage of 20mA is 10V. Setting range of P25.24: 0.00V–P25.26 Setting range of P25.25: -300.0%–300.0% Setting range of P25.26: P25.24–10.00V Setting range of P25.27: -300.0%–300.0% P25.28 setting range: 0.000s–10.000s	0.030s	○
P25.29–P25.39	Reserved	/	/	/
P25.40	AI3 input signal type	0: Voltage type 1: Current type	0	○
P25.41	Type of sensor for IO card to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84 4: 5K NTC temperature sensor 5: 10K NTC temperature sensor	0	○
P25.42	IO card detected motor OH protection threshold	Setting range: -20.0–200.0℃	110.0℃	○
P25.43	Detection time of IO card detected motor OH protection	Setting range: 0.0–3600.0s	5.0s	○

Inverter function code	Name	Description	Default	Modify
P25.44	IO card detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C	○
P25.45	IO card NTC sensor B25/85 value	Setting range: -20.0–50.0°C	10.0°C	○
P25.46	NTC temperature calibration coefficient	Setting range: 0–6000k	0	○
P25.47	Type of sensor for PG card to detect motor temperature	0: No temperature sensor 1: PT100 2: PT1000 3: KTY84	0	○
P25.48	PG card detected motor OH protection threshold	Setting range: -20.0–200.0°C	110.0°C	○
P25.49	Detection time of PG card detected motor OH protection	Setting range: 0.0–3600.0s	5.0s	○
P25.50	PG card detected motor OH alarm threshold	Setting range: -20.0–200.0°C	90.0°C	○

Group P26—I/O card output functions

Inverter function code	Name	Description	Default	Modify				
P26.00–P26.03	Reserved	/	/	/				
P26.04	RO3 output selection	Same as the description for P06.01	0	○				
P26.05–P26.11	Reserved	/	/	/				
P26.12	Expansion card output terminal polarity selection	Setting range: 0x0 –0x8 When a bit is 0, the output terminal is positive. When a bit is 1, the output terminal is negative. <table><tr><td>Bit0–bit2</td><td>Bit3</td></tr><tr><td>Reserved</td><td>RO3</td></tr></table>	Bit0–bit2	Bit3	Reserved	RO3	0x0	○
Bit0–bit2	Bit3							
Reserved	RO3							
P26.13–P26.18	Reserved	The function codes specify the delay time corresponding to the level changes when the programmable output terminals switch on or switch off. 	/	/				
P26.19	RO3 switch-on delay		0.000s	○				
P26.20	RO3 switch-off delay		0.000s	○				
P26.21–P26.34	Reserved	Setting range: 0.000–50.000s Note: P26.13 and P26.14 are valid only when P26.00=1.	/	/				
P26.35	AO2 output	Same as the description for P06.14	0	○				
P26.36–P26.37	Reserved		/	/				

Inverter function code	Name	Description	Default	Modify
P26.38	AO2 output lower limit	Used to define the relationship between the output value and analog output. When the output value exceeds the allowed range, the output uses the lower limit or upper limit.	0.0%	○
P26.39	AO2 output corresponding to lower limit		0.00V	○
P26.40	AO2 output upper limit		100.0%	○
P26.41	AO2 output corresponding to upper limit	When the analog output is current output, 1mA equals 0.5V. In different cases, the corresponding analog output of 100% of the output value is different.	10.00V	○
P26.42	AO2 output filter time	 Setting range of P26.38: -300.0%–P26.40 Setting range of P26.39: 0.00–10.00V Setting range of P26.40: P26.38–300.0% Setting range of P26.41: 0.00–10.00V Setting range of P26.42: 0.000–10.000s	0.000S	○

Group P27—PLC card functions

Inverter function code	Name	Description	Default	Modify
P27.00	PLC card function enable	0: Disable 1: Enable After the PLC card function is enabled, the following programming interfaces and data related to the inverter unit take effect.	0	◎
P27.01	C_WrP1	Setting range: 0–65535 Used to write a value to WrP1 of the PLC card.	0	○
P27.02	C_WrP2	Setting range: 0–65535 Used to write a value to WrP2 of the PLC card.	0	○
P27.03	C_WrP3	Setting range: 0–65535 Used to write a value to WrP3 of the PLC card.	0	○
P27.04	C_WrP4	Setting range: 0–65535 Used to write a value to WrP4 of the PLC card.	0	○
P27.05	C_WrP5	Setting range: 0–65535 Used to write a value to WrP5 of the PLC card.	0	○
P27.06	C_WrP6	Setting range: 0–65535	0	○

Inverter function code	Name	Description	Default	Modify
		Used to write a value to WrP6 of the PLC card.		
P27.07	C_WrP7	Setting range: 0–65535 Used to write a value to WrP7 of the PLC card.	0	○
P27.08	C_WrP8	Setting range: 0–65535 Used to write a value to WrP8 of the PLC card.	0	○
P27.09	C_WrP9	Setting range: 0–65535 Used to write a value to WrP9 of the PLC card.	0	○
P27.10	C_WrP10	Setting range: 0–65535 Used to write a value to WrP10 of the PLC card.	0	○
P27.11	PLC card status	0: Stop 1: Run	0	●
P27.12	C_MoP1	Used to monitor/view the MoP1 value of the PLC.	0	●
P27.13	C_MoP2	Used to monitor/view the MoP2 value of the PLC.	0	●
P27.14	C_MoP3	Used to monitor/view the MoP3 value of the PLC.	0	●
P27.15	C_MoP4	Used to monitor/view the MoP4 value of the PLC.	0	●
P27.16	C_MoP5	Used to monitor/view the MoP5 value of the PLC.	0	●
P27.17	C_MoP6	Used to monitor/view the MoP6 value of the PLC.	0	●
P27.18	C_MoP7	Used to monitor/view the MoP7 value of the PLC.	0	●
P27.19	C_MoP8	Used to monitor/view the MoP8 value of the PLC.	0	●
P27.20	C_MoP9	Used to monitor/view the MoP9 value of the PLC.	0	●
P27.21	C_MoP10	Used to monitor/view the MoP10 value of the PLC.	0	●
P27.22	PLC card digital input	Used to monitor/view the PLC card digital input status. Bit0: PS1 Bit1: PS2 Bit2: PS3 Bit3: PS4 Bit4–Bit5: Reserved	0x00	●
P27.23	PLC card digital output	Used to monitor/view the PLC card digital output status. Bit0: PRO1 Bit1: PRO2	0x0	●

Inverter function code	Name	Description	Default	Modify
P27.24–P27.26	Reserved	/	/	/
P27.27	PLC card power-down data retention	0: Disable 1: Enable	1	⊙

Group P28—Master/slave control

Inverter function code	Name	Description	Default	Modify
P28.00	Master/slave mode	0: Master/slave control is invalid. 1: The local device is the master. 2: The local device is the slave.	0	⊙
P28.01	Master/slave communication data selection	0: CAN 1: Reserved	0	⊙
P28.02	Master/slave control mode	Setting range: 0x000–0x112 Ones place: Master/slave running mode selection 0: Master/slave mode 0. (Both the master and slave use speed control, and power balancing is performed by droop control.) 1: Master/slave mode 1. (The master and slave must be in the same type of vector control. When the master is in speed control, the slave is forced into torque control.) 2: Master/slave mode 2 The slave switches from speed mode (master/slave mode 0) to torque mode (master/slave mode 1) at a frequency point. Tens place: Slave start command source 0: Master 1: Determined by P00.01 Hundreds place: Enable master/slave to transmit/receive data 0: Enable 1: Disable	0x001	⊙
P28.03	Slave speed gain	Setting range: 0.0–500.0%	100.0%	○
P28.04	Slave torque gain	Setting range: 0.0–500.0%	100.0%	○
P28.05	Master/slave mode 2 switching frequency	Setting range: 0.00Hz–P00.03	5.00Hz	○
P28.06	Slave count	Setting range: 1–15	1	⊙
P28.07	Master/slave CAN communication timeout time	Setting range: 0.0–60.0s	5.0s	○
P28.08	Master/slave CAN communication address	Setting range: 0–127 Note: No communication address setting is	1	⊙

Inverter function code	Name	Description	Default	Modify
		required for the master. The communication addresses for slaves must be consecutive, starting from 1.		
P28.09	Master/slave CAN communication baud rate	0: 50kbps 1: 100kbps 2: 125kbps 3: 250kbps 4: 500kbps 5: 800kbps 6: 1Mbps	4	⊙
P28.10	CAN slave torque offset	Setting range: -100.0%–100.0%	0.0%	○
P28.11	Slave speed deviation window enable	0: Disable 1: Enable	0	○
P28.12	Slave positive speed deviation window upper limit	Setting range: 0.00–50.00Hz	5.00Hz	○
P28.13	Slave negative speed deviation window lower limit	Setting range: 0.00–50.00Hz	5.00Hz	○
P28.14	Slave torque mode frequency limiting selection	Setting range: 0x00–0x11 Ones place: 0: The slave's set frequency is 5Hz higher than the master's. 1: The slave's set frequency equals the master's. Tens place: 0: Standard mode 1: In slave torque mode, the REV running frequency under regenerative conditions is limited to 0Hz.	0x00	○
P28.15	Starting torque of slave zero-speed limiting in reverse direction	Setting range: 0.0–100.0%	10.0%	○
P28.16–P28.17	Reserved	/	/	/
P28.18	Master/slave brake synchronization control	Setting range: 0x00–0x11 Ones place: Brake release synchronization 0: Invalid 1: Enable Tens place: brake closing synchronization 0: Invalid 1: Enable	0x11	○
P28.19	Master/slave brake release synchronization timeout time	Setting range: 0.00–30.00s	1.00s	○
P28.20	Master/slave brake close synchronization	Setting range: 0.00–30.00s	2.00s	○

Inverter function code	Name	Description	Default	Modify
	timeout time (Reserved)			
P28.21	Negative droop limit	Setting range: 0.00–20.00Hz	0.00Hz	○
P28.22	Slave torque direction selection in torque mode	Setting range: 0x00–0x12 Ones place: Forcible torque follow-up 0: Standard mode 1: Forced to follow the master torque direction 2: Reserved Tens place: Forcible speed follow-up 0: Standard mode 1: Forced to follow the master speed direction	0x00	○

Group P57—Horizontal anti-sway

Inverter function code	Name	Description	Default	Modify
P57.00	Anti-sway enable	0: Invalid 1: Enable 2: Reserved	0	◎
P57.01	Anti-sway mode selection	0: Common anti-sway 1: Anti-sway without rope length 2: S curve anti-sway	0	◎
P57.02	Rope length source selection	0: Keypad 1: AI1 2: AI2	0	◎
P57.03	Keypad set rope length	Setting range: 0.00–100.00m	0.00m	○
P57.04	Max. rope length	Setting range: 5.00–150.00m	40.00m	◎
P57.05	Rope length compensation value	Setting range: 0.00–150.00m	0.00m	◎
P57.06	Anti-sway switching frequency threshold	Setting range: 0.00–50.00Hz	10.00Hz	○
P57.07	Damping factor	Setting range: 0.000–1.000	0.400	◎
P57.08	Gear switchover filtering delay	Setting range: 0.000–10.000s	0.100s	◎
P57.09	Sway suppression percentage	Setting range: 0–100%	30%	○
P57.10	Residual sway percentage	Setting range: 0–100%	11%	○
P57.11	Anti-sway ACC/DEC time	Setting range: 0.00–10.00s	6.00s	○
P57.12	Low-speed anti-sway ACC/DEC time	Setting range: 0.00–10.00s	2.00s	○
P57.13	Medium-speed anti-sway ACC/DEC time	Setting range: 0.00–10.00s	3.00s	○
P57.14	High-speed anti-sway ACC/DEC time	Setting range: 0.00–10.00s	4.00s	○

Inverter function code	Name	Description	Default	Modify
P57.15	S-curve gain coefficient	Setting range: 0.0–1.0	0.6	○
P57.16	Anti-sway jog time	Setting range: 0.000–5.000s	0.000s	○
P57.17	Anti-sway ACC time	Setting range: 0.00–10.00s	0.00s	○
P57.18	Anti-sway DEC time	Setting range: 0.00–10.00s	0.00s	○
P57.19	System oscillation period	Setting range: 0.000–1.000s	0.000s	○
P57.20	Speed filter count	Setting range: 0–8	3	○
P57.21	Auxiliary calculation period for damping ratio	Setting range: 0.000–60.000s	0.000s	○
P57.22–P57.25	Reserved	/	/	/
P57.26	Height and rope length measurement enable	0: Disable 1–2: Reserved 3: Estimate based on motor encoder pulse linearity	0	◎
P57.27–P57.32	Reserved	/	/	/
P57.33	Encoder pulse measurement coefficient	Setting range: 1–30000 pulse/cm	1000 pulse/cm	○
P57.34	Rope length compensation	Setting range: 0.00–50.00m	0.00m	○
P57.35	Upper/lower limit reached status	Setting range: 0x00–0x11 Ones place: 0: Upper limit not reached 1: Upper limit reached Tens place: 0: Lower limit not reached 1: Lower limit reached	0x00	○

Group P60—Lifting brake functions

Inverter function code	Name	Description	Default	Modify
P60.00–P60.03	Reserved	/	/	/
P60.04	Brake-specific logic enable	0: The brake is controlled by an external controller. 1: The brake is controlled by the VFD.	0	◎
P60.05	Brake release/close torque limiting	Setting range: 0.0–300.0%	250.0%	○
P60.06	Torque mode brake release torque	Setting range: 0.0–200.0%	50.0%	○
P60.07	Brake release current in position control	Setting range: 0.0–200.0%	0.0%	○

Inverter function code	Name	Description	Default	Modify
P60.08	Forward brake release current	Setting range: 0.0–200.0%	0.0%	○
P60.09	Reverse brake release current	Setting range: 0.0–200.0%	0.0%	○
P60.10	Forward brake release torque	Setting range: 0.0–200.0%	0.0%	○
P60.11	Reverse brake release torque	Setting range: 0.0–200.0%	0.0%	○
P60.12	Forward brake release frequency	Setting range: 0.00–20.00Hz	2.50Hz	○
P60.13	Reverse brake release frequency	Setting range: 0.00–20.00Hz	2.50Hz	○
P60.14	Forward brake close frequency	Setting range: 0.00–20.00Hz	1.50Hz	○
P60.15	Reverse brake close frequency	Setting range: 0.00–20.00Hz	1.50Hz	○
P60.16	Delay before forward brake release	Setting range: 0.000–5.000s	0.000s	○
P60.17	Delay before reverse brake release	Setting range: 0.000–5.000s	0.000s	○
P60.18	Delay after forward brake release	Setting range: 0.000–5.000s	0.300s	○
P60.19	Delay after reverse brake release	Setting range: 0.000–5.000s	0.000s	○
P60.20	Delay before forward brake closing	Setting range: 0.000–5.000s	0.000s	○
P60.21	Delay before reverse brake closing	Setting range: 0.000–5.000s	0.000s	○
P60.22	Delay after forward brake closing	Setting range: 0.000–5.000s	0.300s	○
P60.23	Delay after reverse brake closing	Setting range: 0.000–5.000s	0.000s	○
P60.24	DEC buffer frequency	Setting range: 0.00–50.00Hz After receiving a stop command, the VFD decelerates to the frequency set by P60.24 according to the selected stop mode and maintains that frequency for the time set by P60.25.	5.00Hz	○
P60.25	DEC buffer frequency duration	Setting range: 0.000–5.000s	0.000s	○
P60.26	Jog braking type	Setting range: 0x00–0x11 Ones place: Brake release type 0: Same as the hoisting-oriented brake release frequency 1: Same as the jog frequency Tens place: Brake closing type 0: Same as hoisting-oriented brake closing	0x00	◎

Inverter function code	Name	Description	Default	Modify
		frequency 1: Same as the jog frequency		
P60.27	Brake selection for forward/reverse switchover	0: No switchover 1: Switchover	0	⊙
P60.28	Restart selection during braking	0: No restart during braking 1: Restart allowed during braking	0	⊙
P60.29	Wait time for restart	Setting range: 0.0–10.0s	0.5s	⊙
P60.30	Braking method in open-loop vector control	0: Standard open-loop vector control brake timing 1: Open-loop vector control brake timing with limiting 2: Torque-switched-speed open-loop vector control brake timing (Lifting) 3: Torque-switched-speed open-loop vector control no-brake timing (Horizontal moving)	0	⊙
P60.31–P60.34	Reserved	/	/	/
P60.35	Brake extension control selection	Setting range: 0x0000–0x3211 Ones place: Torque verification mode 0: Standard torque verification mode 1: Quick torque verification mode Tens place: Pre-brake-release brake slip detection enable (closed-loop) 0: Disable 1: Enable Hundreds place: Brake detection enable 0: Disable (S terminal enabling is active) 1: Enable power-on brake detection 2: Reserved Thousands place: Brake status monitoring enable 0: Disable 1: Enable brake feedback detection 2: Enable brake detection + Current detection upon a fault (closed-loop) 3: Enable brake detection + Current & speed detection upon a fault (closed-loop)	0x0010	⊙
P60.36	Torque verification fault detection time	Setting range: 0.000–10.000s	6.000s	○
P60.37	Brake slip speed deviation	Setting range: 0.05–1.00Hz	0.05Hz	○
P60.38	Reserved	/	/	/
P60.39	Brake slip fault delay	Setting range: 0.000–5.000s	0.500s	○
P60.40	Brake detection reminding interval	0.0–1000.0h	0.0h	⊙

Inverter function code	Name	Description	Default	Modify
P60.41	Brake detection reminding hold time	0–100min	5min	○
P60.42	Brake detection torque setting	Setting range: 0.0–180.0%	100.0%	○
P60.43	Brake detection frequency setting	Setting range: 0.00–20.00Hz	2.00Hz	○
P60.44	Brake detection time setting	Setting range: 0.0–30.0s	1.5s	○
P60.45	Brake detection pulse threshold	Setting range: 0–20000	1000	○
P60.46	Brake feedback fault delay time	Setting range: 0.000–20.000s	1.000s	○
P60.47	Brake monitoring current threshold	Setting range: 0.0–200.0%	100.0%	○
P60.48–P60.69	Reserved	/	/	/
P60.70	FWD torque enable at REV start/stop	Setting range: 0x00–0x11 Ones place: indicates whether to enable forward torque for reverse-running start 0: Disable (The REV startup torque direction follows the command.) 1: Enable (The REV startup torque direction is always forward.) Tens place: indicates whether to enable forward torque for reverse-running stop 0: Disable (The REV stop torque direction follows the command.) 1: Enable (The REV stop torque direction is always forward.)	0x00	◎
P60.71	Pre-torque input signal source and effective period selection	Setting range: 0x00–0x117 Ones place: Input signal source 0: Invalid 1: AI1 2: AI2 3: Modbus communication 4: Internally given (Reserved) 5: PROFIBUS/CANopen/PROFINET/EtherCAT communication 6: Reserved 7: Keypad Tens place: Pre-torque action effective period 0: During brake release in VFD brake control 1: When the given pre-torque changes Hundreds place: Pre-torque direction 0: Forward 1: Reverse	0x000	○

Inverter function code	Name	Description	Default	Modify
P60.72	Pre-torque keypad setting value	Setting range: 0.0–300.0%	0.0%	○
P60.73	Hoist pre-torque offset	Setting range: -100.0%–100.0%	0.0%	○
P60.74	Hoist drive-side gain	Setting range: 0.000–7.000	1.000	○
P60.75	Hoist braking-side gain	Setting range: 0.000–7.000	1.000	○
P60.76–P60.90	Reserved	/	/	/
P60.91	Conical motor function	0: Disable 1: Enable	0	⊙
P60.92	Conical motor excitation increase coefficient	Setting range: P60.93–150.0% Output voltage coefficient during conical motor acceleration.	120.0%	○
P60.93	Conical motor excitation constant coefficient	Setting range: P60.94–P60.92 Output voltage coefficient during conical motor constant-speed operation.	100.0%	○
P60.94	Conical motor excitation decrease coefficient	Setting range: 0.0–P60.93% Output voltage coefficient during conical motor deceleration.	80.0%	○

Group P64—Hoisting status display

Inverter function code	Name	Description	Default	Modify
P64.00–P64.02	Reserved	/	/	/
P64.03	Hoist alarm display value	Range: 0–20 0: No alarm 1: Reserved 2: Upper limit alarm (A9002) 3: Lower limit alarm (A9003) 4: Reserved 5: Motor overload alarm (A9005) 6: Brake failure alarm (A9006) 7: Brake feedback alarm (A9007) 8: Reserved 9: Expansion card PT100 overtemperature alarm (A9009) 10–12: Reserved 13: Expansion card KTY84 overtemperature alarm (A9013) 14: AI detected overheating (OH) alarm (A9014) 15: Reserved 16: Alarm of slave brake feedback in master/slave control (A9016) 17: Power-on brake detection in progress (A9017)	0	●

Inverter function code	Name	Description	Default	Modify
		18: Set frequency below brake application frequency after brake release alarm (A9018) 19: Minor brake wear alarm detected by the brake detection function (A9019) 20: Brake detection major wear alarm (A9020)		
P64.04	Reserved	/	/	/
P64.05	Brake slip speed	Range: 0.00–10.00Hz	0.00Hz	●
P64.06	Brake slip pulses	Range: 0–65535	0	●
P64.07– P64.08	Reserved	/	/	/
P64.09	Upper/lower limit height value	Range: 0.00–655.35m	0.00m	●
P64.10– P64.13	Reserved	/	/	/
P64.14	Obtained rope length	Range: 0.00–600.00m	0.00m	●
P64.15	Rope length with compensation	Range: 0.00–600.00m	0.00m	●
P64.16	Current anti-sway mode	Range: 0–3	0	●
P64.17	Pendulum length cycle	Range: 0–60000ms	0 ms	●
P64.18	Real-time ACC/DEC time	Range: 0–60000ms	0 ms	●
P64.19– P64.28	Reserved	/	/	/
P64.29	Test software version	Range: 0–65535	Depends on version	●
P64.30– P64.32	Reserved	/	/	/
P64.33	Motor group number before last power-down	0: Motor group 1 1: Motor group 2	0	●
P64.34– P64.38	Reserved	/	/	/
P64.39	Accumulative run time	Range: 0–65535min	0min	●

Group P90—Tension control basic functions

Inverter function code	Name	Description	Default	Modify
P90.00	Tension control mode selection	0: Standard mode (tension control disabled; operates as a general-purpose VFD) 1: Open-loop torque mode 2: Closed-loop speed mode 3: Closed-loop torque mode 4: Constant linear speed mode (reserved) 5: Traction mode 6: Standard winding/unwinding mode 7: Direct speed torque mode (inertia/friction compensation required)	0	◎

Inverter function code	Name	Description	Default	Modify
		8: Wire alignment mode (reserved) Note: Closed loop means that there is a feedback signal from an external sensor. Using closed loop requires the settings for the PID function group.		
P90.01	Winding/unwinding mode	0: Winding. Forward rotation corresponds to bottom winding of the material. 1: Unwinding. Forward rotation corresponds to top unwinding of the material. Note: The winding and unwinding depends on the run direction and the direction used for roll diameter calculation.	0	⊙
P90.02	Winding frequency upper limit	Setting range: 0.01Hz–P00.03	50.00Hz	⊙
P90.03	Unwinding frequency upper limit	Setting range: 0.01Hz–P00.03	1.00Hz	⊙
P90.04	Frequency upper limit channel	0: Keypad 1: AI1 2: AI2 3: AI3 4–5: Reserved 6: Automatic upper limit (actual frequency for winding)	0	⊙
P90.05	Actual frequency upper limit	Range: 0.01Hz–P00.03	20.00Hz	●
P90.06	Mechanical transmission ratio	Setting range: 0.01–300.00	1.00	⊙
P90.07	Debug mode torque reference	Setting range: 0.0–300.0%	0.0%	○
P90.08	Static friction torque compensation	Setting range: 0.0–100.0%	0.0%	○
P90.09	Dynamic friction torque compensation	Setting range: 0.0–100.0%	0.0%	○
P90.10	Torque compensation for max. line speed	Setting range: 0.0–100.0%	0.0%	○
P90.11	Static friction frequency threshold	Setting range: 0.01Hz–P00.03	1.00Hz	○
P90.12	Dynamic friction frequency threshold	Setting range: 0.01Hz–P00.03	5.00Hz	○
P90.13	Line speed input method	0: Line speed is 0 1: AI1 2: AI2 3: AI3 4–5: Reserved 6: Modbus communication 7: Max. line speed 8: Based on master pulse calculation	0	⊙

Inverter function code	Name	Description	Default	Modify
		(encoder pulse train) 9: CANopen/PROFINET/EtherCAT/PROFIBUS-DP communication		
P90.14	Max. line speed	Setting range: 0.0–3000.0m/min	300.0m/min	⊙
P90.15	Real-time line speed	Setting range: 0.0m/min–P90.14	0.0m/min	●
P90.16	Roll diameter calculation method	0: No calculation 1: Linear speed 2: PG thickness accumulation method 3–5: Reserved 6: AI1 calibration method 7: AI2 calibration method 8: AI3 calibration method 9: SVC evaluation method 10: Automatic recognition switching (Reserved)	0	⊙
P90.17	Max. roll diameter	Setting range: 1–10000mm	1200mm	⊙
P90.18	Winding initial roll diameter 0	Setting range: 1mm–P90.17	80mm	⊙
P90.19	Winding initial roll diameter 1	Setting range: 1mm–P90.17	100mm	⊙
P90.20	Winding initial roll diameter 2	Setting range: 1mm–P90.17	120mm	⊙
P90.21	Winding initial roll diameter 3	Setting range: 1mm–P90.17	150mm	⊙
P90.22	Unwinding initial roll diameter 0	Setting range: 1mm–P90.17	800mm	⊙
P90.23	Unwinding initial roll diameter 1	Setting range: 1mm–P90.17	900mm	⊙
P90.24	Unwinding initial roll diameter 2	Setting range: 1mm–P90.17	1000mm	⊙
P90.25	Unwinding initial roll diameter 3	Setting range: 1mm–P90.17	1200mm	⊙
P90.26	Roll diameter change rate 2	Setting range: 0.01–10.00mm/T	1.00mm/T	⊙
P90.27	Roll diameter reset method selection	0: Terminal reset 1: Stop reset 2: Communication reset (set to 2, auto changed to 0, reset once)	0	⊙
P90.28	Min. line speed for roll diameter calculation	Setting range: 0.1–300.0m/min	15.0m/min	⊙
P90.29	Roll diameter calculation interval	Setting range: 0.000–30.000	1.000	○
P90.30	Roll diameter calculation monotonicity selection	0: No restriction 1: Increasing only for winding, and decreasing only for unwinding	1	⊙

Inverter function code	Name	Description	Default	Modify
P90.31	Roll diameter change rate 1	Setting range: 0.00mm/T–P90.26	0.10mm/T	⊙
P90.32	Material type	0: Wire 1: Strip	1	⊙
P90.33	Reel width	Setting range: 0–10000mm	1000mm	⊙
P90.34	Wire diameter 0 or strip thickness 0	Setting range: 0.001–60.000mm	0.100mm	⊙
P90.35	Wire diameter 1 or strip thickness 1	Setting range: 0.001–60.000mm	0.150mm	⊙
P90.36	Wire diameter 2 or strip thickness 2	Setting range: 0.001–60.000mm	0.200mm	⊙
P90.37	Wire diameter 3 or strip thickness 3	Setting range: 0.001–60.000mm	0.250mm	⊙
P90.38	Real-time material diameter or thickness	Range: 0.000–60.000mm	0.000mm	●
P90.39	Machine shaft pulses per revolution	Setting range: 0–65535	600	⊙
P90.40	Real-time pulse count	Range: 0–65535	0	●
P90.41	Roll diameter calculation filter time	Setting range: 0.000–10.000s	3.000s	○
P90.42	Real-time roll diameter (Modifiable)	Setting range: 0mm–P90.17	0mm	⊙
P90.43	Real-time roll diameter (Read-only)	Range: 0mm–P90.17	0mm	●
P90.44	Actual working mode	Range: 0x00–0x1F	0x00	●
P90.45	Material density	Setting range: 0–60000	0	⊙
P90.46	Material inertia	Setting range: 0.00–300.00	0.00	○
P90.47	Mechanical inertia	Setting range: 0.00–300.00	0.00	○
P90.48	Traction machine ACC Time	Setting range: 0.00–300.00s	15.00s	⊙
P90.49	Traction machine DEC time	Setting range: 0.00–300.00s	15.00s	⊙
P90.50	Inertia compensation torque	Range: 0.0–300.0%	0.0%	●
P90.51	Line acceleration	Range: -99.00–99.00	0.00	●
P90.52	Inertia compensation ACC/DEC time	Setting range: 0.000–10.000s	0.100s	⊙
P90.53	Pulses per equipment revolution	Range: 0–65535	0	●
P90.54	Motor revolutions per drum turn	Setting range: 0–65535	0	⊙
P90.55	Tension reference method selection	0: Keypad 1: AI1 2: AI2 3: AI3 4–5: Reserved	0	⊙

Inverter function code	Name	Description	Default	Modify
		6: Modbus communication 7: Direct torque setting 8: CANopen/PROFINET/EtherCAT /PROFIBUS-DP communication		
P90.56	Digital tension reference	Setting range: 0N–P90.57	0N	○
P90.57	Max. tension	Setting range: 0–60000N	10000N	◎
P90.58	Tension reference change time	Setting range: 0.00–60.00s	0.00s	○
P90.59	Tension taper input method	0: Digital tension taper 1: AI1 (relative to digital tension taper value) 2: AI2 3: AI3 4–5: Reserved 6: Communication	0	◎
P90.60	Digital tension taper	Setting range: 0.00–100.00%	0.00%	○
P90.61	Tension taper method	0: Curve taper 1: Single-segment linear taper (denominator 1000) 2: Two-segment linear taper (interpolation) 3: Twenty-segment linear taper (interpolation)	1	◎
P90.62	Tension taper compensation	Setting range: 0–10000mm	1mm	○
P90.63	Intermediate roll diameter	Setting range: P90.18–P90.22	500	○
P90.64	Intermediate tension	Setting range: 0.00–100.00%	80.00%	○
P90.65	Tension at max. roll diameter	Setting range: 0.00–100.00%	50.00%	○
P90.66–P90.68	Reserved	/	/	/
P90.69	Set tension value	Range: 0–30000N	0N	●
P90.70	Taper tension value	Range: 0–30000N	0N	●
P90.71	Output frequency filter time	Setting range: 0.000–10.000s	0.010s	○
P90.72	Output frequency for roll diameter calculation	Range: 0.00–300.00Hz	0.00Hz	●
P90.73	Line speed stabilization time	Setting range: 0–60s	20s	○
P90.74	Set roll diameter	Setting range: 0mm–P90.17	0mm	○
P90.75	Stop roll diameter	Setting range: 0mm–P90.17	0mm	○
P90.76	Min. roll diameter	Setting range: 0–P90.17mm	0mm	○
P90.77	Winding/Unwinding reverse direction selection	0: Normal 1: Winding/unwinding reversed	0	◎
P90.78	Main traction roller diameter	Setting range: 1–10000mm	500mm	◎

Inverter function code	Name	Description	Default	Modify
P90.79	Traction roller transmission ratio	Setting range: 0.01–300.00	1.00	⊙
P90.80	Pulses per revolution of traction motor	Setting range: 1–10000	1024	⊙
P90.81	Line speed sampling time	Setting range: 0.001–0.200s	0.025s	⊙
P90.82	Sampling time pulse count L	Range: 0–65535	0	●
P90.83	Line speed filter time	Setting range: 0.000–10.000s	0.000s	○
P90.84	Torque mode zero-speed offset enable	0: Invalid 1: Enable	0	○
P90.85– P90.86	Reserved	/	/	/
P90.87	Flexible control coefficient	Setting range: 0.0–1.0	0.3	⊙
P90.88	High-speed pulse count A	Range: 0–65535	0	●
P90.89	High-speed pulse count B	Range: 0–65535	0	●
P90.90	A pulse percent	Range: 0.00–100.00%	0.00%	●
P90.91	B pulse percent	Range: 0.00–100.00%	0.00%	●
P90.92	Actual length	Range: 0–65535	0	●

Group P91—Tension control closed-loop functions

Inverter function code	Name	Description	Default	Modify
P91.00	PID reference method	0: Dancer position reference 1: Tension reference 2: AI1 3: AI2 4: AI3 5–6: Reserved 7: Modbus communication (0.00–100.00%) 8: CANopen/PROFINET/EtherCAT/PROFIBUS-DP communication	0	⊙
P91.01	Dancer position reference	Setting range: 0.00–10.00V	5.00V	○
P91.02	Position reference ACC time	Setting range: 0.000–20.000s	2.000s	○
P91.03	Position reference DEC time	Setting range: 0.000–20.000s	2.000s	○
P91.04	Position reference start position selection	0: Feedback position 1: Present position	0	⊙

Inverter function code	Name	Description	Default	Modify
P91.05	Dancer/tension feedback selection	0: AI1 1: AI2 2: AI3 3–4: Reserved 5: Output torque (Calibrated at 200.0%) 6: Modbus communication 7: CANopen/PROFINET/EtherCAT/PROFIBUS-DP communication	1	⊙
P91.06	PID control action selection	0: Direct action 1: Reverse action	0	⊙
P91.07	PID output control selection	0: Max. frequency 1: Reference given frequency A 2: Max. tension 3: Reference tension 4: Reference given frequency B	0	⊙
P91.08	Reserved	/	/	/
P91.09	PID control parameter selection	0: Use the first set of parameters 1: Control based on roll diameter (winding/unwinding initial roll diameter linear change) 2: Adjust based on frequency 3: Adjust based on linear speed 4: Adjust based on deviation 5: Terminal	0	⊙
P91.10	Proportional gain 1	Setting range: 0.000–30.000	0.200	○
P91.11	Integral time 1	Setting range: 0.00–30.00s	0.00s	○
P91.12	Differential time 1	Setting range: 0.000–30.000s	0.000s	○
P91.13	Proportional gain 2	Setting range: 0.000–30.000	0.200	○
P91.14	Integral time 2	Setting range: 0.00–30.00s	0.00s	○
P91.15	Differential time 2	Setting range: 0.000–30.000s	0.000s	○
P91.16	PID1 switching point	Setting range: 0.00–100.00%	4.00%	○
P91.17	PID2 switching point	Setting range: 0.00–100.00%	45.00%	○
P91.18	PID deviation limit	Setting range: 0.00–100.00%	0.00%	○
P91.19	PID integral separation	Setting range: 0.00–100.00%	100.00%	○
P91.20	PID differential limit	Setting range: 0.00–100.00%	0.00%	○
P91.21	PID output upper limit	Setting range: 0.00–100.00%	100.00%	○
P91.22	PID output lower limit	Setting range: 0.00–100.00%	100.00%	○
P91.23	PID calculation cycle	Setting range: 1–1000ms	1ms	○
P91.24	Reserved	/	/	/
P91.25	PID start delay	Setting range: 0.000–10.000s	0.000s	○
P91.26	PID output filter time	Setting range: 0.000–10.000s	0.000s	○
P91.27	PID reference value	Range: 0.00–100.00%	0.00%	●
P91.28	PID feedback value	Range: 0.00–100.00%	0.00%	●
P91.29	PID deviation value	Range: -100.00–100.00%	0.00%	●
P91.30	PID-Kp monitor	Range: -100.00–100.00%	0.00%	●

Inverter function code	Name	Description	Default	Modify
P91.31	PID-Ki monitor	Range: -100.00–100.00%	0.00%	●
P91.32	PID output percentage	Range: -100.00–100.00%	0.00%	●
P91.33	Deviation 0	Setting range: 0.00%–P91.34	4.00%	○
P91.34	Deviation 1	Setting range: P91.33–P91.35	12.00%	○
P91.35	Deviation 2	Setting range: P91.34–P91.36	22.00%	○
P91.36	Deviation 3	Setting range: P91.35–P91.37	37.00%	○
P91.37	Deviation 4	Setting range: P91.36–P91.38	52.00%	○
P91.38	Deviation 5	Setting range: P91.37–100.00%	72.00%	○
P91.39	Soft startup integral time	Setting range: 0.0–1000.0s	167.0s	○
P91.40	Integral time 1	Setting range: 0.0–1000.0s	909.0s	○
P91.41	Integral time 2	Setting range: 0.0–1000.0s	333.0s	○
P91.42	Integral time 3	Setting range: 0.0–1000.0s	133.0s	○
P91.43	Integral time 4	Setting range: 0.0–1000.0s	67.0s	○
P91.44	Integral time 5	Setting range: 0.0–1000.0s	25.0s	○
P91.45	Integral time 6	Setting range: 0.0–1000.0s	9.0s	○
P91.46	Deviation integral actual value	Range: 0.00–500.00%	0.00%	●
P91.47	Deviation integral action channel selection	0: Feedforward gain*AI1 1: Feedforward gain*AI2 2: Feedforward gain×10V 3–4: Reserved	0	◎
P91.48	Deviation integral range selection	0: Feedforward gain unchanged 1: 0 to the feedforward gain upper limit 2: -(feedforward gain upper limit) to +(feedforward gain upper limit)	1	◎
P91.49	Deviation integral upper limit	Setting range: 0.00–500.00%	500.00%	◎
P91.50	Deviation integral gain	Setting range: 0.00–500.00%	50.00%	◎
P91.51	Deviation integral power-down memory selection	Setting range: 0x00–0x11 Ones place: 0: Automatic reset 1: Terminal reset (shared roll diameter reset terminal) Tens place: 0: Save at power loss 1: Do not save at power loss	0x10	◎
P91.52	Low-speed PID output limit	Setting range: 0.00–100.00%	0.00%	◎
P91.53	Low-speed PID range	Setting range: 0.00–100.00%	2.00%	◎
P91.54	Low-speed PID re-effective time	Setting range: 0.000–60.000s	0.000s	○
P91.55	Reverse control	0: Enable 1: Disable 1 2: Disable 2 (Reverse rotation, frequency reference is 0)	0	◎
P91.56	Zero-speed control	0: Zero speed run (Reverse rotation,	0	◎

Inverter function code	Name	Description	Default	Modify
		frequency reference is 0) 1: Self-adaptive operation (reverse, PID feedforward no longer active)		
P91.57	Reserved	/	/	/
P91.58	Material break detection upper limit	Setting range: 0.00–10.00V	0.00V	⊙
P91.59	Material break detection lower limit	Setting range: 0.00–10.00V	0.00V	⊙
P91.60	Feeding interrupt detection filter time	Setting range: 0–10000ms	500ms	⊙
P91.61	Material break detection start delay	Setting range: 0.0–10.0s	6.0s	⊙
P91.62	Continued run time after Material break	Setting range: 0.0–60.0s	10.0s	⊙
P91.63	Running frequency after material break	Setting range: 0.00–50.00Hz	5.00Hz	⊙
P91.64	Disconnection detection mode	0: Automatic 1: External terminal signal	0	⊙

Group P92—Tension control auxiliary functions

Inverter function code	Name	Description	Default	Modify
P92.00	Winding pre-drive frequency gain	Setting range: 50.00–200.00%	105.00%	⊙
P92.01	Unwinding pre-drive frequency gain	Setting range: 50.00–200.00%	95.00%	⊙
P92.02	Pre-drive control delay	Setting range: 0.0–60.0s	1.0s	⊙
P92.03	Fixed length setting	Setting range: 0–65535m	10000m	⊙
P92.04	Pulses per meter	Setting range: 0.01–655.35	1.00	⊙
P92.05	Creep speed (Reserved)	Setting range: 0.01–20.00	5.00	⊙
P92.06	Fixed-length creep length (Reserved)	Setting range: 0–1000m	10m	⊙
P92.07	Fixed length output control	0: No output at length reached 1: Output at length reached	1	⊙
P92.08	Segmented roll diameter 1 setting	Setting range: 0–P92.09	100	○
P92.09	Segmented roll diameter 2 setting	Setting range: P92.08–P92.10	150	○
P92.10	Segmented roll diameter 3 setting	Setting range: P92.09–P92.11	200	○
P92.11	Segmented roll diameter 4 setting	Setting range: P92.10–P92.12	230	○
P92.12	Segmented roll diameter 5 setting	Setting range: P92.11–P92.13	280	○

Inverter function code	Name	Description	Default	Modify
P92.13	Segmented roll diameter 6 setting	Setting range: P92.12–P92.14	320	○
P92.14	Segmented roll diameter 7 setting	Setting range: P92.13–P92.15	350	○
P92.15	Segmented roll diameter 8 setting	Setting range: P92.14–P92.16	380	○
P92.16	Segmented roll diameter 9 setting	Setting range: P92.15–P92.17	400	○
P92.17	Segmented roll diameter 10 setting	Setting range: P92.16–P92.18	420	○
P92.18	Segmented roll diameter 11 setting	Setting range: P92.17–P92.19	450	○
P92.19	Segmented roll diameter 12 setting	Setting range: P92.18–P92.20	460	○
P92.20	Segmented roll diameter 13 setting	Setting range: P92.19–P92.21	470	○
P92.21	Segmented roll diameter 14 setting	Setting range: P92.20–P92.22	480	○
P92.22	Segmented roll diameter 15 setting	Setting range: P92.21–P92.23	500	○
P92.23	Segmented roll diameter 16 setting	Setting range: P92.22–P92.24	520	○
P92.24	Segmented roll diameter 17 setting	Setting range: P92.23–P92.25	560	○
P92.25	Segmented roll diameter 18 setting	Setting range: P92.24–P92.26	600	○
P92.26	Segmented roll diameter 19 setting	Setting range: P92.25–P92.27	620	○
P92.27	Segmented roll diameter 20 setting	Setting range: P92.26–P90.17	680	○
P92.28	Taper 1	Setting range: 0.00–100.00%	1.00%	○
P92.29	Taper 2	Setting range: 0.00–100.00%	3.00%	○
P92.30	Taper 3	Setting range: 0.00–100.00%	5.00%	○
P92.31	Taper 4	Setting range: 0.00–100.00%	10.00%	○
P92.32	Taper 5	Setting range: 0.00–100.00%	15.00%	○
P92.33	Taper 6	Setting range: 0.00–100.00%	20.00%	○
P92.34	Taper 7	Setting range: 0.00–100.00%	25.00%	○
P92.35	Taper 8	Setting range: 0.00–100.00%	30.00%	○
P92.36	Taper 9	Setting range: 0.00–100.00%	32.00%	○
P92.37	Taper 10	Setting range: 0.00–100.00%	35.00%	○
P92.38	Taper 11	Setting range: 0.00–100.00%	38.00%	○
P92.39	Taper 12	Setting range: 0.00–100.00%	40.00%	○
P92.40	Taper 13	Setting range: 0.00–100.00%	42.00%	○
P92.41	Taper 14	Setting range: 0.00–100.00%	44.00%	○
P92.42	Taper 15	Setting range: 0.00–100.00%	46.00%	○
P92.43	Taper 16	Setting range: 0.00–100.00%	48.00%	○
P92.44	Taper 17	Setting range: 0.00–100.00%	50.00%	○
P92.45	Taper 18	Setting range: 0.00–100.00%	52.00%	○

Inverter function code	Name	Description	Default	Modify
P92.46	Taper 19	Setting range: 0.00–100.00%	54.00%	○
P92.47	Taper 20	Setting range: 0.00–100.00%	56.00%	○
P92.48	Industry macro	Setting range: 0–5 0: Reserved 1: HNKS travel-specific macro 2: HNKS lifting-specific macro 3: Reserved 4: Reserved 5: HNKS in-plant lifting-specific macro	0	◎

9 Troubleshooting

9.1 What this chapter contains

This chapter describes how to view fault information, reset faults, and query the fault history for the rectifier and inverter units. A complete list of alarms and fault information as well as possible causes and corrective measures are presented in this chapter.



Only trained and qualified professionals are allowed to carry out the operations mentioned in this chapter. Please carry out operations according to instructions presented in chapter 1 Safety precautions.

9.2 Indications of alarms and faults

Faults are indicated by indicators. Refer to section 5.4 Operation procedure. When the **TRIP** indicator is on, the alarm or fault code displayed on the keypad indicates the power unit is in an abnormal state. Use the information provided in this chapter to identify the cause of the alarm or fault and the corresponding corrective action. If you cannot determine the cause of the alarm or fault, contact your local INVT office.

9.3 Fault reset

9.3.1 Rectifier fault reset

When the fault screen is displayed, the rectifier unit can be reset by pressing the **DATA/ENT** key on the keypad, via a digital input, or by power cycling the rectifier unit. After the fault is cleared, the rectifier unit can be restarted.

9.3.2 Inverter fault reset

When the fault screen is displayed, the inverter unit can be reset by pressing the **DATA/ENT** key on the keypad, via a digital input, or by power cycling the inverter unit. After the fault is cleared, the motor can be started again.

9.4 Fault history

Function codes P19.00 to P19.05 of the rectifier unit record the types of the six most recent faults. Function codes P19.06 to P19.13, P19.16 to P19.23, and P19.26 to P19.33 record the operating data of the rectifier unit at the time of the three most recent faults.

Function codes P07.27 to P07.32 of the inverter unit record the types of the six most recent faults. Function codes P07.33 to P07.40, P07.41 to P07.48, and P07.49 to P07.56 record the operating data of the inverter unit at the time of the three most recent faults.

9.5 Faults and solutions

9.5.1 Rectifier unit faults and solutions

When a fault occurred, handle the fault as follows:

1. After the rectifier unit has a fault, check whether keypad display is improper. If yes, contact the local INVT office.
2. If no, check function group P19 to view the fault record parameters and understand the actual condition.
3. Check the following table for the exception and solution.
4. Rectify the fault or ask for help.
5. After confirming the fault is removed, perform fault reset, and start running.

Note: The numbers enclosed in square brackets such as [1], [2] and [3] in the **Fault type** column in the following table indicate the fault type codes read through communication.

Fault code	Fault description	Possible cause	Solution
Lv1	Input grid undervoltage	The grid voltage is 20% lower than the general value, or the internal hardware circuit of the rectifier unit is abnormal.	Check the grid input power.
ov1	[2] Grid overvoltage	The grid voltage is 20% higher than the general value, or the internal hardware circuit of the rectifier unit is abnormal.	Check the grid input power. Check the settings of related function codes.
SPI1	Half-controlled rectifier input R-phase loss	Wiring of the R phase on the half-controlled rectifier.	Check the wiring of the R phase on the half-controlled rectifier and check the grid voltage.
SPI2	Half-controlled rectifier input S-phase loss	Wiring of the S phase on the half-controlled rectifier.	Check the wiring of the S phase on the half-controlled rectifier and check the grid voltage.
SPI3	Half-controlled rectifier input T-phase loss or uncontrolled rectifier output phase loss	Wiring of the T phase on the half-controlled rectifier. All outputs of the uncontrolled rectifier.	Check the wiring of the T phase on the half-controlled rectifier and check the grid voltage. Check the grid voltage of the uncontrolled rectifier.
PLL F	[6] Phase lock failure	The grid voltage is abnormal.	Check the input wiring and grid voltage.
Lv	[7] Bus undervoltage	Bus undervoltage occurs during running.	Check the bus voltage. Adjust the undervoltage threshold parameter. Replace the main control board.
ov	[8] Bus overvoltage	DC bus overvoltage occurs during running.	Check the bus voltage. Adjust the overvoltage threshold parameter. Replace the main control board. Check the braking unit wiring.
EEP	0] EEPROM operation fault	Control parameter reading/writing error. EEPROM damaged.	Press STOP/RST to reset. Replace the main control board.
bCE	11] Braking unit direct connection fault	Braking circuit fault or damaged braking transistor.	Check the braking unit, and replace with new braking transistor. Increase the brake resistance.
EF	[12] External fault	External fault input active at S terminal	Check external device input.
boL	3] Braking unit overload	Braking circuit fault or damaged braking transistor. Resistance of the external braking resistor is small.	Check the braking unit, and replace with new braking transistor. Increase the braking resistor resistance.
boC	4] Braking component overcurrent	Braking circuit fault or damaged braking transistor. Resistance of the external braking resistor is small.	Check the braking unit, and replace with new braking transistor. Increase the braking resistor resistance.
E-485	] RS485 communication fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.

Fault code	Fault description	Possible cause	Solution
E-CAN	CANopen/CAN broadcast communication fault	Poor line contact. Termination resistor not enabled. Communication baud rates do not match; The peripheral interference is too large.	Check the wiring and connect the termination resistor. Set the same baud rate. Check the surrounding environment, and eliminate interference effects.
E-DP	[18] PROFIBUS-DP communication fault	Incorrect communication address. Termination resistor disconnected. Improper master GSD file configuration. The peripheral interference is too large.	Check the related settings; Check the surrounding environment, and eliminate interference effects.
E-PLC	[20] PLC card communication fault	Line contact is poor. The peripheral interference is too large.	Check the line. Check the surrounding environment, and eliminate interference effects.
oH1	[21] Bridge rectifier module overheating	The air duct is blocked or the fan is damaged.	Ventilate the air duct or replace the fan. Lower the ambient temperature.
boH	[22] Brake overheat fault	Ambient temperature too high. Long-time overload running.	
E-PN	PROFINET communication timeout	The configuration on the host controller is incorrect. The peripheral interference is too large. Note: This fault does not apply to non-gateway-type rectifier units.	Check the configuration on the host controller. Check the surrounding environment, and eliminate interference effects.
E-DNE	[55] Parameter download error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Data storage error occurred to the keypad.	Check for and remove the external interference source. Replace the hardware and seek maintenance services. Re-back up the data on the keypad.
OFFL	[56] Partial slave unit offline	The number of actual slave nodes (P17.15) conflicts with the number of set slave nodes (P21.33). Line contact is poor. Termination resistor not enabled. Communication baud rates do not match. The master/slave addresses conflict. Note: This fault does not apply to non-gateway-type rectifier units.	Check the values of P17.15 and P21.33. Switch on the matching resistor. Set the same baud rate. Check all master/slave addresses. Check CANopen network parameters.

Fault code	Fault description	Possible cause	Solution
E-CAT	[57] EtherCAT communication timeout fault	The configuration on the host controller is incorrect. The peripheral interference is too large. Note: This fault does not apply to non-gateway-type rectifier units.	Check the configuration on the host controller. Check the surrounding environment, and eliminate interference effects.
SECAN	[58] Master/slave CAN communication fault	Duplicate slave nodes on the communication network in master mode. Mismatch between the number of slave nodes detected by the master and the number configured on the master in master mode	Check for duplicate slave node IDs in the communication network. Check the wiring between the master node and each slave node in the communication network.
S-Err	[59] Slave fault on the master/slave CAN network	A slave fault occurs.	Check the slave status and remove the slave fault.

Note: Uncontrolled rectifier units do not have Lv1, Ov1, E-485, E-CAN, E-PN, OFFL, or E-CAT faults, and SPI1 indicates an input phase loss fault.

9.5.2 Inverter unit faults and solutions

When a fault occurred, handle the fault as follows:

1. After the inverter unit has a fault, check whether keypad display is improper. If yes, contact the local INVT office.
2. If no, check function group P07 to view the fault record parameters and understand the actual condition.
3. See the following table for a detailed solution and check for exceptions.
4. Rectify the fault or ask for help.
5. After confirming the fault is removed, perform fault reset, and start running.

Note: The numbers enclosed in square brackets such as [1], [2] and [3] in the **Fault type** column in the following table indicate the fault type codes read through communication.

Fault code	Fault description	Possible cause	Solution
E001	[1] Inverter unit U-phase protection	ACC is too fast.	Increase ACC/DEC time. Replace the power unit.
E002	[2] Inverter unit V-phase protection	IGBT module damaged. Misoperation is caused by interference.	The device and system has been grounded reliably. Check for loose drive wires.
E003	[3] Inverter unit W-phase protection	Drive wires are poorly connected. To-ground short circuit occurs.	Check whether there is strong interference surrounding the peripheral device. Check for abnormal motor wiring and motor-to-ground short connection.
E004	[4] Overcurrent during ACC	ACC/DEC is too fast. The voltage of the grid is too	Increase ACC/DEC time. Check the input power;

Fault code	Fault description	Possible cause	Solution
E005	[5] Overcurrent during DEC	low. Inverter power is too small;	Select the inverter with larger power;
E006	[6] Overcurrent during constant speed running	Load transient or exception occurred; To-ground short circuit or output phase loss occurred. Strong external interference sources existed. The overvoltage stall protection is not enabled.	Check if the load is short circuited (to-ground short circuit or line-to-line short circuit) or the rotation is not smooth; Check the output wiring. Check whether there is strong interference. Check the setting of related function codes.
E007	[7] Overvoltage during ACC	Exception occurred to input voltage.	Check the input power. Check whether load DEC time is too short.
E008	[8] Overvoltage during DEC	Large energy feedback. Lack of braking units.	or the motor starts during rotating. Install dynamic brake components.
E009	[9] Overvoltage during constant speed running	Energy-consumption braking is not enabled.	Check the settings of related function codes.
E010	[10] Bus undervoltage	Grid voltage is too low. The overvoltage stall protection is not enabled.	Check the grid input power supply. Check the settings of related function codes.
E011	[11] Motor overload	Grid voltage is too low. The motor rated current is set incorrectly. Motor stalling has occurred or load sudden change is too great.	Check the grid voltage. Reset the rated current of the motor. Check the load and adjust the torque boost quantity.
E012	[12] Inverter unit overload	ACC is too fast. The motor is restarted during rotating. Grid voltage is too low. Load is too large. Power is too small.	Increase ACC time. Avoid restart after stop. Check the grid voltage; Select the inverter with larger power; Select a proper motor.
E013	[13] Input phase loss	One or two of the R, S, and T phases missing	Check the input wiring. Check the grid voltage.
E014	[14] Output phase loss	Phase loss occurred to U, V, W output (or the three phases of motor is asymmetrical).	Check the output wiring. Check the motor and cables.
E015	[15] Rectifier module overheating	Rectifier air duct blocked or fan damaged. Ambient temperature too high. Long-time overload running.	Ventilate the air duct or replace the fan. Lower the ambient temperature.
E016	[16] Inverter module overheat	The air duct is blocked or the fan is damaged. Ambient temperature too high. Long-time overload running.	Ventilate the air duct or replace the fan. Lower the ambient temperature.
E017	[17] External fault	External fault input signal of S terminal acts.	Check external device input.

Fault code	Fault description	Possible cause	Solution
E018	[18] RS485 communication fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.
E019	[19] Current detection fault	Poor contact of the connector of control board. The Hall component is damaged. Exception occurred to amplification circuit.	Increase the default value of P11.26. Check the connector and re-plug. Replace the main control board or unit.
E020	[20] Motor autotuning fault	Motor capacity does not match with the inverter capacity, this fault may occur easily if the difference between them exceeds five power classes; Motor parameter is set improperly; The parameters gained from autotuning deviate sharply from the standard parameters. Autotuning timeout.	Replace the inverter unit with a suitable model, or use V/F control. Set the motor type and nameplate parameters correctly. Empty the motor load and re-perform autotuning. Check the motor wiring and parameter setup. Check whether the frequency upper limit is larger than 2/3 of the rated frequency.
E021	[21] EEPROM operation fault	Control parameter reading/writing error. EEPROM damaged.	Press STOP/RST to reset. Replace the main control board.
E022	[22] PID feedback offline fault	PID feedback offline. PID feedback source disappears.	Check PID feedback signal wires. Check PID feedback source.
E023	[23] Rectifier braking unit fault	Braking resistor resistance too low. Internal damage to the braking IGBT. False triggering caused by interference. Poor drive wire connection. Short circuit to ground. Braking transistor overtemperature.	Replace the braking resistor with one of higher resistance. Check the drive wire. Check whether there is strong interference surrounding the peripheral device. Keep good ventilation to lower ambient temperature. Ventilate the air duct or replace the fan.
E024	[24] Running time reached	The actual running time is longer than the set time.	Ask for the supplier and adjust the set running time.
E025	[25] Electronic overload fault	The inverter releases overload alarm based on the set value	Check the load and the overload alarm points.
E026	[26] Keypad communication fault	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference.	Check the keypad cable to determine whether a fault occurs. Check for and remove the external interference source.

Fault code	Fault description	Possible cause	Solution
		Keypad or mainboard communication circuit error.	Replace the hardware and seek maintenance services.
E027	[27] Parameter upload error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Keypad or mainboard communication circuit error.	Check for and remove the external interference source. Replace the hardware and seek maintenance services. Replace the hardware and seek maintenance services.
E028	[28] Parameter download error	Keypad cable connected improperly or disconnected. Keypad cable too long, causing strong interference. Data storage error occurred to the keypad.	Check for and remove the external interference source. Replace the hardware and seek maintenance services. Re-back up the data on the keypad.
E029	[29] PROFIBUS-DP communication fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.
E030	[30] Rectifier CAN broadcast fault or rectifier CANopen communication fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.
E031	[31] Local CANopen communication fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.
E032	[32] Ground short-circuit fault 1 (Hardware overcurrent)	Inverter unit output shorted to ground. Current detection circuit fault. Actual motor power setting differs excessively from the inverter unit power.	Check whether the motor wiring is normal. Replace the Hall sensor. Replace the main control board. Reset the motor parameters properly.
E033	[33] Ground short-circuit fault 2 (Software overcurrent)	Inverter unit output shorted to ground. Current detection circuit fault. Actual motor power setting differs excessively from the inverter unit power.	Check whether the motor wiring is normal. Replace the Hall sensor. Replace the main control board. Reset the motor parameters properly.
E034	[34] Speed deviation fault	The load is too heavy or stalled.	Check the load to ensure it is proper, and increase the detection time. Check whether the control parameters are set properly.

Fault code	Fault description	Possible cause	Solution
E035	[35] Mal-adjustment fault	SM control parameters are set incorrectly. Autotuned parameters are not accurate. The inverter is not connected to the motor.	Check the load and ensure the load is normal. Check whether control parameters are set correctly. Increase the mal-adjustment detection time.
E036	[36] Electronic underload fault	The inverter performs the underload alarm based on the set value	Check the load and the underload alarm points.
E037	[37] Encoder disconnection fault	Incorrect encoder wire sequence, or one or more signal wires not properly connected.	Check the encoder wiring.
E038	[38] Encoder reverse direction fault	Encoder speed signal opposite to motor running direction.	Correct the encoder direction setting.
E039	[39] Encoder Z pulse disconnection fault	Z signal wires are disconnected.	Check the wiring of Z signal.
E040	[40] Safe torque off	Safe torque off function is enabled by external forces.	/
E041	[41] Exception occurred to safe circuit of channel 1	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel 1.	Check whether terminal wiring of STO is proper and firm enough; Check whether the external switch of STO can work properly; Replace the control board.
E042	[42] Exception occurred to safe circuit of channel 2	The wiring of STO is improper; Fault occurred to external switch of STO; Hardware fault occurred to safety circuit of channel 2.	Check whether terminal wiring of STO is proper and firm enough; Check the external wiring of the user interface and verify that the 24 V supply is normal. Check whether the external switch of STO can work properly; Replace the control board.
E043	[43] Exception occurred to both channel 1 and channel 2	Hardware fault occurred to STO circuit.	Replace the control board.
E044	[44] Safety code FLASH CRC check fault	Control board is faulty.	Replace the control board.
E045	[45] PLC card custom fault 1	Fault defined by the PLC expansion card.	Check the PLC expansion card application program to determine the cause of the fault.
E046	[46] PLC card custom fault 2		
E047	[47] PLC card custom fault 3		

Fault code	Fault description	Possible cause	Solution
E048	[48] PLC card custom fault 4		
E049	[49] PLC card custom fault 5		
E050	[50] PLC card custom fault 6		
E051	[51] PLC card custom fault 7		
E052	[52] PLC card custom fault 8		
E053	[53] PLC card custom fault 9		
E054	[54] PLC card custom fault 10		
E055	[55] Duplicate expansion card type	Two expansion cards of the same type installed. At least two PZD groups are configured in groups P14, P15, and P16.	Two expansion cards of the same type are not supported. Check the expansion card types, and remove one card after power-off. Check the PZD settings in groups P14, P15, and P16.
E056	[56] Encoder UVW loss fault	No electric level variation occurred to UVW signal.	Check the wiring of UVW; Encoder is damaged.
E057	[57] PROFINET communication timeout fault	Incorrect host controller configuration. Excessive external interference.	Check the host controller configuration. Check the surrounding environment, and eliminate interference effects.
E058	[58] Master/slave CAN communication fault	Duplicate slave nodes on the communication network in master mode. Mismatch between the number of slave nodes detected by the master and the number configured on the master in master mode.	Check for duplicate slave node IDs in the communication network. Check the wiring between the master node and each slave node in the communication network.
E059	[59] Motor overtemperature fault	Motor overtemperature input terminal is valid. The temperature detection resistance is abnormal. Long-time overload running or exception occurred.	Check the wiring of the motor overtemperature input terminal (terminal function 57). Check whether the temperature sensor is proper; Check the motor, and perform maintenance on the motor.
E060	[60] Failure to identify the card in card slot 1	There is data transmission in the interface of card slot 1, but it cannot read the card type.	Check whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
E061	[61] Card recognition	There is data transmission in	Check whether the expansion card

Fault code	Fault description	Possible cause	Solution
	failure in slot 2	the interface of card slot 2, but it cannot read the card type.	inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
E063	[63] Slot 1 card communication timeout fault	There is no data transmission in the interface of card slot 1.	Check whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
E064	[64] Slot 2 card communication timeout fault	There is no data transmission in the interface of card slot 2.	Check whether the expansion card inserted can be supported. Stabilize the expansion card interfaces after power-off, and check whether the fault persists at next power-on. Check whether the insertion port is damaged, if yes, replace the insertion port after power-off.
E066	[66] EtherCAT communication timeout fault	Incorrect host controller configuration. Excessive external interference.	Check the host controller configuration. Check the surrounding environment, and eliminate interference effects.
E069	[69] Slave fault on the master/slave CAN network	A slave fault occurs.	Check the slave status and remove the slave fault.
E072	[72] Brake feedback fault	Incorrect brake wiring. Mechanical damage to the brake.	Check the brake wiring. Check the brake mechanism.
E073	[73] Torque verification fault	Incorrect brake wiring. Mechanical damage to the brake.	Check the brake wiring. Check the brake mechanism.
E076	[76] Terminal command abnormal protection	Incorrect terminal settings. Incorrect terminal connection mode.	Check the terminal settings. Check the terminal connection mode.
E079	[79] Brake failure	Incorrect brake wiring. Mechanical damage to the brake.	Check the brake wiring. Check the brake mechanism.
E092	[92] AI1 disconnection fault	No AI1 input. Incorrect AI1 connection mode.	Check the AI1 input. Check the AI1 connection mode.
E093	[93] AI2 disconnection fault	No AI2 input. Incorrect AI2 connection mode.	Check the AI2 input. Check the AI2 connection mode.

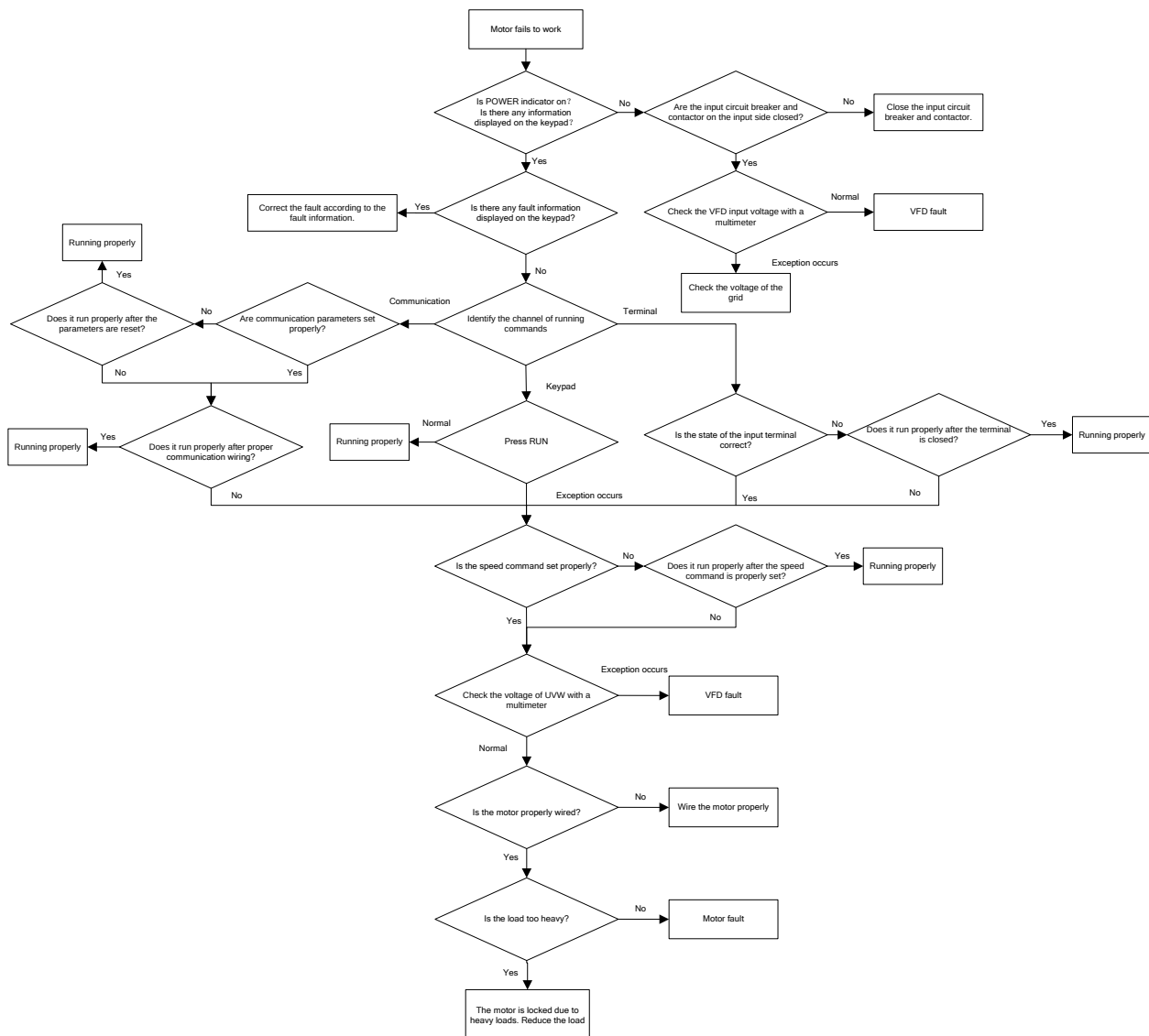
Fault code	Fault description	Possible cause	Solution
E094	[94] AI3 disconnection fault	No AI3 input. Incorrect AI3 connection mode.	Check the AI3 input. Check the AI3 connection mode.
E096	[96] No upgrade bootloader	The program cannot be upgraded remotely.	If remote upgrade is not required, disable it via P14.40.
E109	[109] Tension control feedback disconnection fault	No tension control feedback input. Incorrect tension control feedback connection mode.	Check the tension control feedback input. Check the tension control feedback connection mode.
E110	[110] PG card detected motor overtemperature fault	The temperature detected by EC-PG707-24 exceeds the threshold.	Check for external overtemperature. Check and maintain related devices.
E111	[111] IO card detected motor overtemperature fault	The temperature detected by EC-IO702 exceeds the threshold.	Check for external overtemperature. Check and maintain related devices.
E112	[112] Analog input detected motor overtemperature fault	Temperature detection exceeds the threshold. Incorrect AO output type selected.	Check the cooling device. Check the related function codes.
E129	[129] Slave offline fault	Incorrect baud rate. Communication line fault. Incorrect communication address. Communication suffers from strong interference.	Set a proper baud rate. Check the communication port wiring. Set the communication address correctly. Replace or change wiring to enhance anti-interference.
E591	[591] Full-closed-loop position encoder disconnection	Incorrect encoder wire sequence, or one or more signal wires not properly connected.	Check the encoder wiring.
E592–E599	[592–E599] SSI card fault	Incorrect position control parameter settings.	Check the position control parameter settings.

9.5.3 Other status

Displayed code	Status type	Possible cause	Solution
PoFF	System power failure	The system is powered off or the bus voltage is too low.	Check the grid environment.

9.6 Analysis of common inverter unit faults

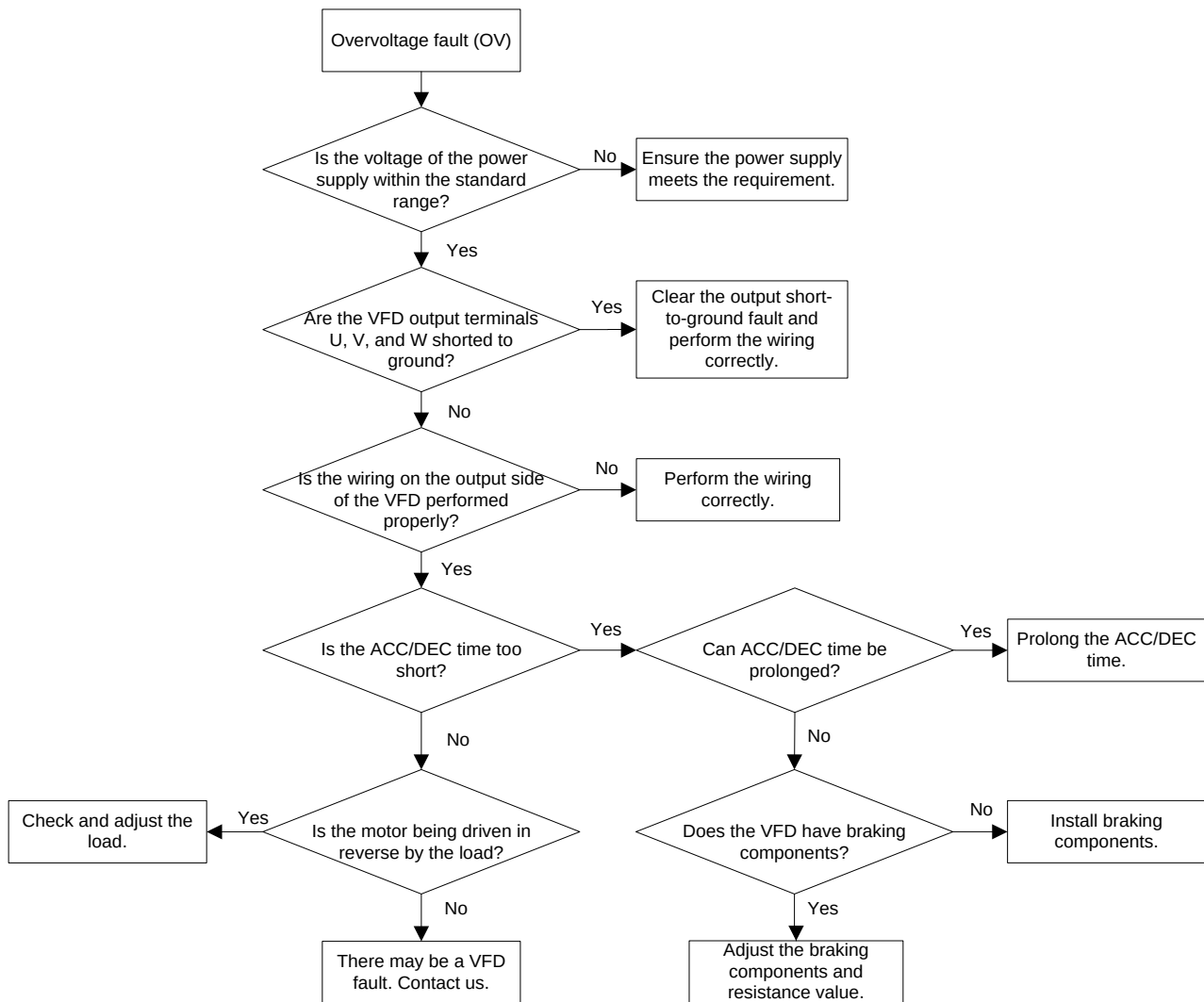
9.6.1 Motor fails to work



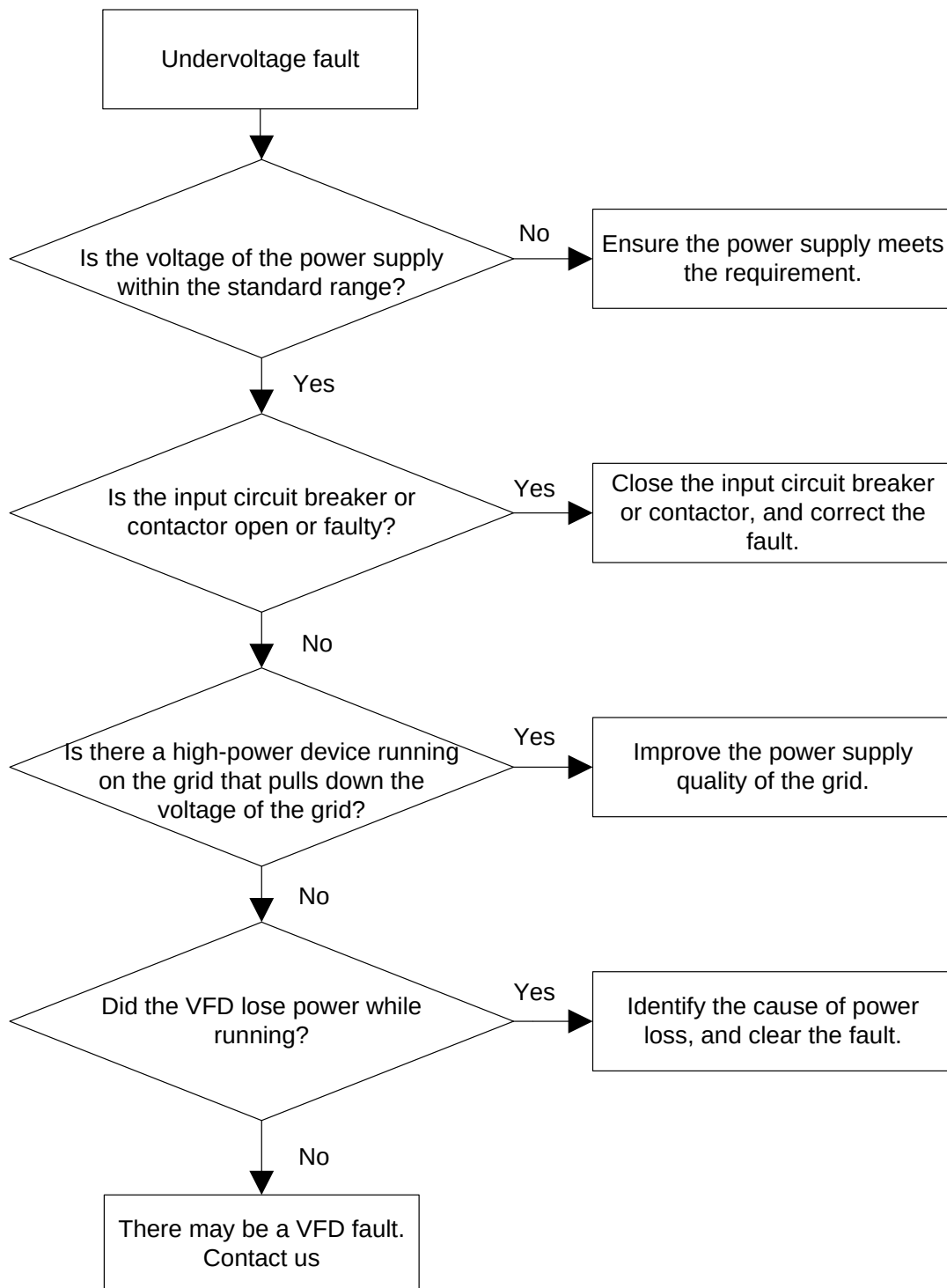
9.6.2 Motor vibrates



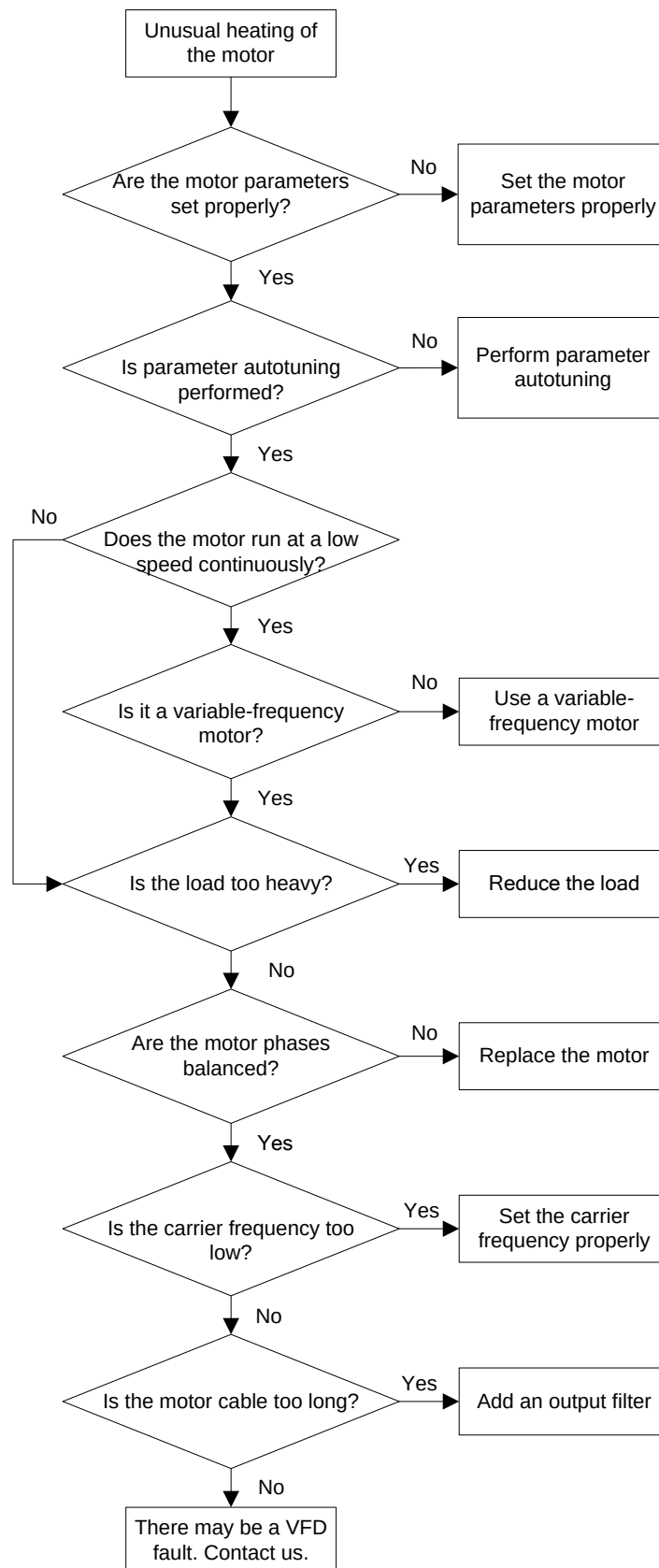
9.6.3 Overvoltage



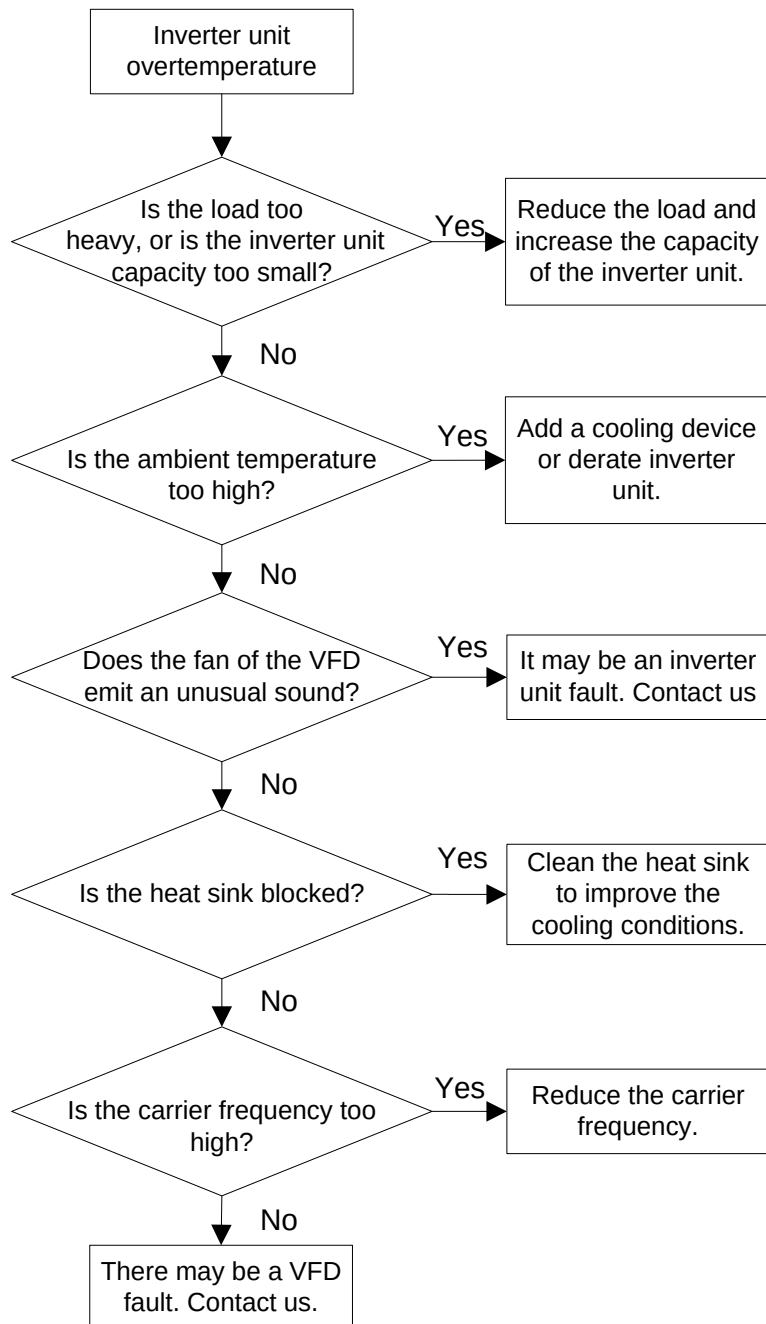
9.6.4 Undervoltage



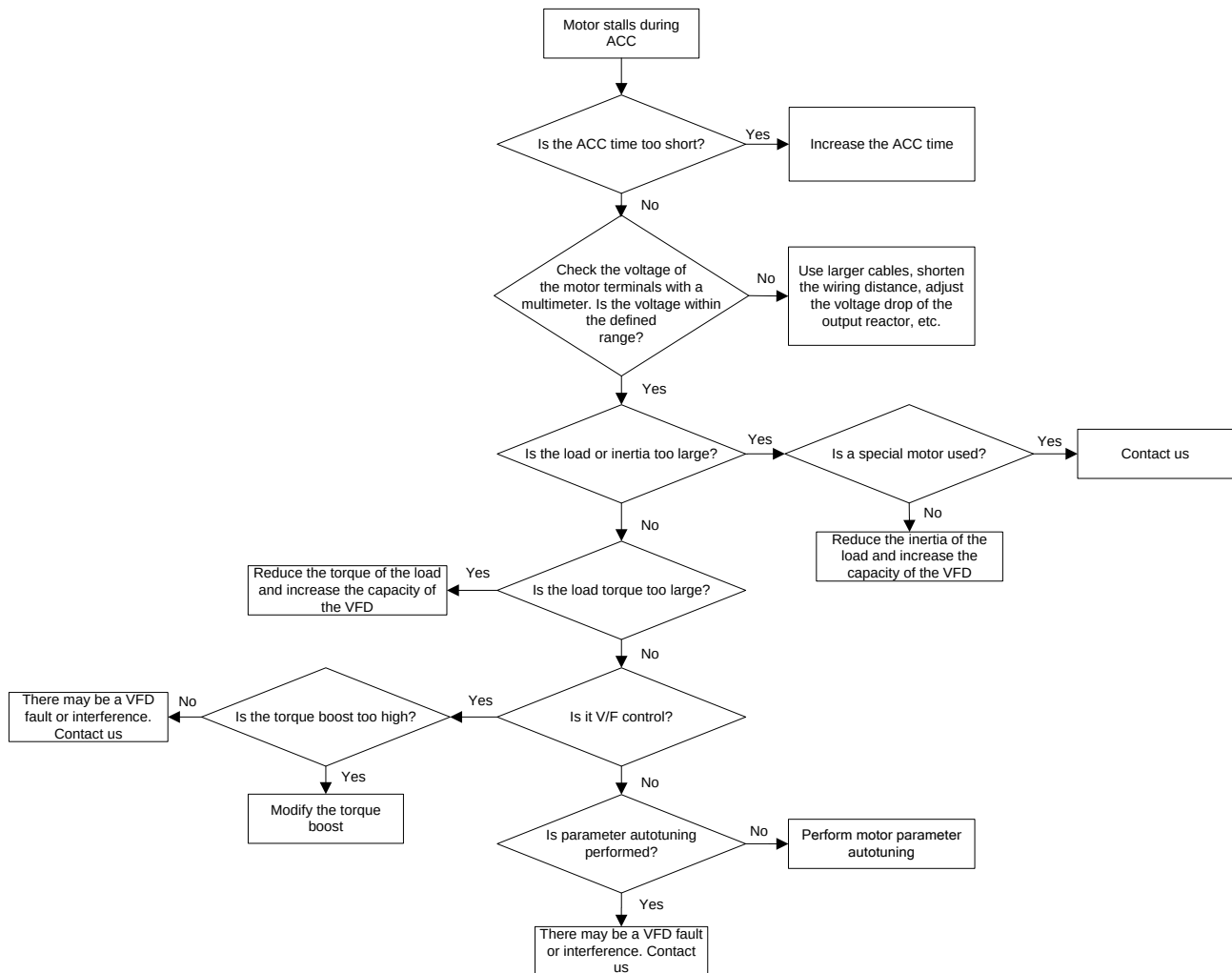
9.6.5 Motor overheating



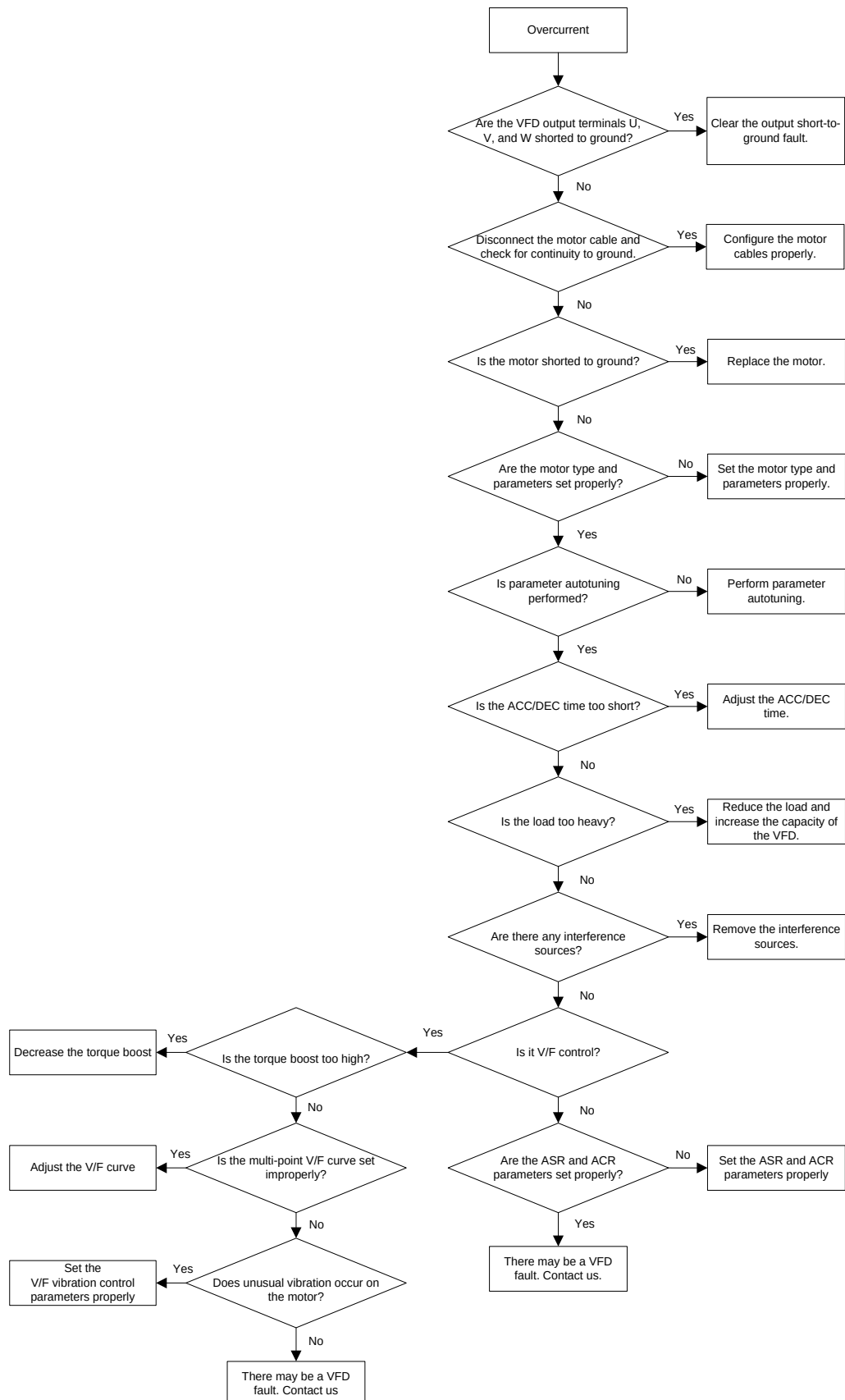
9.6.6 Inverter unit overtemperature



9.6.7 Motor stalls during ACC



9.6.8 Overcurrent



9.7 Countermeasures on common interference

9.7.1 Interference on meter switches and sensors

Interference symptoms:

Pressure, temperature, displacement, and other signals of a sensor are collected and displayed by a human-machine interaction device. The values are incorrectly displayed as follows after the power unit is started:

1. Incorrect display of upper limit or lower limit value, such as 999 or -999.
2. The display of values jumps (usually occurring on pressure transmitters).
3. The display of values is stable, but there is a large deviation. For example, the temperature is dozens of degrees higher than the common temperature (usually occurring on thermocouples).
4. A signal collected by a sensor is not displayed but functions as a drive system running feedback signal. For example, the inverter unit is expected to decelerate when the upper pressure limit of the compressor is reached, but in actual running, it starts to decelerate before the upper pressure limit is reached.
5. After the inverter unit is started, the display of all kinds of meters (such as frequency meter and current meter) that are connected to the inverter unit AO terminal is severely affected, displaying the values incorrectly.
6. Proximity switches are used in the system. After the inverter unit is started, the indicator of a proximity switch flickers, and the output level flips.

Solution:

1. Check and ensure that the feedback cable of the sensor is 20 cm or farther away from the motor cable.
2. Check and ensure that the ground wire of the motor is connected to the PE terminal of the power unit (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω).
3. Try to add a safety capacitor of 0.1 μ F to the signal end of the feedback signal terminal of the sensor.
4. Try to add a safety capacitor of 0.1 μ F to the power end of the sensor meter (pay attention to the voltage of the power supply and the voltage endurance of the capacitor).
5. For interference on meters connected to the VFD AO terminal, if AO uses current signals of 0 to 20mA, add a capacitor of 0.47 μ F between the AO and GND terminals; and if AO uses voltage signals of 0 to 10V, add a capacitor of 0.1 μ F between the AO and GND terminals.

Note:

- When a decoupling capacitor is required, add it to the terminal of the device connected to the sensor. For example, if a thermocouple is to transmit signals of 0 to 20mA to a temperature meter, the capacitor needs to be added on the terminal of the temperature meter; if an electronic ruler is to transmit signals of 0 to 30V to a PLC signal terminal, the capacitor needs to be added on the terminal of the PLC.
- If a large number of instruments or sensors at the application site are susceptible to interference, it is recommended to install the external C2 filter at the rectifier unit AC input. (For details, refer to appendix E.7.2 EMC filter model selection.)

9.7.2 RS485/CAN communication interference issues

The analysis of RS485/CAN communication interference issues mainly applies to cases where, after the GD600A multi-drive system starts running, communication that was previously normal begins to exhibit delays, loss of synchronization, intermittent normal operation, or complete disconnection.

If communication remains abnormal regardless of whether the GD600A multi-drive system is running, the issue may not necessarily be caused by interference. In this case, perform the following checks:

1. Check whether the RS485/CAN communication bus is open-circuited or has poor contact.

2. Check whether the two RS485/CAN communication bus wires are reversed.
3. Check whether the communication protocol between the GD600A multi-drive system and the host controller is consistent. Check whether the communication protocol (such as the baud rate, data bits, and check bit) of the VFD is consistent with that of the host controller.
4. If the communication issue is confirmed to be caused by interference, perform the following checks:
 - Do not route the communication cables in the same cable tray as the motor cables.
 - In multi-unit applications, daisy-chain connections for the communication cables between power units can improve interference immunity.
 - In multi-unit applications, ensure that the drive capability of the master is sufficient.
 - A 120 Ω termination resistor must be connected at both ends of the multi-unit communication link.

Solution

1. Check and ensure that the ground wire of the motor is connected to the PE terminal of the power unit (if the ground wire of the motor has been connected to the ground block, you need to use a multimeter to measure and ensure that the resistance between the ground block and PE terminal is lower than 1.5 Ω).
2. Do not connect the power unit and motor to the same ground terminal as the host controller (PLC, HMI, and touch screen). It is recommended that you connect the power unit and motor to the power ground, and connect the host controller separately to a ground stud.
3. Try to short the signal reference ground terminal (CGND) of the power unit with that of the host controller controller to ensure that ground potential of the communication chip on the control board of the power unit is consistent with that of the communication chip of the host controller.
4. Try to short CGDN of the power unit to its ground terminal (PE).

Try to add a safety capacitor of 0.1 μ F at the power supply end of the host controller (PLC, HMI, or touch screen). Alternatively, use a magnet ring (Fe-based nanocrystalline magnet rings are recommended). Pass the L/N cable or +/- cable of the host controller power supply through the magnet ring in the same direction and wind around the magnet ring for 8 turns.

9.7.3 Failure to stop and dimly lit indicators caused by motor-cable coupling

Interference phenomenon

1. Failure to stop

In a power unit system where an S terminal is used to control the start and stop, the motor cable and control cable are arranged in the same cable tray. After the system is started properly, the S terminal cannot be used to stop it.

2. Dim indicator illumination

After the power unit is started, the relay indicator, power distribution box indicator, PLC indicator may become dimly lit or flicker, or the buzzer may produce abnormal sounds unexpectedly.

Solution:

1. Check and confirm that the affected signal cables are routed at least 20cm away from the motor cables.
2. Add a safety capacitor of 0.1 μ F between the digital input terminal (S) and the COM.
3. Connect the digital input terminal (S) that controls the start and stop to other idle digital input terminals in parallel. For example, if S1 is used to control the start and stop and S4 is idle, you can try to short connect S1 to S4 in parallel.

Note: If the controller (such as PLC) in the system controls more than 5 power units at the same time through digital input terminals (S), this scheme is not applicable.

9.7.4 Leakage current and residual current device (RCD)

Inverters output high-frequency PWM voltage to drive motors. In this process, the distributed capacitance between the

internal IGBT of an inverter and the heat sink and that between the stator and rotor of a motor may inevitably cause the inverter to generate high-frequency leakage current to the ground. A residual current operated protective device (RCD) is used to detect the power-frequency leakage current when a grounding fault occurs on a circuit. The application of an inverter may cause misoperation of a RCD.

1. Rules for selecting RCDs

- (1) Inverter systems are special. In these systems, it is required that the rated residual current of common RCDs at all levels is larger than 200 mA, and the inverters are grounded reliably.
- For RCDs, the time limit of an action needs to be longer than that of a next action, and the time difference between two actions need to be longer than 20ms. For example, 1s, 0.5s, and 0.2s.
- (3) For circuits in multi-drive systems, electromagnetic RCDs are recommended. Electromagnetic RCDs have strong anti-interference capability, and thus can prevent the impact of high-frequency leakage current.

Electronic RCD	Electromagnetic RCD
Low cost, high sensitivity, small in volume, susceptible to voltage fluctuation of the grid and ambient temperature, and weak anti-interference capability	Requiring highly sensitive, accurate, and stable zero-phase sequence current transformer, using permalloy high-permeability materials, complex process, high cost, not susceptible to voltage fluctuation of the power supply and ambient temperature, strong anti-interference capability

2. Solution to RCD misoperation (handling the VFD)

- Try setting the modulation mode to "Three-phase modulation and two-phase modulation" (P08.40 ones place = 0).
- Try to decrease the carrier frequency to 1.5kHz (P00.14=1.5).
- Try removing the screws of the rectifier unit safety capacitor-to-ground jumpers. (Refer to section 4.4.4 Safety capacitor jumper.)

3. Solution to RCD misoperation (handling the system power distribution)

- Check and ensure that the power cable is not soaking in water.
- Check and ensure that the power cables are not damaged or spliced.
- Check and ensure that secondary grounding is not occurred to the neutral wire.
- Check and ensure that the main power cable terminal is in good contact with the air switch or contactor (all screws are tightened).
- Check 1PH powered devices, and ensure that no earth wires are used as neutral wires by these devices.
- VFD power cable and motor cable should not be shielded ones.

9.7.5 Live device housing

After the VFD is started, there is sensible voltage on the chassis, and you may feel an electric shock when touching the chassis. However, when the VFD is powered up without running, the shell will be uncharged (or the voltage it carries is far lower than human body safety voltage).

Solution

1. If there is power distribution ground or ground stud on the site, ground the cabinet chassis of the VFD through the power ground or stud.
2. If there is no grounding on the site, you need to connect the motor chassis to the ground terminal PE of the VFD, and ensure that the screw for grounding jumper of the rectifier unit safety capacitor has been removed.

9.7.6 Interference issues with the motor speed pulse reference and PG encoder

Solution:

Route the encoder feedback cable at least 20 cm away from the motor cable.

Connect the motor housing and the VFD housing with a ground wire of low impedance.

Short GND to PE at the terminal board interface.

At the motor end, connect the shield of the encoder feedback cable to the motor housing with low impedance. If the encoder cable passes through a junction box, ensure that the shield of the cable after transfer is connected to the original encoder cable shield with low grounding impedance.

At the VFD end, connect the shield of the encoder feedback cable to the PE terminal with low impedance, or to the GND terminal with low impedance.

If the system uses a multifunction incremental PG card (EC-PG705-xxx), try connecting the shield of the encoder feedback cable on the VFD side to the PGND terminal.

If shielded cables are used for speed pulse reference signals, any unused shield ends must be wrapped with insulating tape to prevent electrical contact with PE or other terminals. Verify the interference levels onsite with single-ended grounding, double-ended grounding, or floating (no grounding) configurations.

Install a ferrite ring or snap-on ferrite on the encoder signal cable near the VFD end. For the VFD output (U, V, W), apply a ferrite core and wind the cables through it for 2 to 4 turns.

10 Maintenance

10.1 What this chapter contains

This chapter describes how to carry out preventive maintenance on the VFD.

10.2 Periodical inspection

Little maintenance is required when the VFD is installed in an environment that meets requirements. The following table describes the routine maintenance periods recommended by INVT.

Check scope		Item	Method	Expected result
Ambient environment		Check the temperature, and humidity, and whether there is vibration, dust, gas, oil spray, and water droplets in the environment.	Visual inspection and instrument measurement	The requirements stated in this manual are met.
		Check whether there are foreign matters, such as tools, or dangerous substances placed nearby.	Visual inspection	There are no tools or dangerous substances placed nearby.
Voltage		Check the voltage of the main circuit and control circuit.	Use multimeters or other instruments for measurement.	The requirements stated in this manual are met.
Keypad		Check the display of information.	Visual inspection	The characters are displayed properly.
		Check whether characters are not completely displayed.	Visual inspection	The requirements stated in this manual are met.
Main circuit	Common	Check whether bolts are loose or fall off.	Screw them up.	No exception occurs.
		Check whether the machine is deformed, cracked, or damaged, or their color changes due to overheating and aging.	Visual inspection	No exception occurs.
		Check whether there are stains and dust attached.	Visual inspection	No exception occurs. Note: Discoloration of copper bars does not mean that they cannot work properly.
	Conductor and wire	Check whether conductors are deformed or color change for overheat.	Visual inspection	No exception occurs.
		Check whether the wire sheaths are cracked or their color changes.	Visual inspection	No exception occurs.
	Terminal block	Check whether there is damage.	Visual inspection	No exception occurs.
	Filter capacitor	Check whether there is electrolyte leakage, discoloration, cracks, and chassis expansion.	Visual inspection	No exception occurs.
		Check whether the safety valves are released.	Determine the service life based	No exception occurs.

Check scope		Item	Method	Expected result
			on the maintenance information, or measure them through electrostatic capacity.	
		Check whether the electrostatic capacity is measured as required.	Use instruments to measure the capacity.	Electrostatic capacity $\geq$ initial value $\times 0.85$
	Resistor	Check whether there is displacement caused due to overheat.	Olfactory and visual inspection	No exception occurs.
		Check whether the resistors are disconnected.	Visual inspection, or remove one end of the connection cable and use a multimeter for measurement.	Resistance range: $\pm 10\%$ (of the standard resistance)
	Transformer and reactor	Check whether there is unusual vibration sounds or smells.	Auditory, olfactory, and visual inspection	No exception occurs.
	Electromagnetic contactor and relay	Check whether there are vibration sounds in the workshop.	Auditory inspection	No exception occurs.
		Check whether the contacts are in good contact.	Visual inspection	No exception occurs.
Control circuit	Control PCB and connector	Check whether the screws and connectors are loose.	Screw them up.	No exception occurs.
		Check whether there is unusual smell or discoloration.	Olfactory and visual inspection	No exception occurs.
		Check whether there are cracks, damage, deformation, or rust.	Visual inspection	No exception occurs.
		Check whether there is electrolyte leakage or deformation.	Visual inspection, and determine the service life based on the maintenance information.	No exception occurs.
Cooling system	Cooling fan	Check whether there are unusual sounds or vibration.	Auditory and visual inspection, and turn the fan blades with your hand.	The rotation is smooth.
		Check whether the bolts loose.	Screw them up.	No exception occurs.
		Check whether there is discoloration caused due to overheat.	Visual inspection, and determine the service life based on the	No exception occurs.

Check scope		Item	Method	Expected result
			maintenance information.	
	Ventilation duct	Check whether there are foreign matters blocking or attached to the cooling fan, air inlets, or air outlets. Check whether there are foreign objects attached.	Visual inspection	No exception occurs.

For more details about maintenance, contact the local INVT office, or visit our website www.invt.com, and choose **Support > Services**.

10.3 Cooling fan

The service life of the cooling fan of the VFD is more than 25,000 hours. The actual service life of the cooling fan is related to the use of the VFD and the temperature in the ambient environment.

You can view the running duration of the VFD through Function code P07.14 (Accumulated running time).

The increase of the bearing noise indicates a fan fault. If the VFD is applied in a key position, replace the fan once the fan starts to generate unusual noise. You can purchase spares of fans from INVT.

Cooling fan replacement:



Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

Step 1 Stop the VFD, disconnect the AC power supply, and wait for a time no shorter than the waiting time designated on the VFD.

Step 2 Remove the fan cover.

Step 3 Pull out the fan and disconnect the fan cable connector.

Step 4 Replace the fan.

Step 5 Install the new fan inside the VFD, connect the pluggable terminal of the fan cable in the reverse order, put the fan into the corresponding position of the VFD, and fasten the fan coverplate. Ensure that the air direction of the fan is consistent with that of the VFD, as shown Figure 10-1.

Step 6 Connect to the power supply.

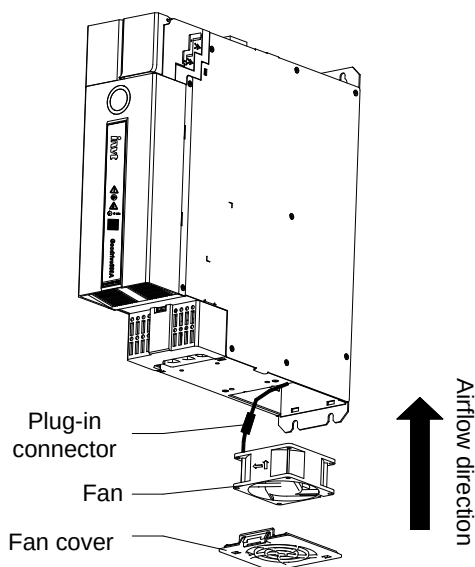
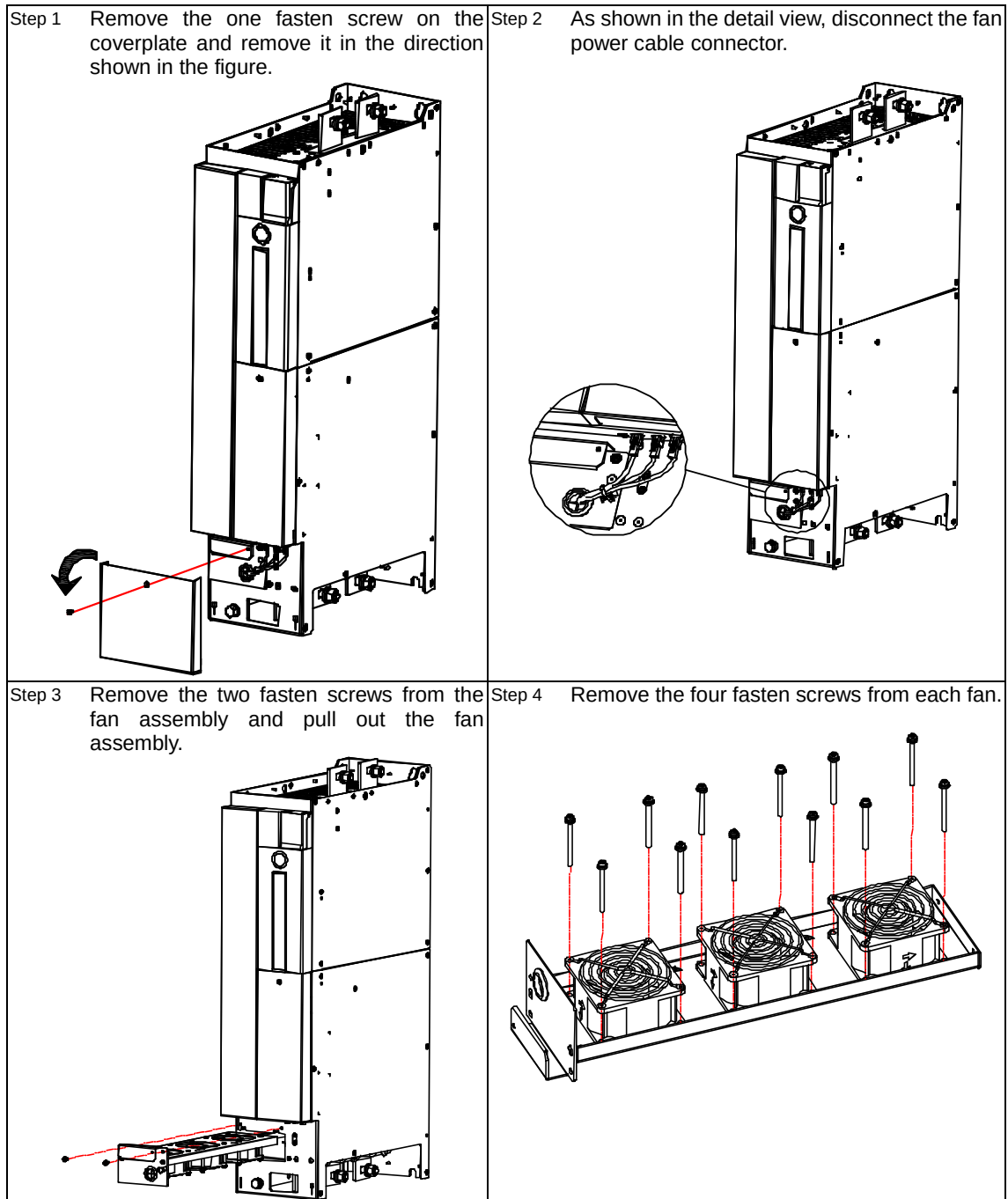


Figure 10-1 Fan maintenance diagram

355 kW rectifier unit fan removal procedure:



10.4 Capacitor reforming

If the VFD has been left unused for a long time, you need to follow the instructions to reform the DC bus capacitor before using it. The storage time is calculated from the date the product is delivered.

Storage time	Operation principle
Less than 1 year	No charging operation is required.
1 to 2 years	The VFD needs to be powered on for 1 hour before the first running command.
2 to 3 years	Use a voltage controlled power supply to charge the VFD: ● Charge the VFD at 25% of the rated voltage for 30 minutes, ● and then charge it at 50% of the rated voltage for 30 minutes, ● at 75% for another 30 minutes,

Storage time	Operation principle
	and finally charge it at 100% of the rated voltage for 30 minutes.
More than 3 years	Use a voltage controlled power supply to charge the VFD: - Charge the VFD at 25% of the rated voltage for 2 hours, - and then charge it at 50% of the rated voltage for 2 hours, - at 75% for another 2 hours, - and finally charge it at 100% of the rated voltage for 2 hours.

The method for using a voltage controlled power supply to charge the VFD is described as follows:

The selection of an adjustable power supply depends on the power supply of the VFD. For VFDs with incoming voltage of 1PH/3PH 220V AC, you can use a 1PH 220V AC/2A voltage regulator. Both 1PH and 3PH VFDs can be charged with a 1PH voltage controlled power supply (connect L+ to R, and N to S or T). All the DC bus capacitors share one rectifier, and therefore they are all charged.

For VFDs of a high voltage class, ensure that the voltage requirement (for example, 380 V) is met during charging. Capacitor charging requires little current, and therefore you can use a small-capacity power supply (2 A is sufficient).

The method for using a resistor (incandescent lamp) to charge the VFD is described as follows:

If you directly connect the drive device to a power supply to charge the DC bus capacitor, it needs to be charged for a minimum of 60 minutes. The charging operation must be performed at a normal indoor temperature without load, and you must connect a resistor in series mode in the 3PH circuit of the power supply.

For a 380 V drive device, use a resistor of 1 k Ω /100W. If the voltage of the power supply is no higher than 380 V, you can also use an incandescent lamp of 100W. If an incandescent lamp is used, it may go off or the light may become very weak.

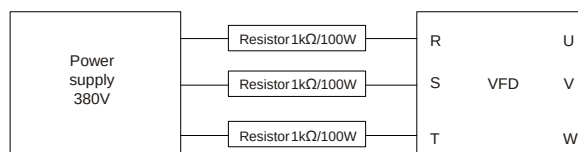


Figure 10-2 380V drive device charging circuit example

10.5 Electrolytic capacitor replacement



Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

The electrolytic capacitor of a VFD must be replaced if it has been used for more than 35,000 hours. For details about the replacement, contact the local INVT office.

10.6 Power cable



Read chapter 1 Safety precautions carefully and follow the instructions to perform operations. Ignoring these safety precautions may lead to physical injury or death, or device damage.

1. Stop the VFD, disconnect the power supply, and wait for a time no shorter than the waiting time designated on the VFD.
2. Check the connection of the power cables. Ensure that they are firmly connected.
3. Connect to the power supply.

Appendix A Expansion card

A.1 Model definition

EC - PG 7 01 - 05 B

① ② ③ ④ ⑤ ⑥

Symbol	Description	Description
①	Product category	EC: Expansion card
②	Board card category	PG: PG card
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Code	01: Incremental PG card + frequency-divided output
		02: Sine/Cosine PG card + pulse direction setting + frequency-divided output
		03: UVW PG interface + pulse direction setting + frequency-divided output
		04: Resolver PG interface + pulse direction setting + frequency-divided output
		05: Incremental PG card + pulse direction setting + frequency-divided output
		06: Absolute PG interface + pulse direction setting + frequency-divided output
		07: 24V simplified incremental PG card
		08: SSI absolute PG card
⑤	Working power supply	00: No power (passive)
		05: 5V
		12: 12–15V
		24: 24V
⑥	Version description	Used to distinguish versions. The letter indicates a product upgrade.
		A: Version A (Empty by default)
		B: Version B
		C: Version C

EC - PC 7 01 - 02

① ② ③ ④ ⑤

Symbol	Description	Description
①	Product category	EC: Expansion card
②	Board card category	PC: PLC card
③	Technology	Indicates the generation of a technical version by using odd numbers,

Symbol	Description	Description
	version	for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Code	02: Reserved
⑤	Special requirement	Reserved

EC - TX 7 01

① ② ③ ④

Symbol	Description	Description
①	Product category	EC: Expansion card
②	Board card category	TX: communication expansion card
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Code	01: Reserved
		02: Reserved
		03: PROFIBUS-DP
		04: Ethernet communication card
		05: CANopen communication card
		06: DeviceNet communication card
		07: BACnet communication card
		08: EtherCAT communication card
		09: PROFINET communication card
		10: RS485 communication card

EC - IO 7 01 - 00

① ② ③ ④ ⑤

Symbol	Description	Description
①	Product category	EC: Expansion card
②	Board card category	IO: IO expansion card
③	Technology version	Indicates the generation of a technical version by using odd numbers, for example, 1, 3, 5, and 7 indicate the 1st, 2nd, 3rd and 4th generations of the technical version.
④	Code	01: Multiple-function I/O card
		02: Digital I/O card
		03: Analog I/O card
		04: Reserved
		05: Reserved
⑤	Special requirement	-

The following table lists expansion cards that the VFD supports. The expansion cards are optional and need to be purchased separately.

Name	Model	Specification	Part No.
Resolver PG card	EC-PG704-00	- Applicable to resolver encoders - Supporting frequency-divided output of resolver-simulated A, B, Z - Supporting input of pulse train reference	Expansion card part No. See section Appendix H Ordering information
Multi-function incremental PG card	EC-PG705-12B	- Applicable to OC encoders of 5V or 12V - Applicable to push-pull encoders of 5V or 12V - Applicable to differential encoders of 5V - Supporting the orthogonal input of A, B, and Z - Supporting the frequency-divided output of A, B, and Z - Supporting input of pulse train reference	
24V simplified incremental PG card	EC-PG707-24	- Applicable to 24V push-pull encoders - Applicable to 24V OC encoders - Applicable to 24V differential encoders - Supporting the orthogonal input of A, B, and Z - Supporting PT100/PT1000/KTY84-130 temperature detection	
Multifunction incremental PG card	EC-PG705-24	- Applicable to 24V push-pull, open-collector, and differential encoders - Supporting the orthogonal input of A, B, and Z - Supporting the frequency-divided output of A, B, and Z - Supporting input of pulse train reference	
SSI absolute PG card	EC-PG708-24	- SSI signal, differential input of 5V - Applicable to encoders of 24V or 5V - The pulse reference supports 24V push-pull, open-collector, and differential inputs.	
PLC card	EC-PC701-02	- Adopting the global mainstream development environment PLC, supporting multiple types of programming languages, such as the instruction language, ladder diagram, and sequential function chart - Supporting resumable commissioning and task period execution mode selection - Providing user program storage space of 128KB, and data storage space of 64KB - Four digital inputs 2 relay outputs (N.C. and N.O.)	
PROFIBUS-DP communication card	EC-TX703	Supporting the PROFIBUS-DP protocol	
Ethernet communication card	EC-TX704	- Supports Ethernet communication and uses INVT internal protocol. - Can be used with INVT Workshop, the host monitoring software	
EtherCAT communication card	EC-TX708	Supporting the EtherCAT protocol	

Name	Model	Specification	Part No.
PROFINET communication card	EC-TX709	Supporting the PROFINET protocol	
IO expansion card	EC-IO702	2 digital inputs 1 analog input 1 analog output 1 double-contact relay output - Supporting PT100/PT1000/KTY84-130/NTC temperature detection	

A.2 Dimensions and installation

All expansion cards are of the same dimensions (119× 70mm) and can be installed in the same way.

Comply with the following rules when installing or removing an expansion card:

1. Ensure that no power is applied before installing the expansion card.
2. The expansion card can be installed in any one of the SLOT1 and SLOT2 card slots.
3. If interference occurs on the external wires after expansion cards are installed, change their installation card slots flexibly to facilitate the wiring. For example, the connector of the connection cable of the DP card is large, so it is recommended to be installed in the SLOT2 card slot.

The following figure shows the installation diagram and the VFD with expansion cards installed.

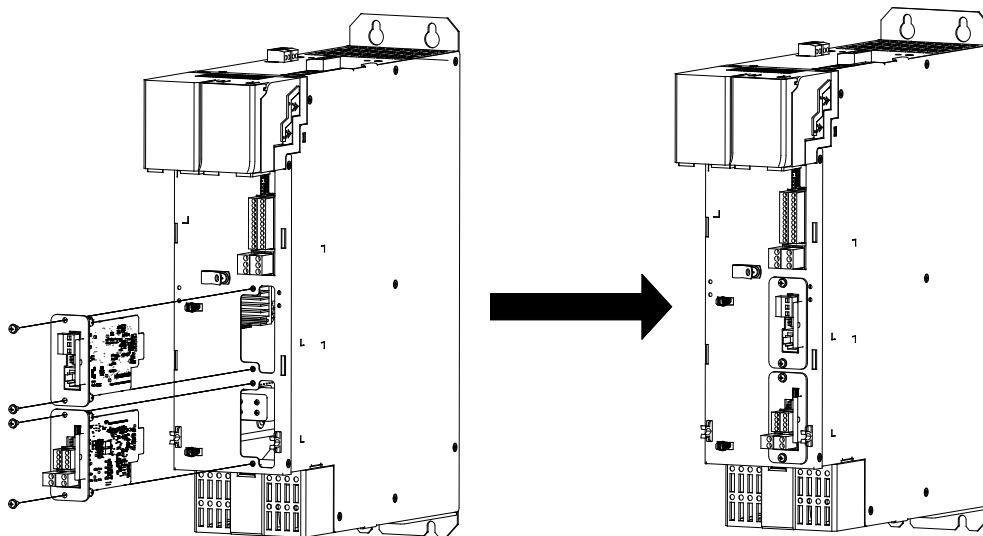
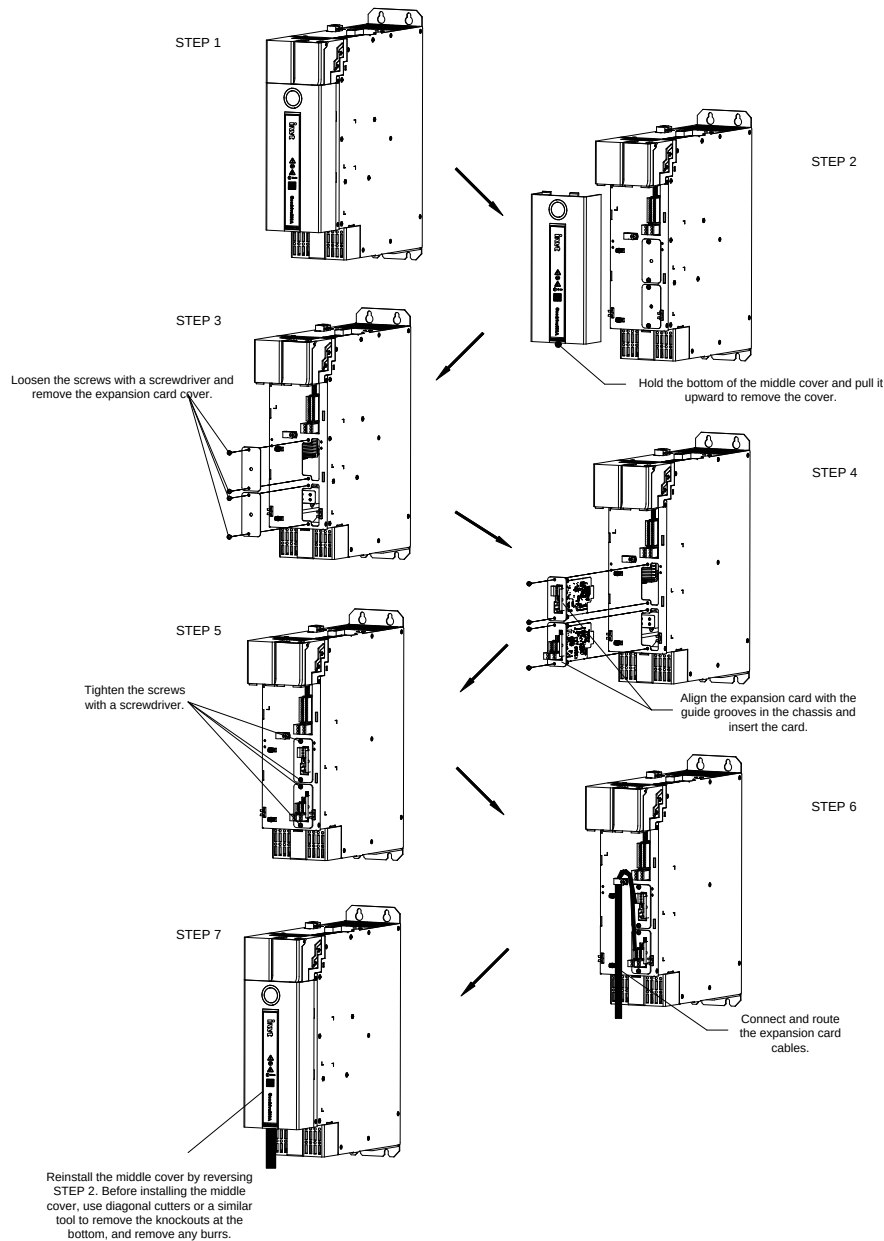


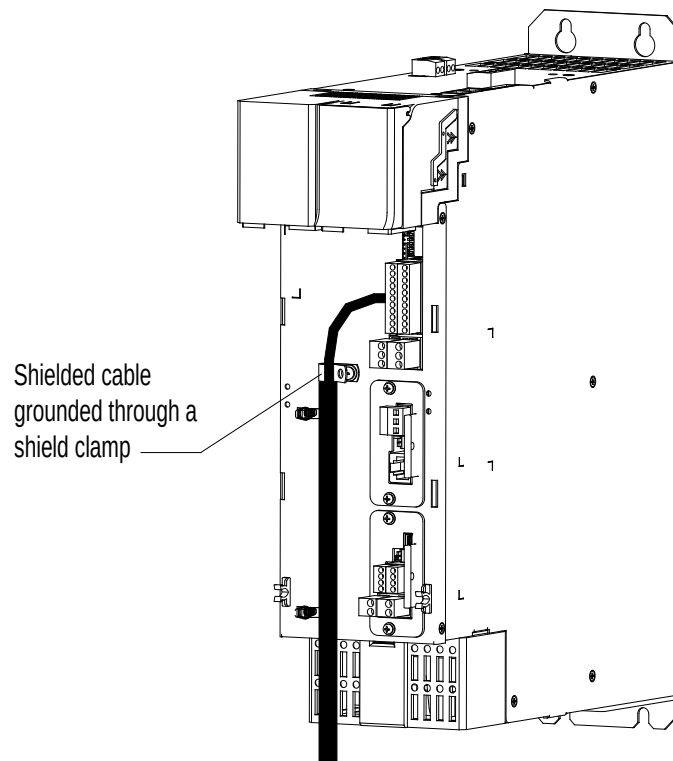
Figure A-1 Expansion card installation result

Expansion card installation procedure:

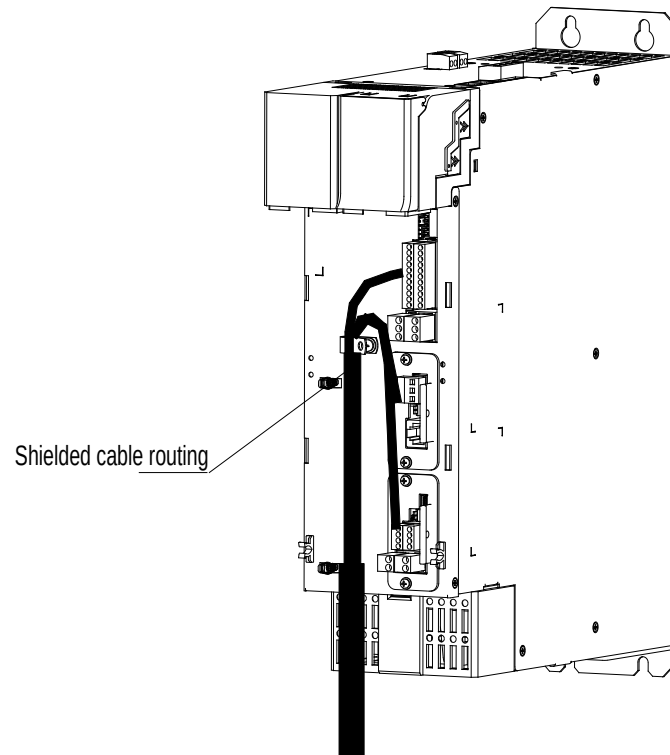


A.3 Wiring

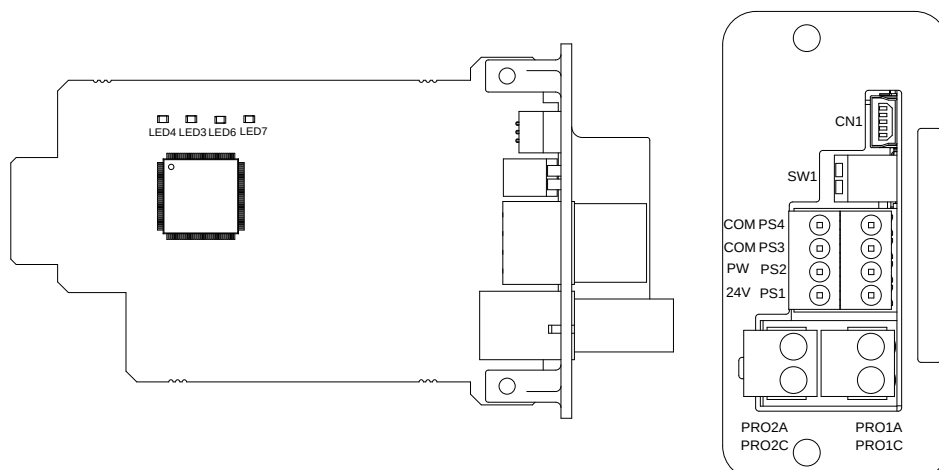
1. Ground a shielded cable as follows:



2. Wire an expansion card as follows:



A.4 PLC card EC-PC701-02



EC-PC701-02 has 4 digital inputs and 2 relay outputs, using spring cage terminals. SW1 is the start/stop switch of the PLC card, CN1 is the program download interface, using a standard USB cable to connect to a computer.

COM	PS4
COM	PS3
PW	PS2
24V	PS1
PRO2A	PRO1A
PRO2C	PRO1C

EC-PC701-02 terminal function description:

Category	Terminal symbol	Name	Description
Power supply	PW	External power supply	Used to provide input digital working power from the external to the internal Voltage range: 12–24V PW and 24V have been short connected before delivery.
	24V	Internal power supply	User power provided by the card. Max. output current: 100mA
Digital input and output	PS1—COM	Digital input 1	Internal impedance: 4kΩ 12–30V voltage input is acceptable. Bi-direction input terminals Max. input frequency: 1kHz
	PS2—COM	Digital input 2	
	PS3—COM	Digital input 3	
	PS4—COM	Digital input 4	
Relay output	PRO1A	NO contact of relay 1	Contact capacity: 2A/AC250V, 1A/DC30V Cannot be used as high frequency digital output
	PRO1C	Common contact of relay 1	
	PRO2A	NO contact of relay 2	
	PRO2C	Common contact of relay 2	

Indicator definition:

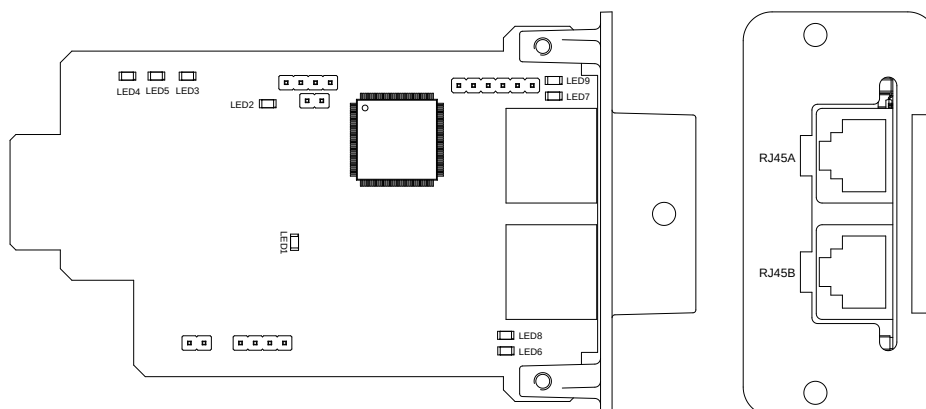
Indicator	Definition	Function
LED3	RUN status indicator (green)	On: The PLC program is running. Off: The PLC program is stopped.

Indicator	Definition	Function
LED4	PWR power indicator (green)	On: The expansion card is powered on.
LED6	ERR fault indicator (red)	Flashing (period: 1s; on for 0.5s and off for 0.5s): An error has occurred. The error type can be queried through the host software Auto Station. Off: No fault
LED7	COMM communication indicator (green)	On: The expansion card is establishing a connection with the control board. Flashing periodically (Cycle: 1s; On: 0.5s; Off: 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

The EC-PC701-02 can replace some micro PLC applications. It uses a mainstream international development environment and supports three programming languages: IL (Instruction List), LD (Ladder Diagram), and SFC (Sequential Function Chart). It provides 16K steps of user program storage, 8K words of data storage, and 1K word of power-down retained data, making secondary development convenient and meeting customized requirements. For instructions on using the programmable expansion card, see the *Goodrive600A Series VFD Programmable Expansion Card Manual*.

A.5 Communication cards

A.5.1 PROFINET communication card EC-TX709



Terminal CN2 is equipped with dual standard RJ45 ports. The two ports are identical and interchangeable. They are arranged as follows:

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	n/c	Not connected
5	n/c	Not connected
6	RX-	Receive Data-
7	n/c	Not connected
8	n/c	Not connected

Indicator definition: The PROFINET communication card has 9 indicators, among which LED1 is the power indicator, LED2–5 are the communication status indicators of the communication card, and LED6–9 are the status indicators of the network port.

LED	Color	Function
LED1	Green	3.3V power indicator
LED2 (Bus status indicator)	Red	On: No network connection Flashes: The connection to the PROFINET controller through a network cable is OK, but the communication is not established. Off: Communication with the PROFINET controller has been established.
LED3 (System fault indicator)	Green	On: PROFINET diagnosis exists. Off: No PROFINET diagnosis.
LED4 (Slave ready indicator)	Green	On: TPS-1 protocol stack has started. Flashes: TPS-1 waits for MCU initialization. Off: TPS-1 protocol stack does not start.
LED5 (Maintenance status indicator)	Green	Manufacturer-specific, depending on the characteristics of the device
LED6/7 (Network port status indicator)	Green	On: The PROFINET communication card and PC/PLC have been connected through a network cable. Off: The connection between the PROFINET communication card and PC/PLC has not been established.
LED8/9 (Network port communication indicator)	Green	On: The PROFINET communication card and PC/PLC are communicating. Off: The PROFINET communication card and PC/PLC have no communication yet.

Electrical connection: The PROFINET communication card uses standard RJ45 interfaces and supports line and star network topologies. The electrical connection for a line network topology is shown in the following figure.

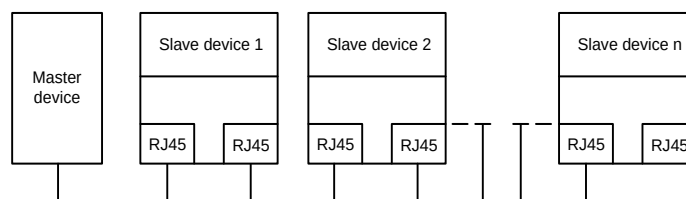


Figure A-2 Linear network topology electrical connection diagram

Note: For star topology, a PROFINET switch is required.

The electrical connection for a star network topology is shown in the following figure.

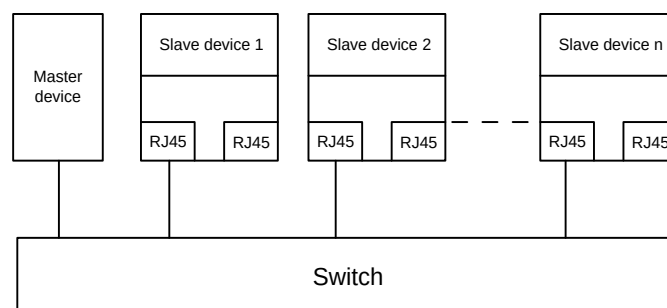
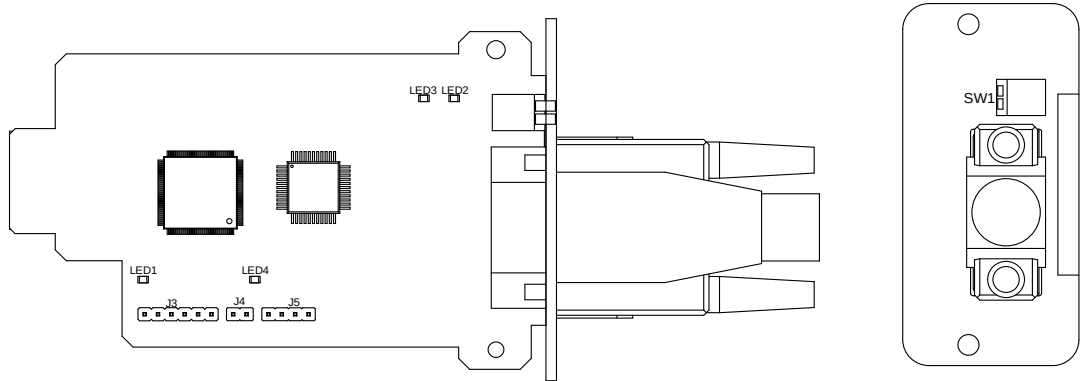
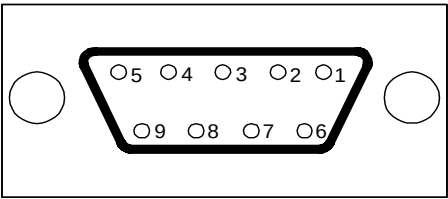


Figure A-3 Star network topology electrical connection diagram

A.5.2 PROFIBUS-DP communication card EC-TX703



SW1 is the DIP switch for the termination resistor. The card uses a 9-pin D-sub connector, of which pins are arranged as follows.



Connector pin		Description
1	-	Unused
2	-	Unused
3	B-Line	Data+ (twisted pair 1)
4	RTS	Request sending
5	GND_BUS	Isolation ground
6	+5V_BUS	Isolated power supply of 5 V DC
7	-	Unused
8	A-Line	Data- (twisted pair 2)
9	-	Unused
Housing	SHLD	PROFIBUS-DP cable shield

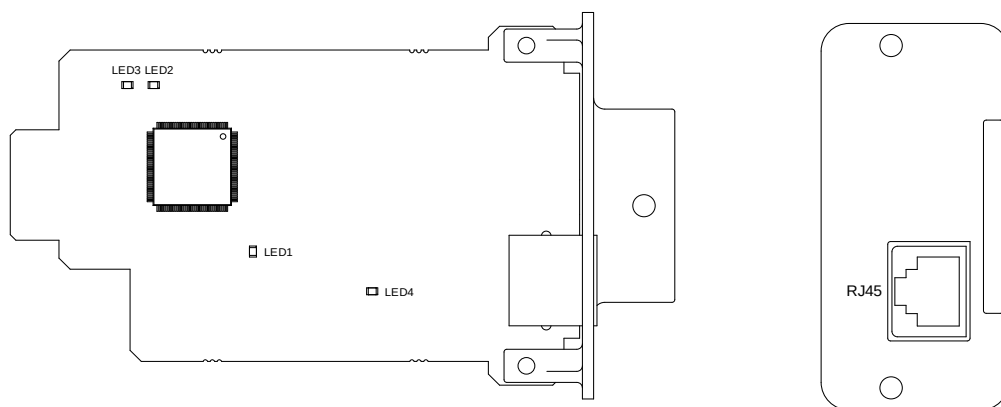
+5V_BUS and GND_BUS are bus terminators. Some devices, such as the optical transceiver (RS485), may need to obtain power through these pins. On some devices, the transmission and receiving directions are determined by RTS. In normal applications, only A-Line B-Line, and the shield layer need to be used.

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Flashing periodically (Cycle: 1s; On: 0.5s; Off: 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Online indicator	On: The communication card is online and data exchange can be performed. Off: The communication card is not in the online state.
LED3	Offline/Fault indicator	On: The communication card is offline and data exchange cannot be performed. Flashing: The communication card is not in the offline state. Flashing at the frequency of 1Hz: A configuration error occurs. The

Indicator	Definition	Function
		length of the user parameter data set during the initialization of the expansion card is different from that during the network configuration. Flashing at the frequency of 2Hz: User parameter data is incorrect. The length or content of the user parameter data set during the initialization of the expansion card is different from that during the network configuration. Flashing at 4Hz: An error has occurred in the ASIC initialization of PROFIBUS-DP communication. Off: The diagnosis function is disabled.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.

A.5.3 Ethernet communication card EC-TX704

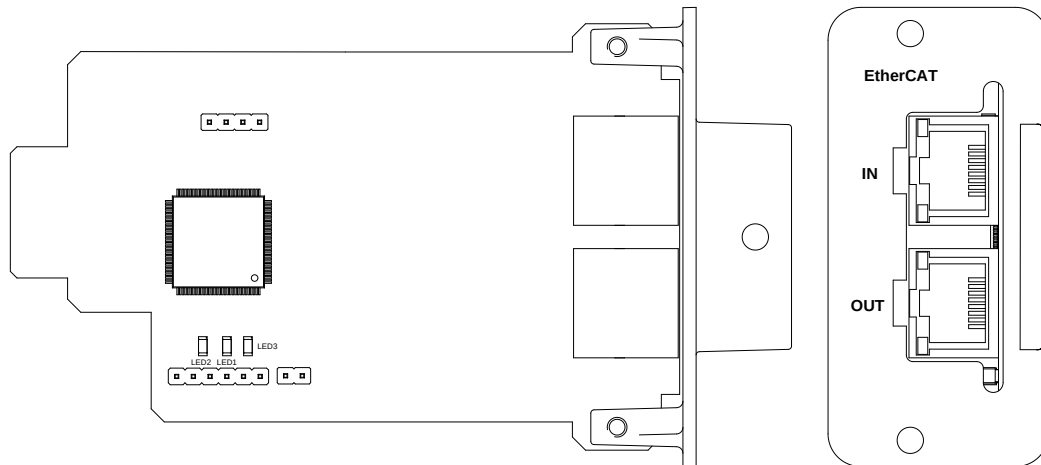


The EC-TX704 communication card adopts standard RJ45 terminals.

Indicator definition:

Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Flashing periodically (Cycle: 1s; On: 0.5s; Off: 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	LINK indicator (Green)	On: Connected properly to the host controller. Off: Disconnected from the host controller.
LED3	ACK indicator (Red)	On: Data is returned to the host controller. Off: No data is returned.
LED4	Power indicator	This indicator is on after the control board feeds power to the communication card.

A.5.4 EtherCAT communication card EC-TX708

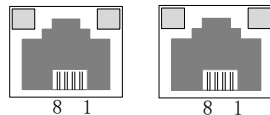


Features:

1. Supported functions
 - Automatic network address setting
2. Supported services
 - **PDO** service
 - Manufacturer-defined object dictionary
 - PKW reading data from and writing data to VFD function codes

Components

The EtherCAT communication card is an optional expansion card. The port layout of the communication card is shown below. The IN and OUT ports are EtherCAT network ports, where IN is the input port and OUT is the output port. The interfaces appears as follows:



The following table describes the interface pins.

Pin	Name	Description
1	TX+	Transmit Data+
2	TX-	Transmit Data-
3	RX+	Receive Data+
4	NC	Not connected
5	NC	Not connected
6	RX-	Receive Data-
7	NC	Not connected
8	NC	Not connected

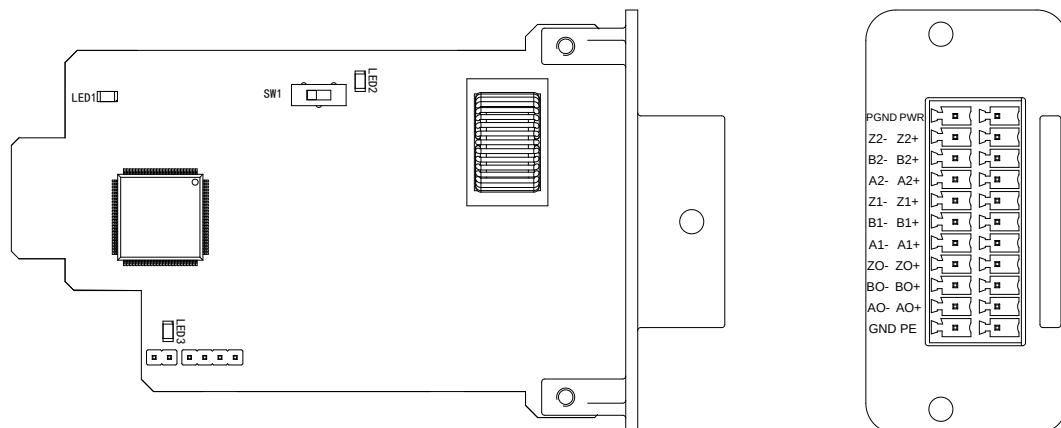
The EtherCAT communication card has six indicators: LED1 and LED4 are located on the PCB, and four indicators are integrated into the two network ports. Description of LEDs:

Indicator	Function
LED1	Flashing or on: Communication connection error. Off: Communication connection is normal.
LED4	On: The power supply is normal. Off: Power is disconnected.

Indicator	Function
IN network port (CN3) yellow LED	On: EtherCAT state machine = Op Flashing (on for 0.2s and off for 0.2s): EtherCAT state machine = Pre-Op Flashing (on for 0.2s and off for 1s): EtherCAT state machine = Safe-Op Off: EtherCAT state machine = Init
IN network port (CN3) green LED	Flashing: Data communication in progress On or Off: No data communication
OUT network port (CN5) yellow LED	(This indicator is available only if the unit is connected with the IN port of the next slave.) On: EtherCAT state machine = Op Flashing (on for 0.2s and off for 0.2s): EtherCAT state machine = Pre-Op Flashing (on for 0.2s and off for 1s): EtherCAT state machine = Safe-Op Off: EtherCAT state machine = Init
OUT network port (CN5) green LED	Flashing: Data communication in progress On or Off: No data communication

A.6 PG expansion cards

A.6.1 Multi-function incremental PG card EC-PG705-12B



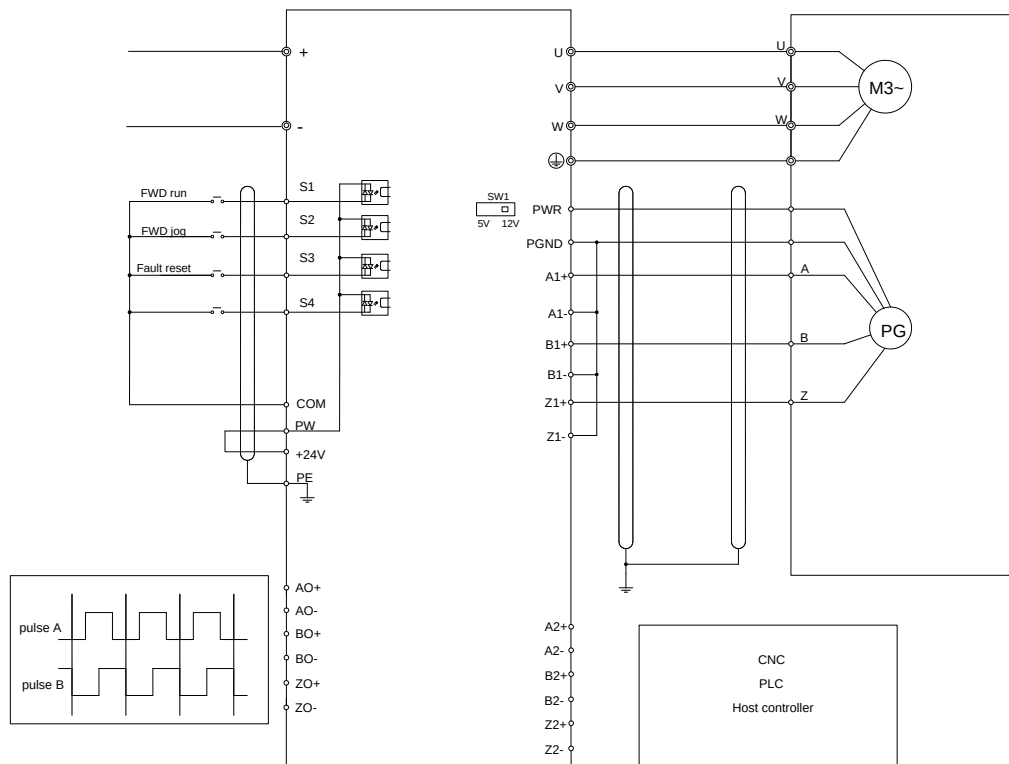
The DIP switch SW1 is used to set the voltage class (5 V or 12 V) of the power supply of the encoder. Select a power class before inserting the card into the slot.

Indicator	Definition	Function
LED1	Signal indicator	On: Other cases Flashing (period: 1s; on for 0.5s and off for 0.5s): A1 or B1 signal is disconnected when the encoder rotates.
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status indicator	On: The expansion card is connecting with the control board. Flashing (period: 1s; on for 0.5s and off for 0.5s): The expansion card is connected properly to the control board. Off: The expansion card is disconnected from the control board.

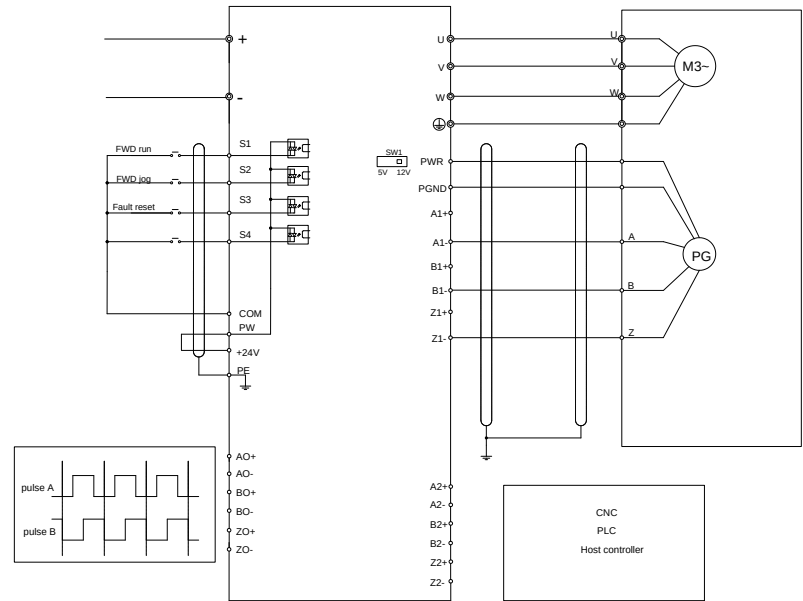
EC-PG705-12B terminal function description:

Signal	Port description	Function description
PWR	Encoder power supply	Voltage: 5V/12V $\pm$ 5%
PGND		Max. output: 150mA Select the voltage class through SW1 based on the voltage class of the used encoder.
A1+	Encoder interface	Applicable to 5V/12V push-pull encoders Applicable to 5V/12V open collector (OC) encoders Applicable to 5V differential encoders Response frequency: 200kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	Supporting the same signal types as the encoder signal types Response frequency: 200kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	Differential output of 5V Supports frequency division of 1–255, which can be set through P20.16 or P24.16
AO-		
BO+		
BO-		
ZO+		
ZO-		

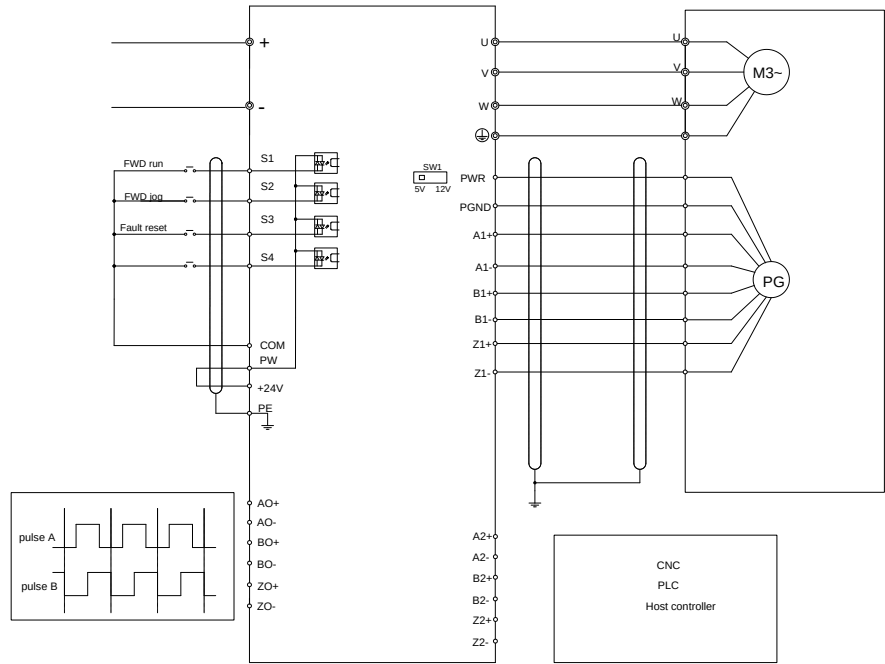
The following figure shows the external wiring when the expansion card is used in combination with an open collector encoder. A pull-up resistor is configured inside the PG card.



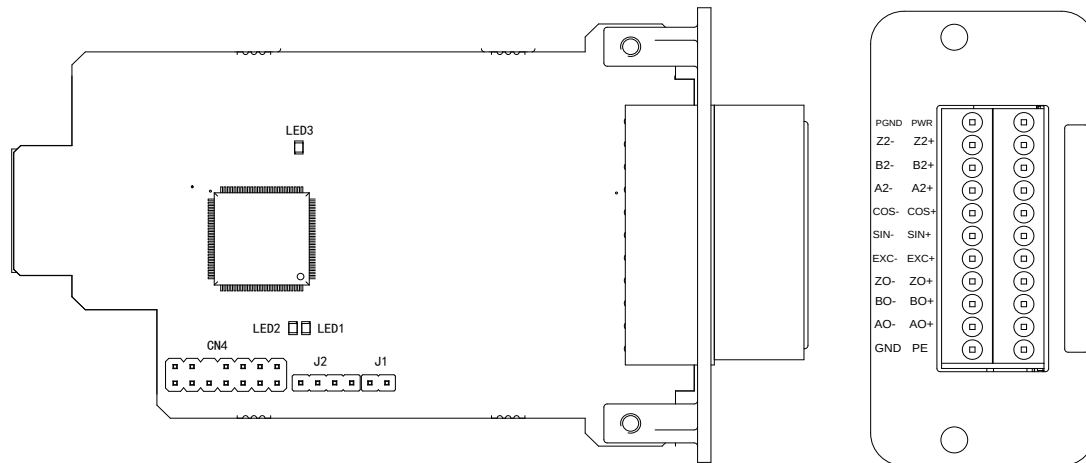
External wiring when the PG card works with a push-pull encoder.



External wiring when the PG card works with a differential encoder.



A.6.2 Resolver PG card EC-PG704-00



Indicator definition:

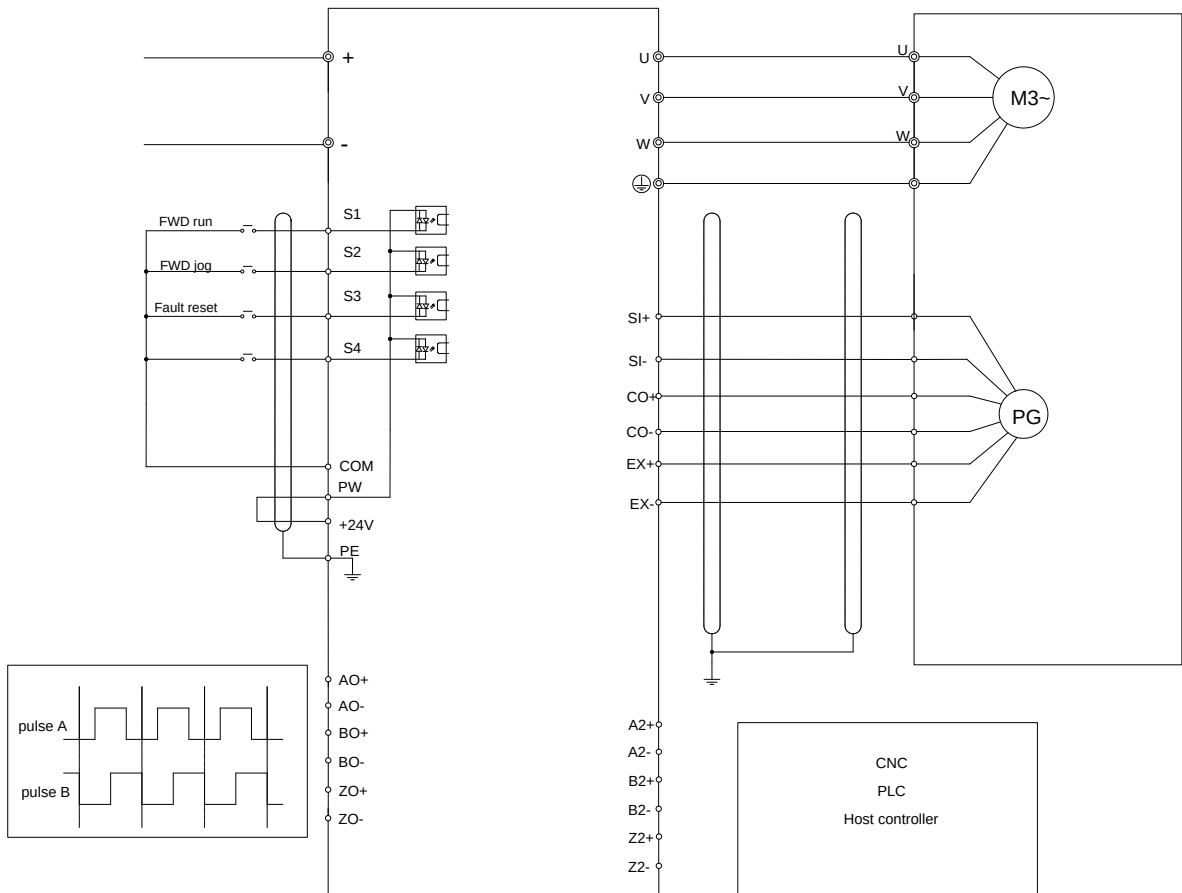
Indicator	Definition	Function
LED1	Status indicator	On: The expansion card is establishing a connection with the control board. Flashing periodically (Cycle: 1s; On: 0.5s; Off: 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.
LED2	Disconnection indicator	On: Encoder signals are normal. Flashing: Encoder signals are not stable. Off: The encoder is disconnected.
LED3	Power indicator	This indicator is on after the control board feeds power to the PG card.

EC-PG704-00 can be used in combination with a resolver of excitation voltage 7 Vrms. It is user-friendly, adopting spring cage terminals.

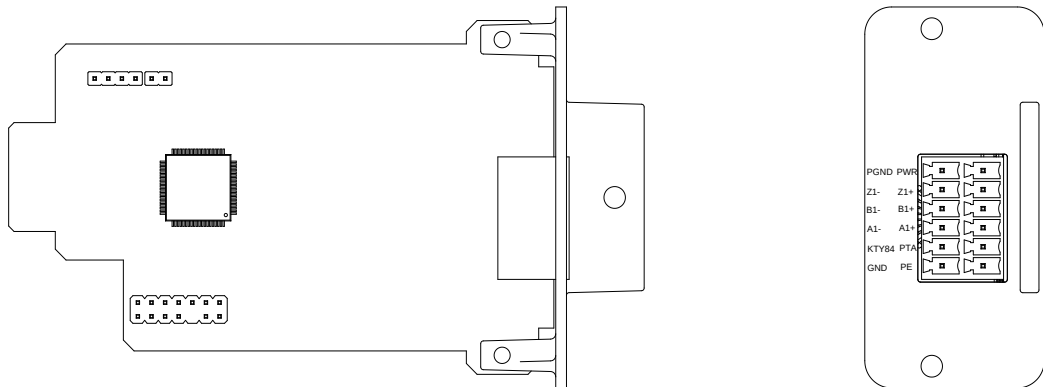
EC-PG704-00 terminal functions:

Signal	Port description	Function description
SI+	Encoder signal input	Recommended resolver transformation ratio: 0.5
SI-		
CO+		
CO-		
EX+	Encoder excitation signal	Factory setting of excitation: 10kHz Supports resolvers with an excitation voltage of 7Vrms
EX-		
A2+	Pulse reference	Differential input of 5V Response frequency: 200kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	Differential output of 5V Supports divided-frequency outputs for simulated resolver signals A1, B1, and Z1, equivalent to a 1024-line incremental PG card. Power-of-two frequency division is supported and can be configured via inverter function code P20.16 or P24.16. The maximum output frequency is 200kHz.
AO-		
BO+		
BO-		
ZO+		
ZO-		

The following figure shows the external wiring when EC-PG704-00 is used.



A.6.3 24V simplified incremental PG card EC-PG707-24



Indicator definition:

Indicator	Definition	Function
LED1	Disconnection indicator	On: Encoder pulses are normal. Off: A1 or B1 of the encoder is disconnected.
LED2	Power indicator	This indicator is on after the control board feeds power to the expansion card.
LED3	Status indicator	On: The expansion card is establishing a connection with the control board. Flashing periodically (Cycle: 1s; On: 0.5s; Off: 0.5s): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

EC-PG707-24 terminal function description:

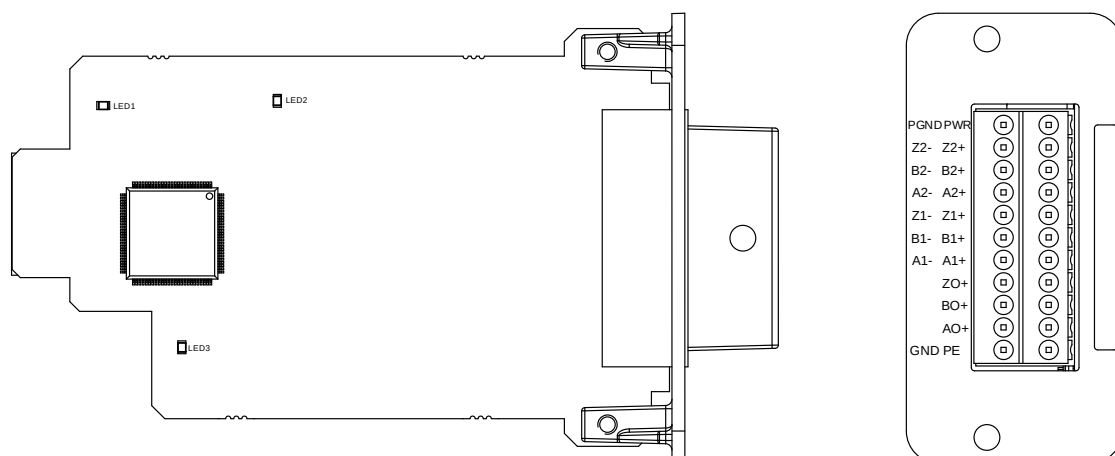
Signal	Port description	Function description
PWR	Encoder power supply	Voltage: 24V $\pm$ 5%
PGND		Max. output current: 150mA
A1+	Encoder interface	Applicable to 24V push-pull encoders Applicable to 24V OC encoders Applicable to 24V differential encoders Response frequency: 200kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
KTY84	KTY84 temperature sensor interface	Supports the KTY84-130 temperature sensor; measurable temperature range: -20°C–175°C; error: $\pm$ 5°C
PTA	PT100/PT1000 temperature sensor interface	Supports the PT100/PT1000 temperature sensor; measurable temperature range: -20°C–175°C; error: $\pm$ 5°C
GND	GND terminal	Temperature sensor reference ground
PE	Grounding terminal	Shield ground

Note:

- The 24V simplified incremental PG card simultaneously supports connecting to one type of temperature sensor, which can be selected through P28.12.
- It is recommended that the max. cable length of the PT100 temperature sensor be 3 meters.
- When the temperature detection sensor and the electricity line are routed in parallel, you are recommended to use shield layers to prevent interference.
- For details about the wiring with the encoder interfaces (push-pull, open collector, and differential), see the description for EC-PG705-12.

A.6.4 Multi-function incremental PG card EC-PG705-24

The external terminal layout is as follows. The encoder power supply voltage is 24V. Verify the power supply voltage class before connecting the encoder.



Indicator definition:

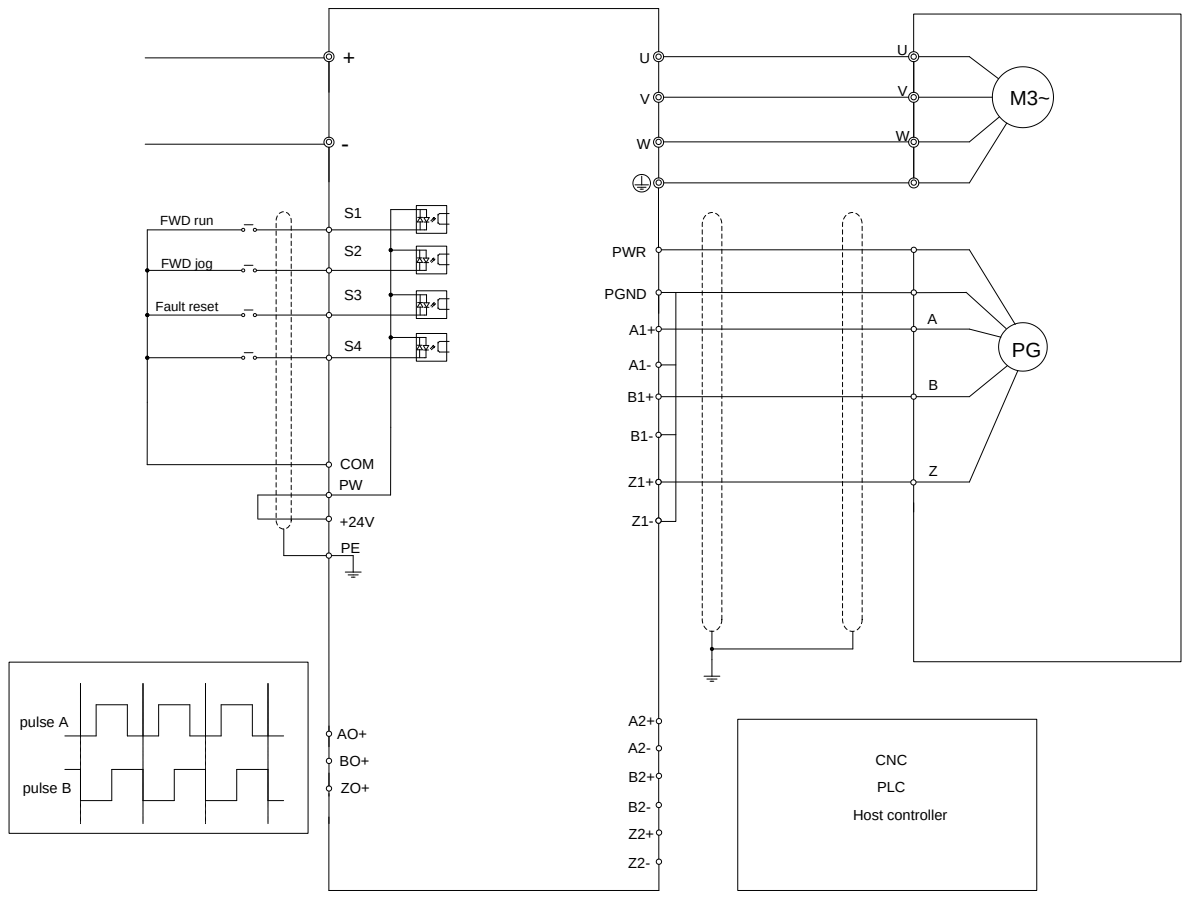
Indicator	Definition	Description
LED1	Signal indicator	On: Other cases Flashing (On: 500ms; Off: 500ms): A1 or B1 signal is disconnected during encoder rotating.

Indicator	Definition	Description
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status indicator	On: The expansion card is establishing a connection with the control board. Flashing (On: 500ms; Off: 500ms): The expansion card is properly connected to the control board. Off: The expansion card is disconnected from the control board.

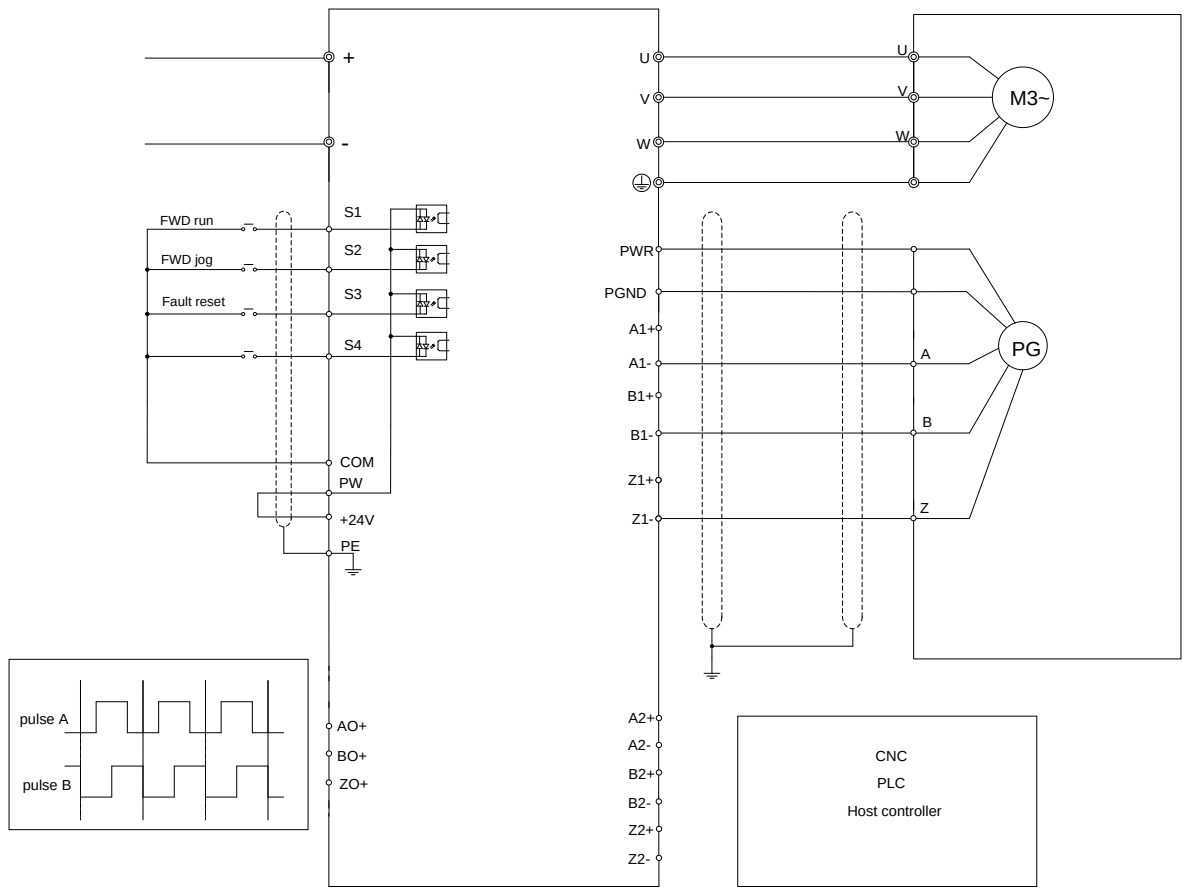
Terminal function description:

Signal	Port description	Function description
PWR	Encoder power supply	Voltage: 24V $\pm$ 5% Max. output current: 150mA
PGND		
PE		
GND		
A1+	Encoder interface	Applicable to 24V push-pull encoders Applicable to 24V OC encoders Applicable to 24V differential encoders Response frequency: 400kHz
A1-		
B1+		
B1-		
Z1+		
Z1-		
A2+	Pulse reference	Applicable to 24V push-pull encoders Applicable to 24V OC encoders Applicable to 5V differential encoders Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	Supports open collector output with a pull-up resistor externally connected to the input port Supports frequency division of 1–255, which can be set through P20.16 or P24.16 Supports frequency-divided output source selection, configurable via P20.17 or P24.17.
BO+		
ZO+		

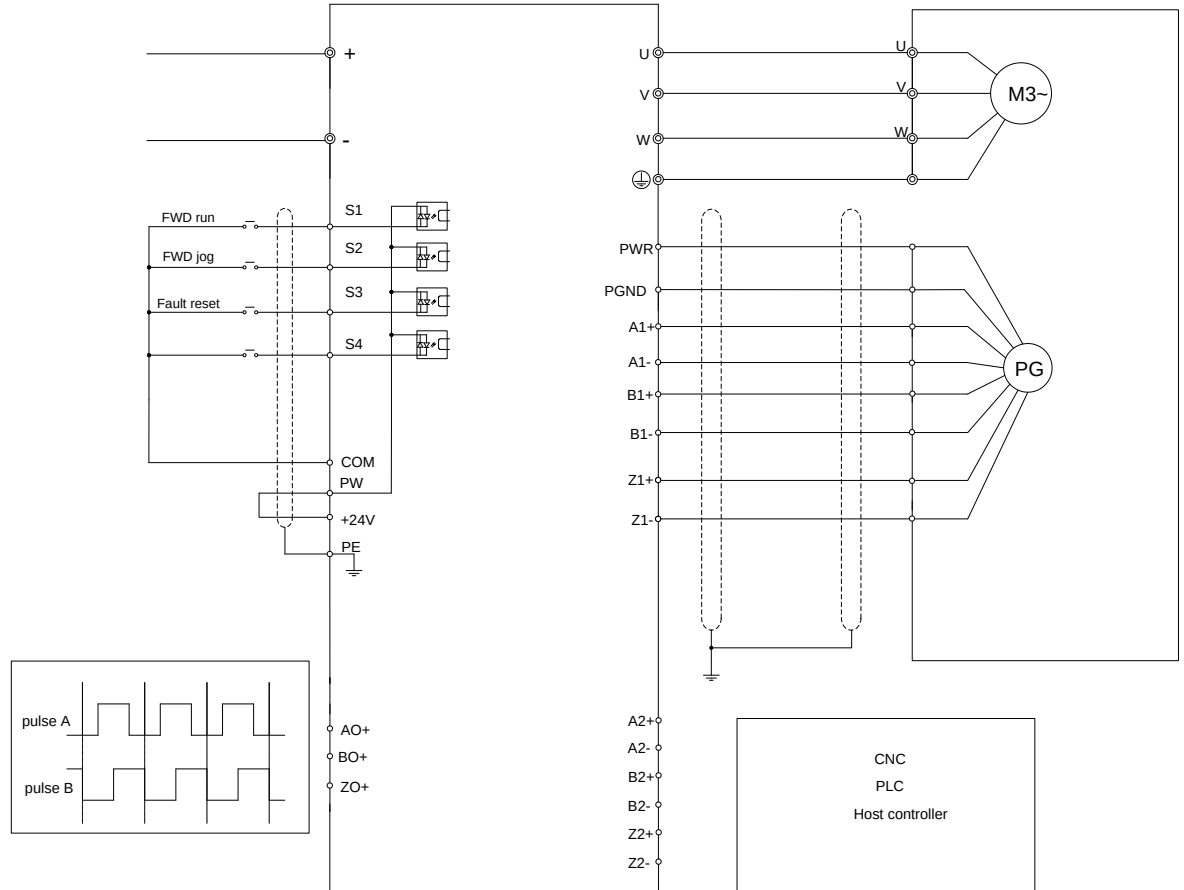
The following figure shows the external wiring when used with an open-collector encoder. The PG card has a built-in pull-up resistor.



External wiring when the PG card works with a push-pull encoder.

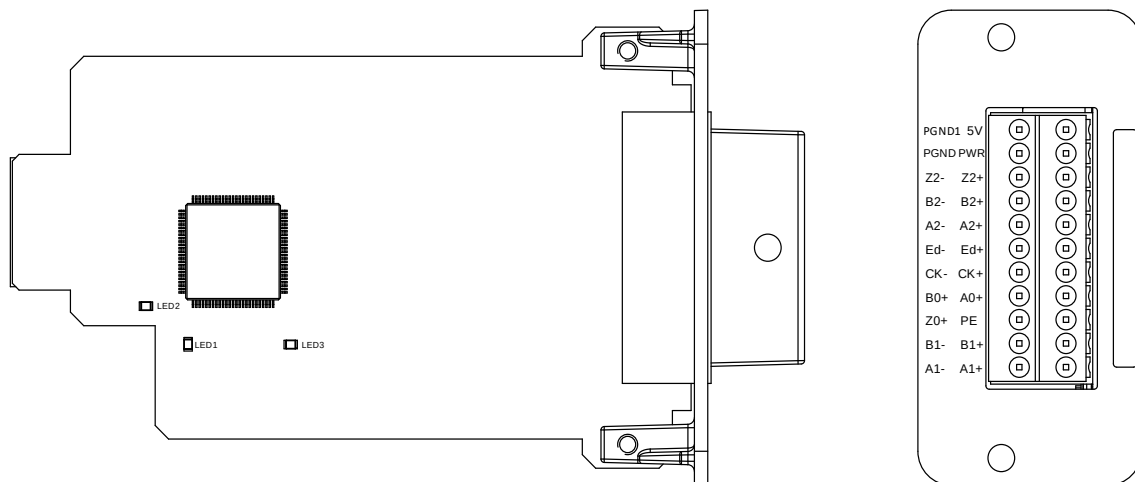


External wiring when the PG card works with a differential encoder.



A.6.5 SSI absolute PG card EC-PG708-24

The external terminal layout is as follows. The encoder power supply voltage class is 5V or 24V. Verify the power supply voltage class before connecting the encoder.



Indicator definition:

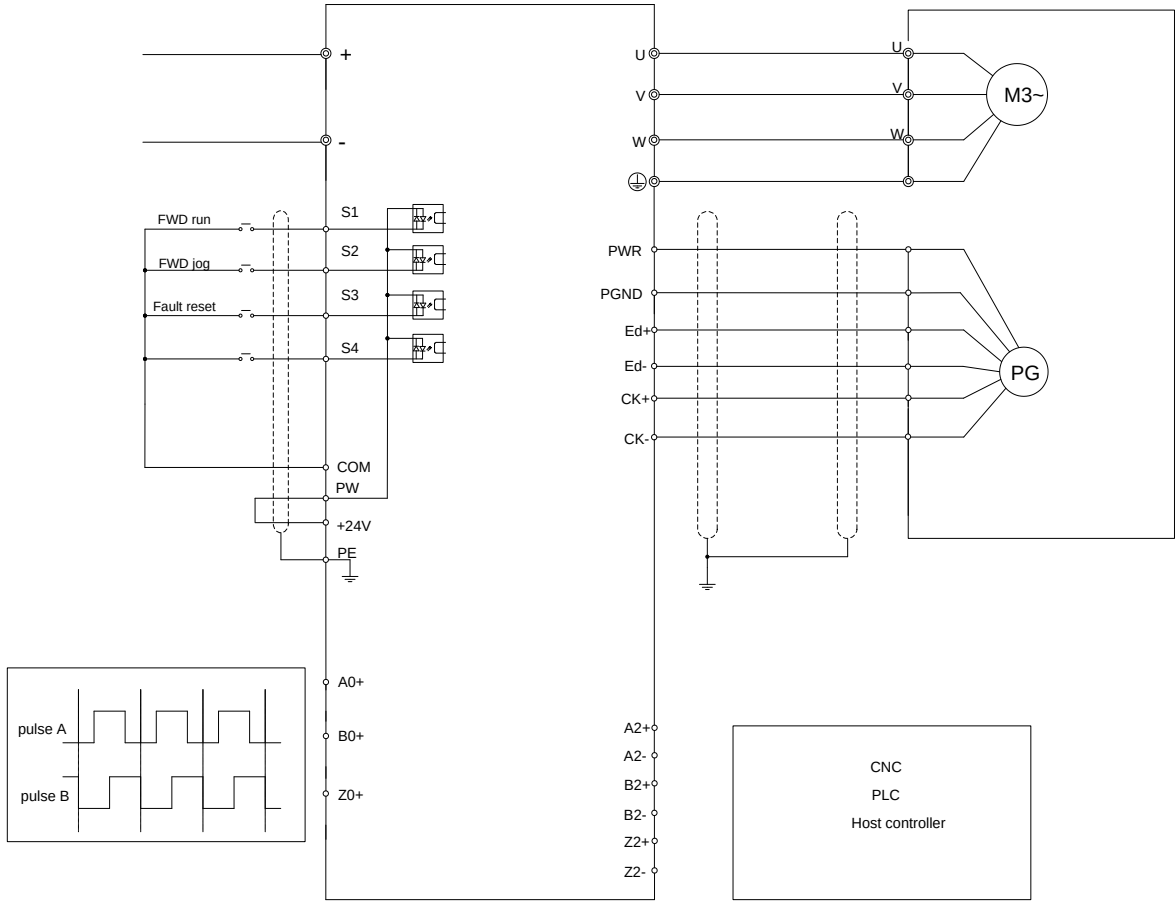
Indicator	Definition	Description
LED1	Reserved	Reserved
LED2	Power indicator	On: The expansion card is powered on. Off: The expansion card is not powered on.
LED3	Status indicator	On: The expansion card is connecting with the control board. Flashing (period: 1s; on for 0.5s and off for 0.5s): The expansion card is connected properly to the control board. Off: The expansion card is disconnected from the control board.

Terminal function description:

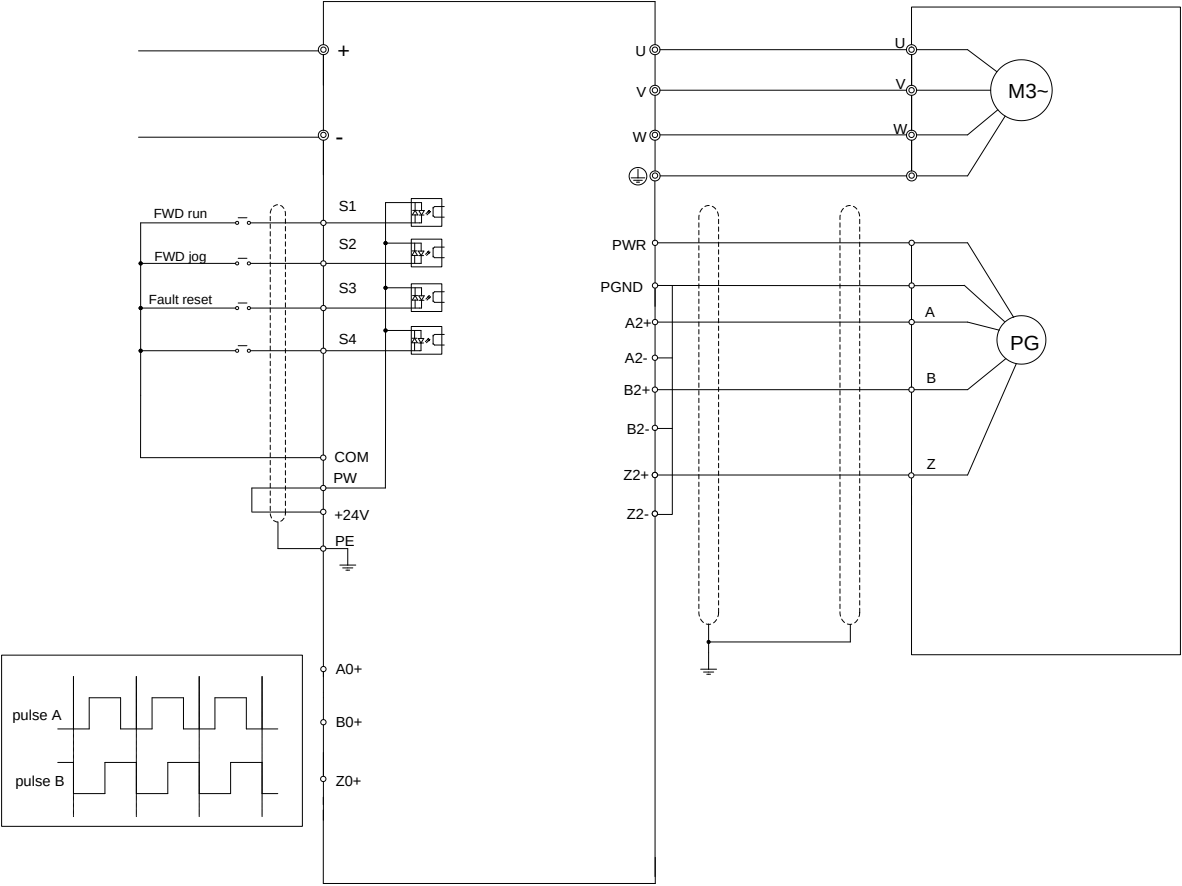
Signal	Port description	Function description
5V	Encoder power supply	Voltage: $5V \pm 5\%$
PGND1		Max. output current: 200mA
PWR		Voltage: $24V \pm 5\%$
PGND		Max. output current: 150mA
PE	Encoder shield ground	It is recommended to ground the two ends of the shielded wire.
Ed+	Encoder interface	SSI signal, 5V isolated differential input, synchronized by interrupt clock signal, max. communication rate 700kHz
Ed-		
CK+		
CK-		
A2+	Pulse reference	Supports 24V push-pull, open-collector, and differential inputs. Response frequency: 400kHz
A2-		
B2+		
B2-		
Z2+		
Z2-		
AO+	Frequency-divided output	Supports only open-collector output. An external pull-up resistor is connected to the input terminal. Supports frequency division of 1–255, which can be set through P20.16 or
BO+		
ZO+		

Signal	Port description	Function description
		P24.16 Supports frequency-divided output source selection, configurable via P20.17 or P24.17.

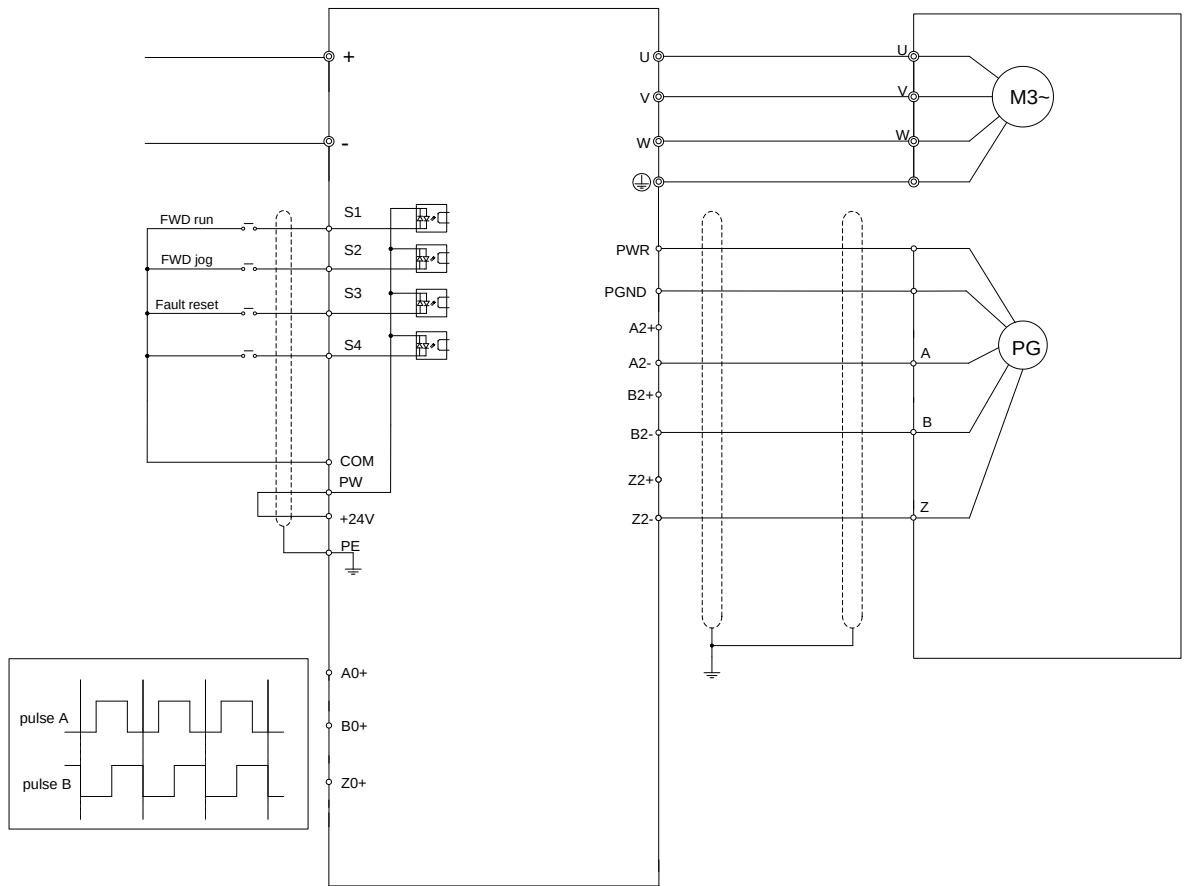
The following figure shows the external wiring when used with an SSI absolute encoder.



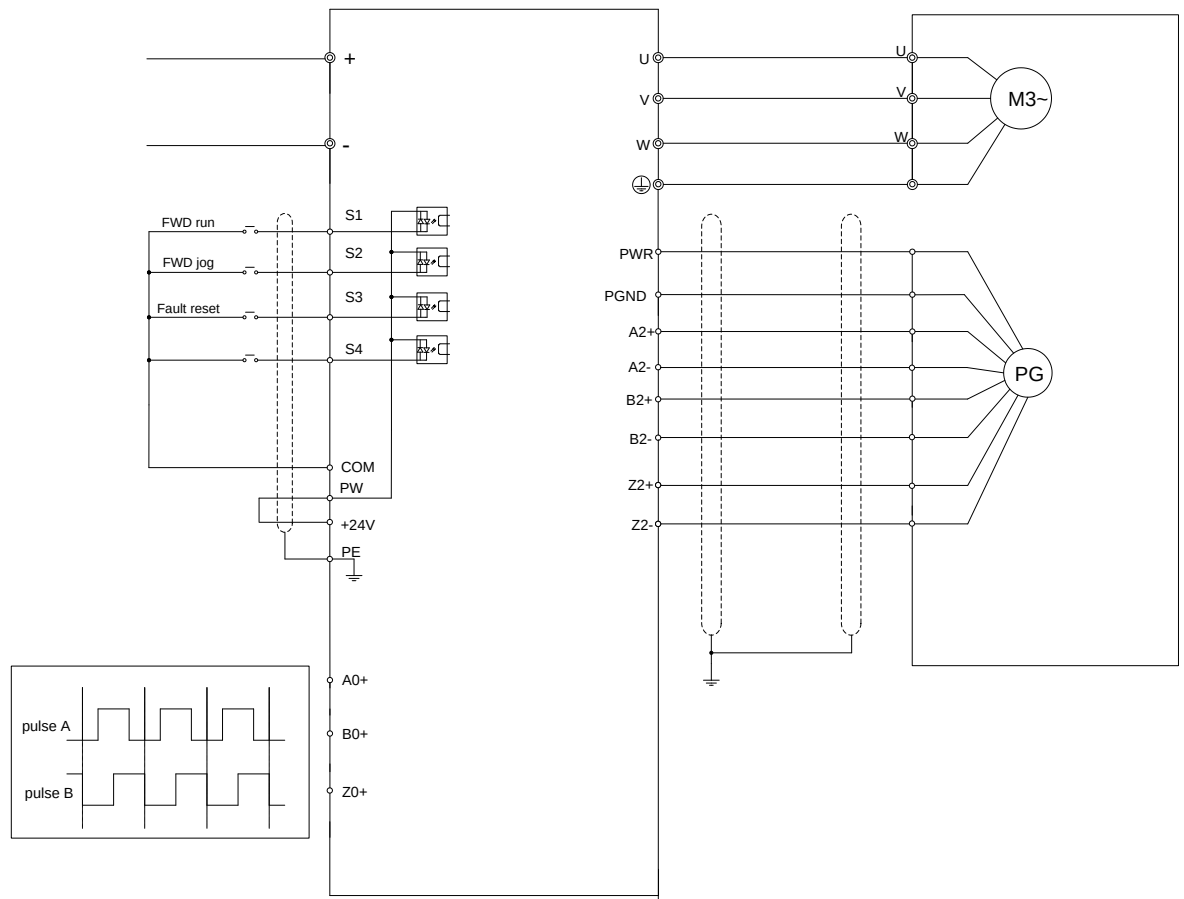
The following figure shows the external wiring when used with an open-collector encoder. The PG card has a built-in pull-up resistor.



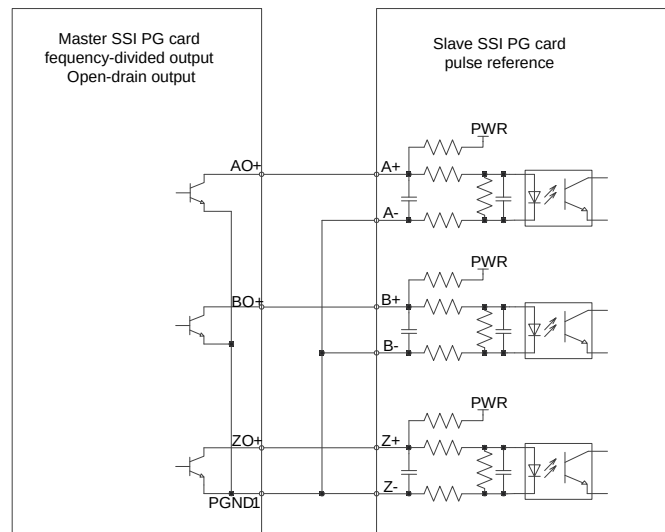
External wiring when the PG card works with a push-pull encoder.



External wiring when the PG card works with a differential encoder.



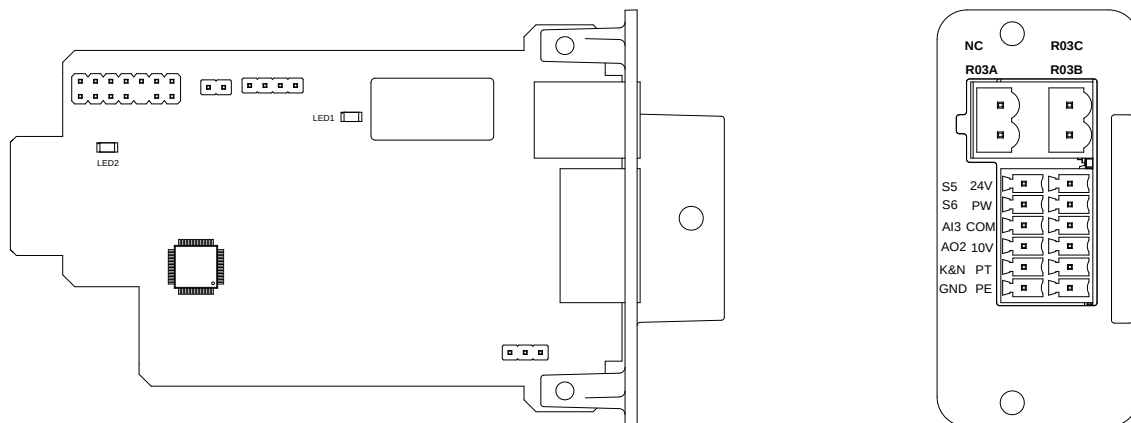
For a stacker crane with dual travel drives, the master drive uses full closed-loop control, and the slave drive uses pulse position control. The pulse reference comes from the frequency-divided signal of the master motor encoder.



The EC-PG708-24 PG card uses open-drain frequency-divided output. The reference ground for frequency-divided output is PGND1. Pay attention to the wiring method.

A.7 IO expansion cards

A.7.1 IO expansion card EC-IO702



EC-IO702 terminal functions:

Category	Terminal symbol	Description
Digital Input and output	PW	Used to provide input digital working power from the external to the internal Voltage range: 12–24V. PW and +24V are shorted by default (factory setting).
	24V	User power supply provided by the VFD. Max. output current: 200mA
	COM	24V reference ground
	S5	Internal resistance: 3.3kΩ
	S6	Acceptable input of 12–30V voltage Bi-direction input terminal, supporting both NPN and PNP Max. input frequency: 1kHz
Analog Input and output	10V	Locally provided +10V power supply
	GND	Reference ground of the 10V power supply
	AI3	Input range: 0(2)–10V/0(4)–20mA P25.40 specifies whether to use voltage or current input. Input impedance: 20kΩ for voltage input; 250Ω for current input Resolution: 5mV when 10V corresponds to 50Hz

Category	Terminal symbol	Description
		Error: $\pm 0.5\%$ when input exceeds 5V or 10mA
	AO2	Output range: 0(2)–10V/0(4)–20mA J3 is used to select voltage or current output. Deviation: $\pm 0.5\%$ when output exceeds 5V or 10mA at 25°C
Relay output	R03A	RO3 output; RO3A: NO; RO3B: NC; RO3C: common Contact capacity: 3A/AC250V, 1A/DC30V
	R03B	
	R03C	
Temperature detection circuit	K&N	Supporting KTY84-130/PT100/PT1000/NTC temperature sensors KTY84-130/NTC are connected through the K&N interface, while PT100/PT1000 are connected through the PT interface. Only one type of temperature sensor can be simultaneously connected, which can be selected through P28.16. Temperature measurement range: -20°C – 175°C NTC supports the 5K/10K types, and the B value range is 0–6000. Temperature measurement error: $\pm 5^{\circ}\text{C}$
	PT	
	GND	Temperature sensor reference ground
Grounding terminal	PE	Grounding terminal
Reserved	NC	Reserved

Note:

- It is recommended that the max. cable length of the PT100 temperature sensor be 3 meters.
- When the temperature detection sensor and the electricity line are routed in parallel, you are recommended to use shield layers to prevent interference.
- EC-IO702 is applicable only to the inverter unit currently.

Appendix B CANopen object dictionary

Index (hex)	Sub-index	Description	Access permission	Data type	Default value
1000	0	Device type	RO	Unsigned32	0x0000 0000
1001	0	Error register	RO	Unsigned8	-
1003	Error register				
	0	Number of subindexes	RO	Unsigned8	1
	1	Error code	RO	Unsigned32	-
1005	0	COB-ID SYNC	RW	Unsigned32	0x0000 0080
1006	0	Communication cycle period	RW	Unsigned32	-
1008	0	Manufacturer-defined device name	CONST	String	INVT CANopen
1009	0	Manufacturer hardware version	CONST	String	V1.00
100A	0	Manufacturer software version	CONST	String	V1.00
100C	0	Protection time	RW	Unsigned16	0
100D	0	Life cycle factor	RW	Unsigned16	0
100E	0	Node protection COB-ID	RO	Unsigned32	700H + Current node ID
1010	Slave store parameters				
	0	Number of subindexes	RO	Unsigned8	3
	1	All slave parameters	RW	Unsigned32	-
	2	Slave communication parameters	RW	Unsigned32	-
	3	Slave application parameters	RW	Unsigned32	-
1016	Consumer heartbeat time				
	0	Number of subindexes	RO	Unsigned8	1
	1	Consumer heartbeat time	RW	Unsigned32	-
1017	0	Producer heartbeat time	RW	Unsigned16	500
1018	Identifier objects				
	0	Number of subindexes	RO	Unsigned8	4
	1	Supplier ID	RO	Unsigned32	-
	2	Product code	RO	Unsigned32	-
	3	Revision No.	RO	Unsigned32	-
	4	Sequence No.	RO	Unsigned32	-
1200	Server SDO				
	0	Number of subindexes	RO	Unsigned8	3
	1	COB-ID Client -> server (Rx)	RO	Unsigned32	600H+Node ID
	2	COB-ID Server -> client (Tx)	RO	Unsigned32	580H+Node ID
	3	Client SDO node ID	RO	Unsigned8	Current node ID
1280	Client SDO				
	0	Number of subindexes	RO	Unsigned8	3
	1	COB-ID Client -> server (Rx)	RO	Unsigned32	0x0000 0600
	2	COB-ID Server -> client (Tx)	RO	Unsigned32	0x0000 0580
	3	Node ID of server SDO	RO	Unsigned8	Current node ID
1400	PDO1 Rx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5

Index (hex)	Sub-index	Description	Access permission	Data type	Default value
	1	COB-ID used by PDO	RW	Unsigned32	200H + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	-	-	Unsigned8	0
	5	Event timer	RW	Unsigned16	0
1401	PDO2 Rx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	300h + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	-	-	Unsigned8	0
	5	Event timer	RW	Unsigned16	0
1402	PDO3 Rx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	400H + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	-	-	Unsigned8	0
	5	Event timer	RW	Unsigned16	0
1403	PDO4 Rx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	500H + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	-	-	Unsigned8	0
	5	Event timer	RW	Unsigned16	0
1600	PDO1 Rx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x21000110
	2	Second mapped object	RW	Unsigned32	0x21000210
	3	Third mapped object	RW	Unsigned32	0x21000310
	4	Fourth mapped object	RW	Unsigned32	0x21000410
1601	PDO2 Rx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x21000510
	2	Second mapped object	RW	Unsigned32	0x21000610
	3	Third mapped object	RW	Unsigned32	0x21000710
	4	Fourth mapped object	RW	Unsigned32	0x21000810

Index (hex)	Sub-index	Description	Access permission	Data type	Default value
1602	PDO3 Rx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x21000910
	2	Second mapped object	RW	Unsigned32	0x21000A10
	3	Third mapped object	RW	Unsigned32	0x21000B10
	4	Fourth mapped object	RW	Unsigned32	0x21000C10
1603	PDO4 Rx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x21000D10
	2	Second mapped object	RW	Unsigned32	0x21000E10
	3	Third mapped object	RW	Unsigned32	0x21000F10
	4	Fourth mapped object	RW	Unsigned32	0x21001010
1800	PDO1 Tx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	180H + Current node ID
	2	Transmission type	RW	Unsigned8	255
	3	Disabled time	RW	Unsigned16	0
	4	Reserved	RW	Unsigned8	0
1801	PDO2 Tx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	280H + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	Reserved	RW	Unsigned8	0
1802	PDO3 Tx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	380H + Current node ID
	2	Transmission type	RW	Unsigned8	254
	3	Disabled time	RW	Unsigned16	0
	4	Reserved	RW	Unsigned8	0
1803	PDO4 Tx communication parameters				
	0	Supported Max. number of subindexes	RO	Unsigned8	5
	1	COB-ID used by PDO	RW	Unsigned32	480H + Current node ID
1803	2	Transmission type	RW	Unsigned8	254

Index (hex)	Sub-index	Description	Access permission	Data type	Default value
	3	Disabled time	RW	Unsigned16	0
	4	Reserved	RW	Unsigned8	0
	5	Event timer	RW	Unsigned16	0
1A00	PDO1 Tx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	3
	1	First mapped object	RW	Unsigned32	0x20000110
	2	Second mapped object	RW	Unsigned32	0x20000210
	3	Third mapped object	RW	Unsigned32	0x20000310
	4	Fourth mapped object	RW	Unsigned32	0x20000410
1A01	PDO2 Tx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x20000510
	2	Second mapped object	RW	Unsigned32	0x20000610
	3	Third mapped object	RW	Unsigned32	0x20000710
	4	Fourth mapped object	RW	Unsigned32	0x20000810
1A02	PDO3 Tx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x20000910
	2	Second mapped object	RW	Unsigned32	0x20000A10
	3	Third mapped object	RW	Unsigned32	0x20000B10
	4	Fourth mapped object	RW	Unsigned32	0x20000C10
1A03	PDO4 Tx mapping parameters				
	0	Number of application program objects mapped in PDO	RW	Unsigned8	4
	1	First mapped object	RW	Unsigned32	0x20000D10
	2	Second mapped object	RW	Unsigned32	0x20000E10
	3	Third mapped object	RW	Unsigned32	0x20000F10
	4	Fourth mapped object	RW	Unsigned32	0x20001010

Appendix C Technical data

C.1 What this chapter contains

This chapter describes the technical data of the VFD and its compliance to CE and other quality certification systems.

C.2 Derated application

C.2.1 Capacity

Choose a VFD model based on the rated current and power of the motor. To endure the rated power of the motor, the rated output current of the VFD must be larger or equal to the rated current of the motor. The rated power of the VFD must be higher or equal to that of the motor.

Note:

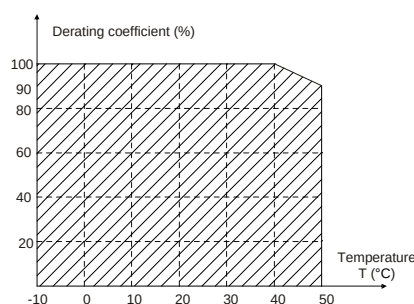
- The maximum allowable shaft power of the motor is limited to 1.5 times the rated power of the motor. If the limit is exceeded, the VFD automatically restricts the torque and current of the motor. This function effectively protects the input shaft against overload.
- The rated capacity is the capacity at the ambient temperature of 40°C.
- You need to check and ensure that the power flowing through the common DC connection in the common DC system does not exceed the rated power of the motor.

C.2.2 Derating

If the ambient temperature on the site where the inverter is installed exceeds 40°C, the altitude exceeds 1000m, or the switching frequency is changed from 4 kHz to 8, 12, or 15 kHz, the VFD needs to be derated.

C.2.2.1 Derating due to temperature

When the temperature ranges from 40°C to 50°C, the rated output current is derated by 1% for each increased 1°C. For the actual derating, see the following figure.



Note: It is not recommended to use the VFD at an environment with the temperature higher than 50°C. If you do, you shall be held accountable for the consequences caused.

C.2.2.2 Derating due to altitude

Designed according to the UL corner-grounded delta system (8mm safety clearance between power and control circuits). In actual application, the altitude must not exceed 2000m, and the safety clearance required between power and control circuits on the PCB is 8mm.

In addition, when the altitude exceeds 1000m, derate by 1% for every increase of 100m.

For units designed according to the UL corner-grounded system but applied in a star (wye) grid system, the max. altitude must not exceed 4000 meters. Similarly, for altitudes above 1000 meters, a derating of 1% per 100-meter rise must be applied.

C.2.2.3 Derating due to carrier frequency

The carrier frequency of the VFD varies with power class. The VFD rated power is defined based on the carrier frequency factory setting. If the carrier frequency exceeds the factory setting, the VFD power is derated by 10% for each increased 1 kHz.

C.3 Grid specifications

Grid Volt	AC 3PH 380V(-15%) – 440V(+10%)
Short-circuit capacity	According to the definition in IEC 61439-1, the maximum allowable short-circuit current at the incoming end is 100kA. Therefore, the VFD is applicable to scenarios where the transmitted current in the circuit is no larger than 100 kA when the VFD runs at the maximum rated voltage.
Frequency	50/60Hz ± 5%, with a maximum change rate of 20%/s

C.4 Motor connection data

Motor type	Asynchronous induction motor or permanent-magnet synchronous motor
Voltage	0–U ₁ (motor rated voltage), 3PH symmetrical, U _{max} (VFD rated voltage) at the field-weakening point
Short-circuit protection	The motor output short-circuit protection meets the requirements of IEC 61800-5-1.
Frequency	0–400Hz
Frequency resolution	0.01Hz
Current	See section 3.6 Product ratings.
Power limit	1.5 times of the motor rated power
Carrier frequency	4, 8, 12, or 15 kHz

C.4.1 EMC compatibility and motor cable length

The following table describes the maximum motor cable lengths that meet the requirements of the EU EMC directive (2014/30/EU).

All models (with external EMC filters)	Maximum motor cable length (m)
Second environment (C3)	3

For the definition of Category C3 (Second Environment), refer to section C.6 EMC regulations.

C.5 Application standards

The following table describes the standards that VFDs comply with.

EN/ISO 13849-1	Safety of machinery—Safety-related parts of control systems—Part 1: General principles for design
IEC/EN 60204-1	Safety of machinery. Electrical equipment of machines. Part 1: General requirements
IEC/EN 62061	Safety of machinery—Safety-related functional safety of electrical, electronic, and programmable electronic control systems
IEC/EN 61800-3	Adjustable speed electrical power drive systems. Part 3: EMC requirements and specific test methods
IEC/EN 61800-5-1	Adjustable speed electrical power drive systems—Part 5-1: Safety requirements—Electrical, thermal and energy
IEC/EN 61800-5-2	Adjustable speed electrical power drive systems—Part 5-2: Safety requirements—Function

C.5.1 CE marking

The CE mark affixed to the VFD indicates that the VFD has obtained CE conformity certification and complies with the European Low Voltage Directive (2014/35/EU) and Electromagnetic Compatibility Directive (2014/30/EU).

C.5.2 EMC compliance declaration

European union (EU) stipulates that the electric and electrical devices sold in Europe cannot generate electromagnetic disturbance that exceeds the limits stipulated in related standards, and can work properly in environments with certain electromagnetic interference. The EMC product standard (EN 61800-3) describes the EMC standards and specific test methods for adjustable speed electrical power drive systems. Our products have been compliant with these EMC regulations.

C.6 EMC regulations

The EMC product standard (EN 61800-3) describes the EMC requirements on VFDs.

Application environment categories:

First environment: Residential environment, including application scenarios where the VFD is directly connected, without an intermediate transformer, to a low-voltage power supply network that supplies residential buildings.

Second environment: Includes all establishments other than those directly connected to a low-voltage power supply network that supplies buildings used for residential purposes.

VFDs are classified into four categories:

VFDs of C1: Rated voltage lower than 1000V, applied to the first environment.

VFDs of C2: Rated voltage lower than 1000V, not a plug-in device or a movable device, and must be installed and commissioned by a professional person when used in the first environment.

Note: The EMC standard IEC/EN 61800-3 no longer restricts the power distribution of the VFD, but defines the use, installation, and commissioning of the VFD. Specialized personnel or organizations must have the necessary skills (including the EMC-related knowledge) for installing and/or performing commissioning on the electrical drive systems.

VFDs of C3: Rated voltage lower than 1000 V, applied to the second environment. They cannot be applied to the first environment.

VFDs of C4: Rated voltage higher than 1000V, or rated current higher than or equal to 400A, applied to complex systems in the second environment.

C.6.1 Category C2

The induction disturbance limit shall meet the following stipulations:

1. Select an optional EMC filter according to Appendix D Dimension drawings and install it following the description in the EMC filter manual.
2. Select the motor and control cables according to the description in the manual.
3. Install the VFD according to the description in the manual.
4. For the maximum motor cable length, see appendix C.4.1 EMC compatibility and motor cable length.



The product may generate radio interference in a domestic environment, and measures need to be taken to reduce the interference.

C.6.2 Category C3

The anti-interference performance of the VFD meets the requirements of the second environment in the IEC/EN 61800-3 standard.

The conducted emission limits comply with the following:

1. Select an optional EMC filter according to Appendix E Peripheral options and install it following the description in the EMC filter manual.
2. Select the motor and control cables according to the description in the manual.
3. Install the VFD according to the description in the manual.
4. For the maximum motor cable length, see appendix C.4.1 EMC compatibility and motor cable length.



VFDs of category C3 cannot be applied to civilian low-voltage common grids. When applied to such grids, the VFDs may generate radio frequency electromagnetic interference.

Appendix D Dimension drawings

D.1 What this chapter contains

This chapter provides VFD dimensions.

D.2 Mounting dimensions

D.2.1 Wall mounting dimensions (for rectifier unit)

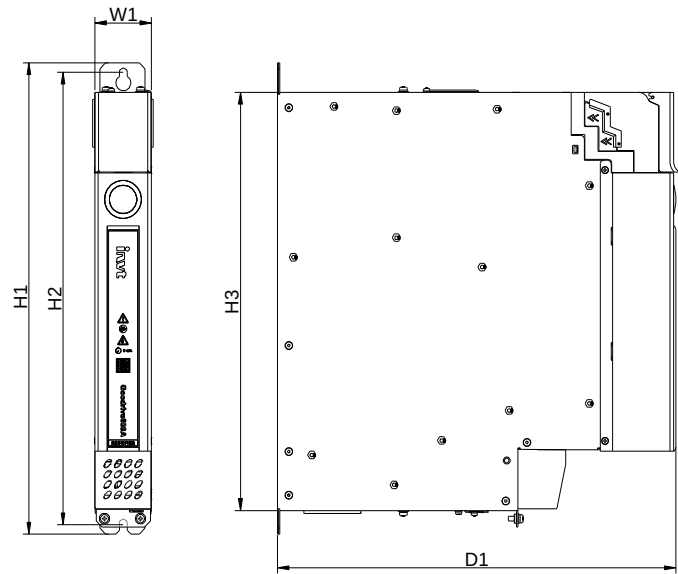


Figure D-1 Wall mounting dimensions for the 380V 22kW uncontrolled rectifier unit

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
GD600A-61-022-4-B(-S)	400	355	50	350	384	-	-	Ø 7	4.7

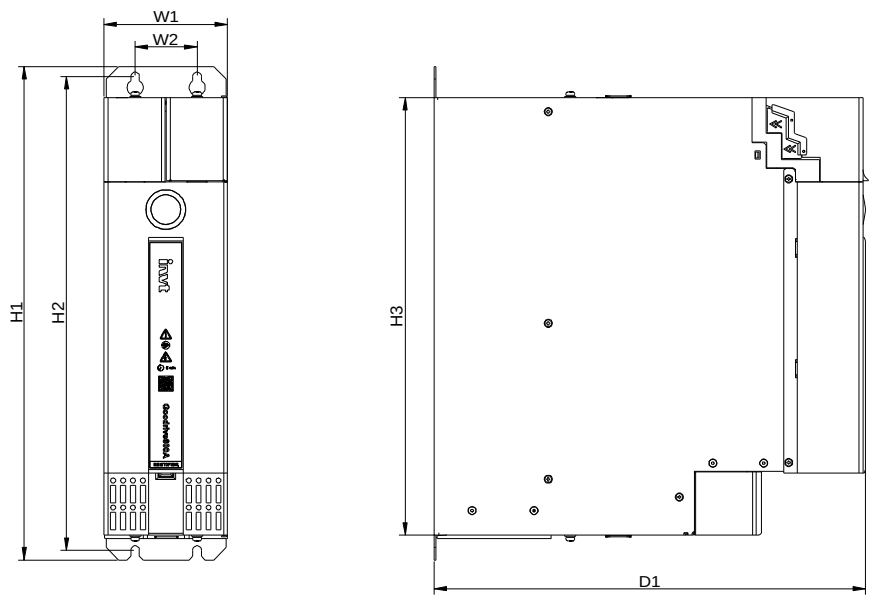


Figure D-2 Wall mounting dimensions for the 380V 45kW rectifier unit

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
GD600A-71-045-4-B	400	355	100	350	384	50	-	Ø 7	9

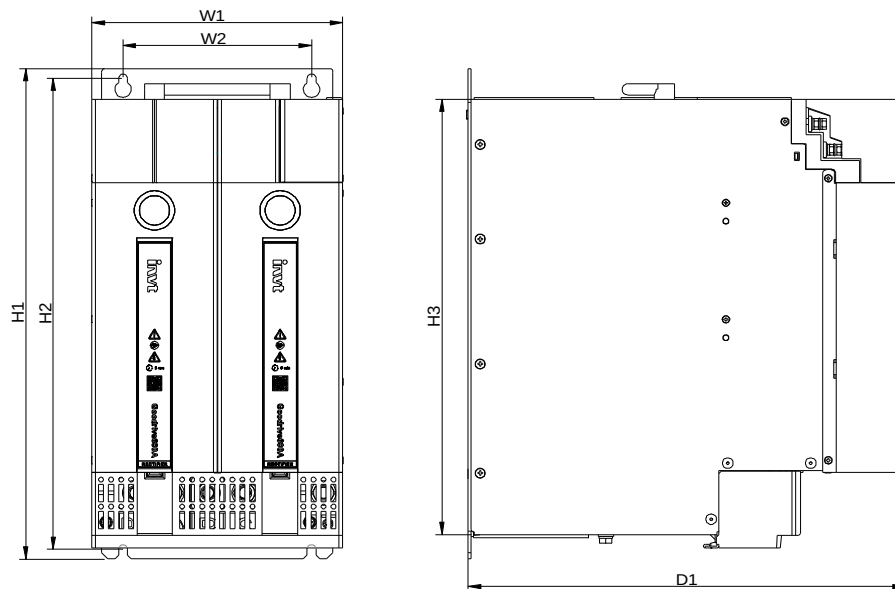


Figure D-3 Wall mounting dimensions for the 380V 110kW uncontrolled rectifier unit

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
GD600A-61-110-4-B(-S)	400	355	200	350	384	150	-	Ø 7	16.8

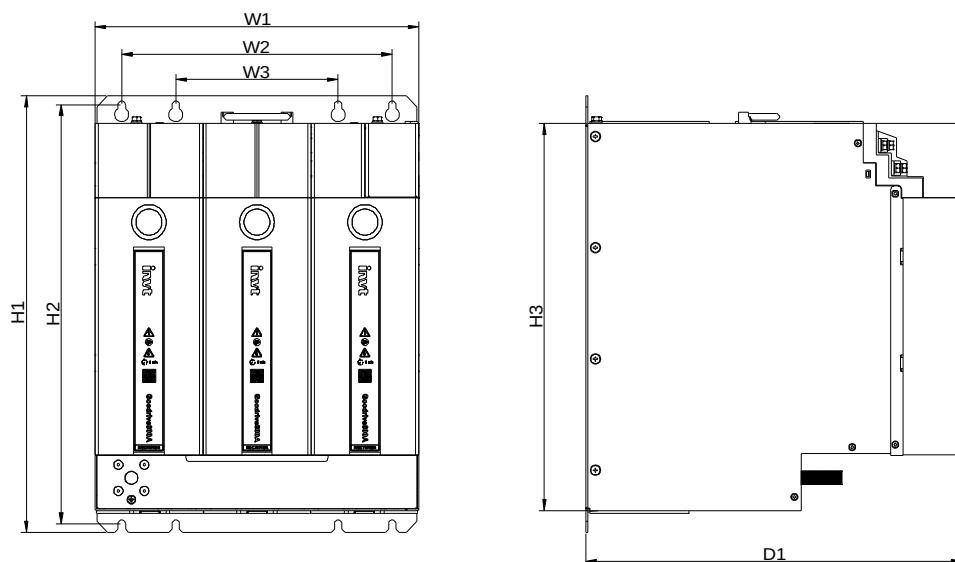


Figure D-4 Wall mounting dimensions for the 380V 160kW rectifier unit

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
GD600A-71-160-4	400	355	300	350	384	250	150	Ø 7	28

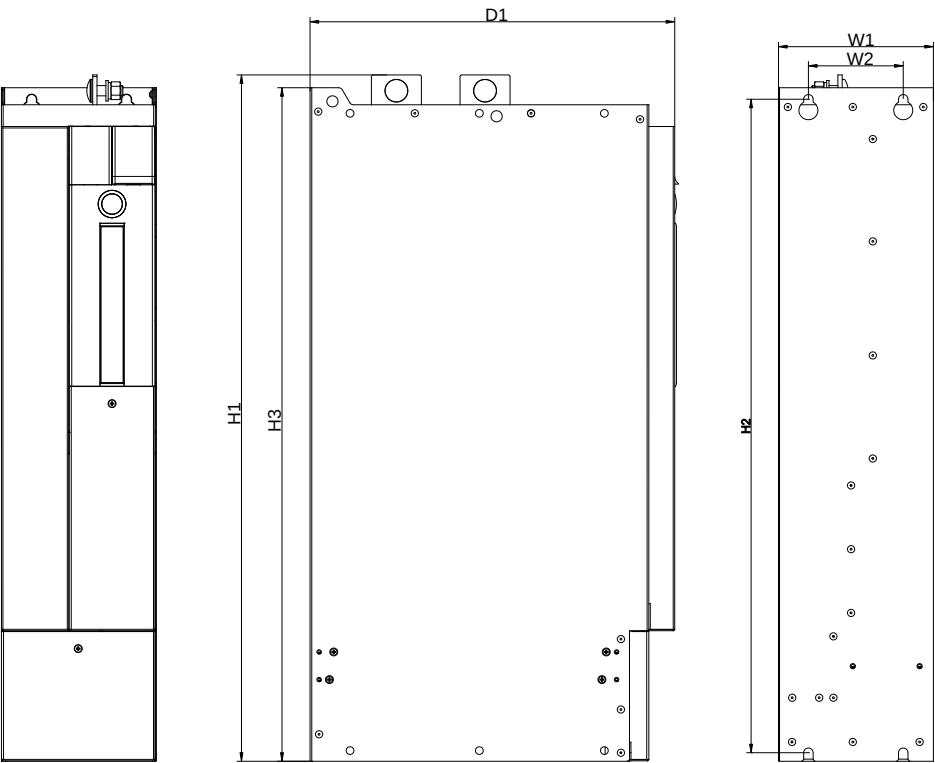


Figure D-5 Wall mounting dimensions for the 380V 355kW rectifier unit

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
GD600A-71-355-4	805	790	180	423	767.5	110	-	Ø 11	42.6

D.2.2 Wall mounting dimensions (for inverter unit)

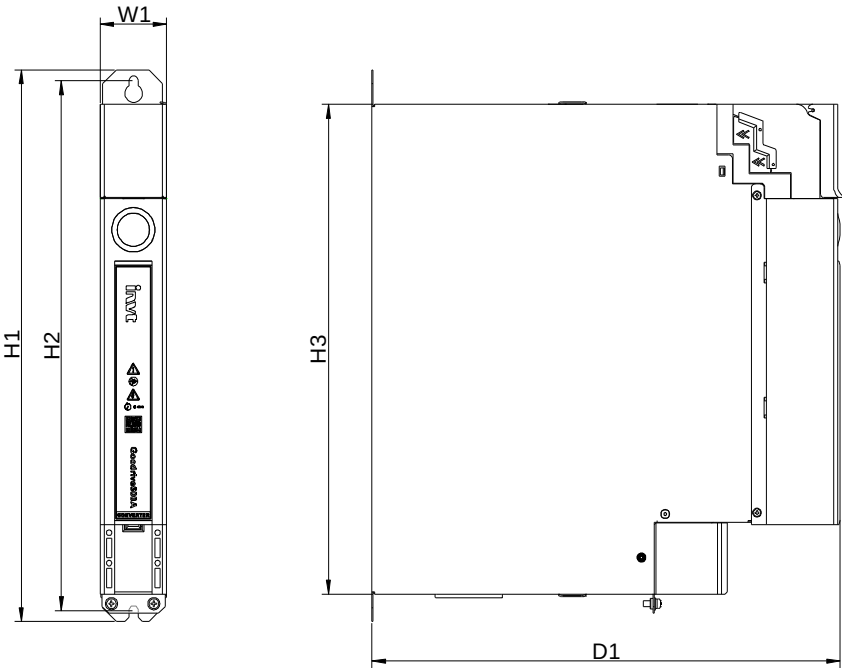


Figure D-6 Wall mounting dimensions for the 380V 1.5–7.5kW inverter units

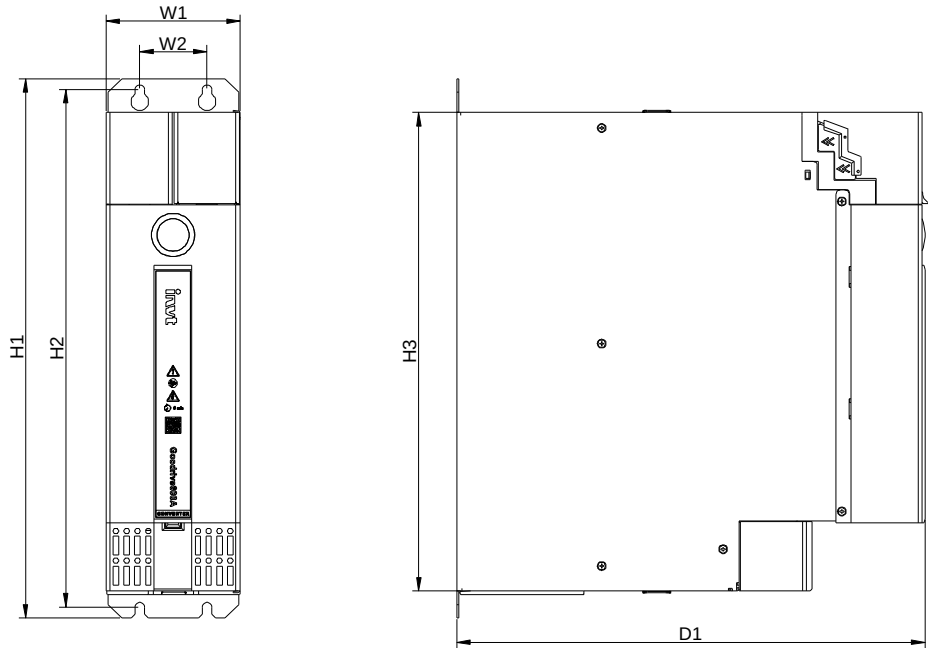


Figure D-7 Wall mounting dimensions for the 380V 11–37kW inverter units

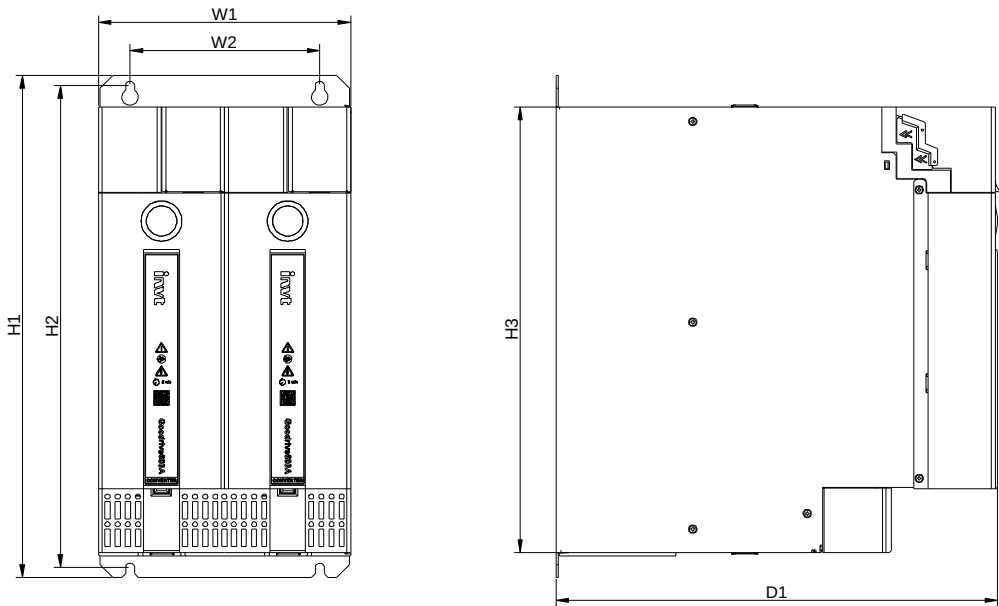


Figure D-8 Wall mounting dimensions for the 380V 45–75kW inverter units

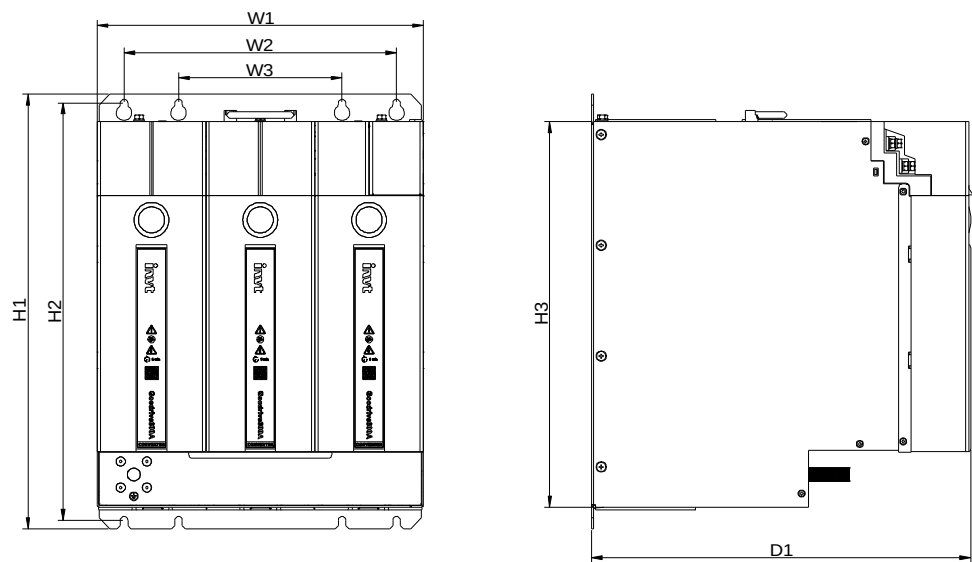


Figure D-9 Wall mounting dimensions for the 380V 90–160kW inverter units

VFD model	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
1.5–7.5kW	400	355	50	350	384	-	-	Ø 7	4
11–37kW	400	355	100	350	384	50	-	Ø 7	9
45–75kW	400	355	200	350	384	150	-	Ø 7	18
90–160kW	400	355	300	350	384	250	150	Ø 7	28

D.2.3 Flange mounting dimensions (Side-by-side installation of rectifier and inverter units)

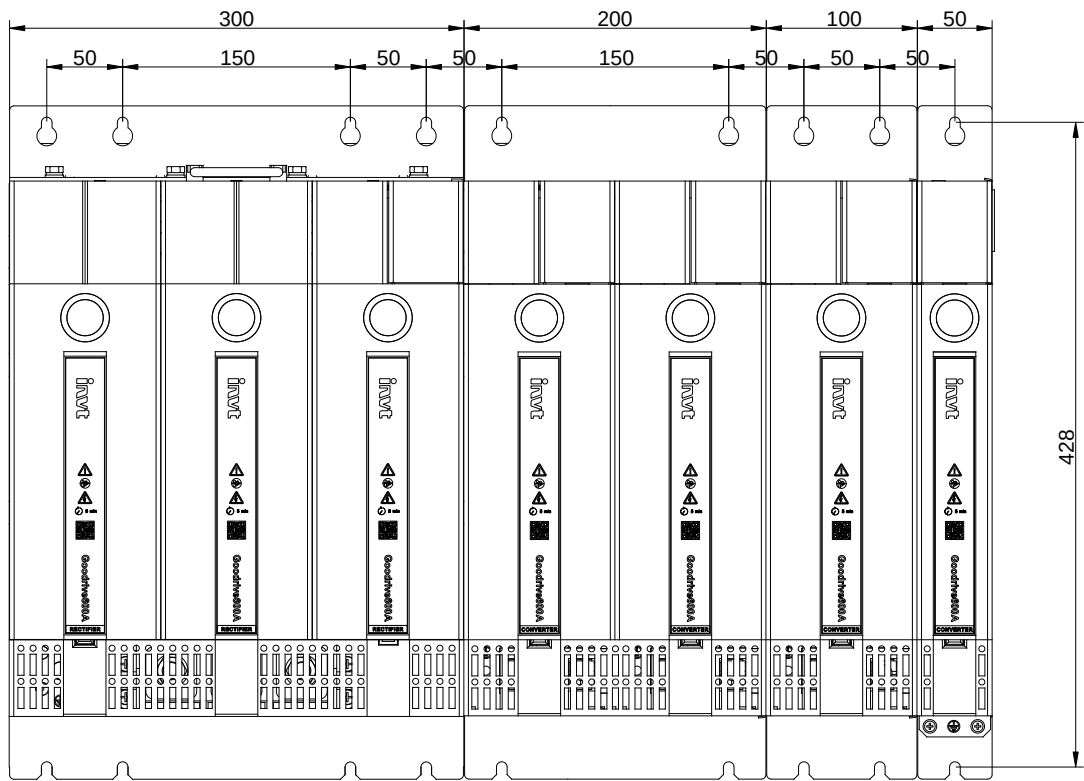


Figure D-10 Flange mounting for the 380V rectifier and inverter units (unit: mm)

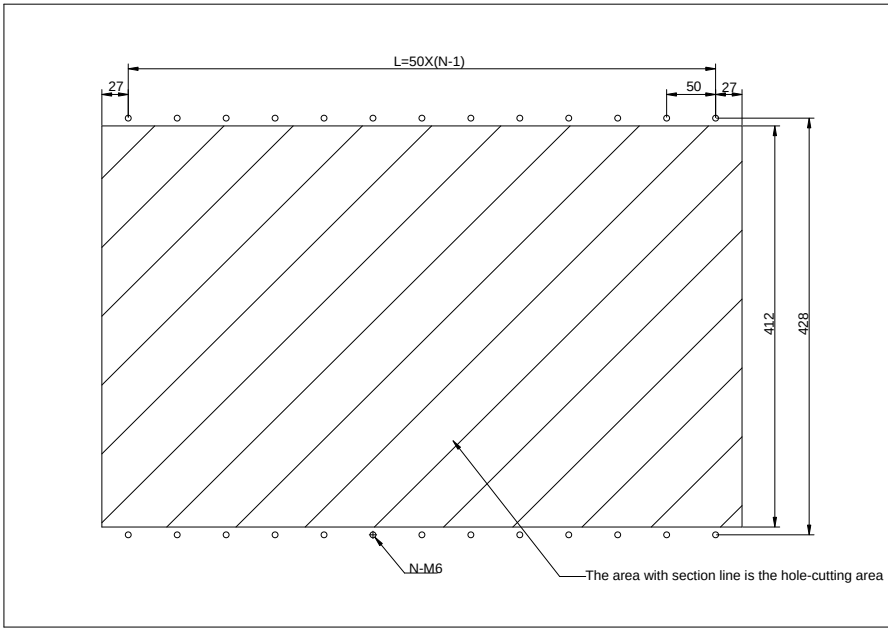


Figure D-11 Flange-mounting cut-out diagram for the 380V rectifier and inverter units (unit: mm)

Appendix E Peripheral options

E.1 What this chapter contains

This chapter provides guidance on selecting peripheral options for the VFD.

E.2 Peripheral wiring

The following figure shows the peripheral wiring of the VFD.

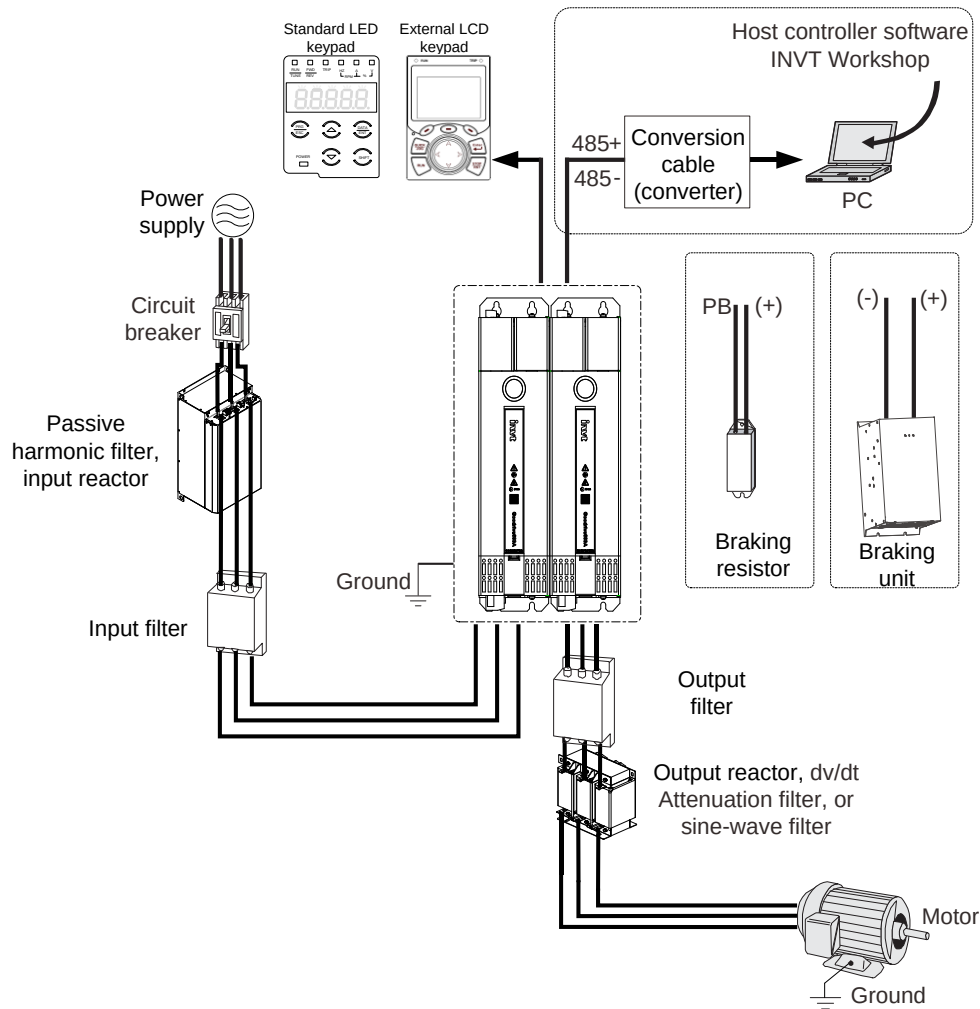
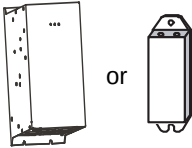
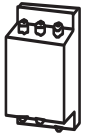
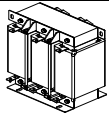
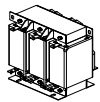


Figure E-1 Peripheral wiring of the VFD

Note:

- A braking unit is built into 22kW, 45kW, and 110kW rectifier units.
- The braking units adopt INVT's DBU series standard braking units. For details, see the DBU operation manual.

Image	Name	Description
	Cable	Medium used for the transmission of electrical power or signals.
	Circuit breaker	Device for electric shock prevention and protection against short-to-ground that may cause current leakage and fire. Select residual-current circuit breakers (RCCBs) that are applicable to VFDs and can restrict high-order harmonics, and

Image	Name	Description
		of which the rated sensitive current for one VFD is larger than 30mA.
	Passive harmonic filter	Device used to reduce the current distortion rate and harmonic content and effectively restrict higher-order harmonic currents, thereby improving the power factor.
	Input reactor	Accessories used to improve the power factor on the input side of the VFD, and thus restrict high-order harmonic currents.
	Input filter	Device that restricts the electromagnetic interference generated by the VFD and transmitted to the public grid through the power cable. Install as close to the input terminal of the VFD as possible.
 or 	Braking unit or braking resistor	Accessories used to consume the regenerative energy of the motor to reduce the DEC time. Rectifier units of 45 kW need only to be configured with braking resistors, other rectifier units also need to be configured with braking units.
	Output filter	Device used to suppress interference generated from the wiring on the output side of the VFD. Install as close to the output terminal of the VFD as possible.
	Output reactor	Device used to extend the effective transmission distance of the VFD and effectively suppress instantaneous high voltage generated when the IGBT module of the VFD switches.
	dv/dt decrement filter	Device used to suppress voltage spikes, reduce traveling waves in long cables, and reflect dv/dt transient voltages, thereby reducing motor eddy current losses and noise, and providing motor insulation protection.
	Sine-wave filter	Device used to suppress and absorb high-order harmonic currents derived from switching frequency ripple currents, correcting the waveform to approximate a sine wave, significantly extending the length of the output cable, reducing motor eddy current losses and noise, and protecting motor insulation.

E.3 Power supply

See chapter 4 Installation and selection guidelines.

	Ensure that the voltage class of the VFD is consistent with that of the grid.
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E.4 Cable

E.4.1 Power cable

The sizes of the input power cables and motor cables must meet the local regulation.

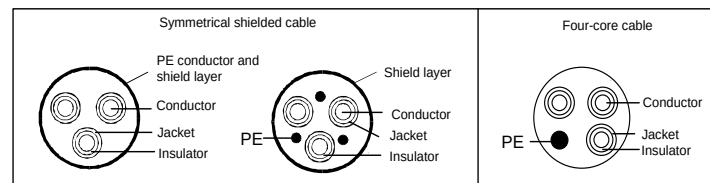
- The input power cables and motor cables must be able to carry the corresponding load currents.
- The maximum temperature margin of the motor cables in continuous operation cannot be lower than 70°C.
- The conductivity of the PE grounding conductor is the same as that of the phase conductor, that is, the cross-sectional

areas are the same.

- For details about the EMC requirements, see Appendix C Technical data.

To meet the EMC requirements stipulated in the CE standards, you must use symmetrical shielded cables as motor cables (as shown in the following figure).

Four-core cables can be used as input cables, but symmetrical shielded cables are recommended. Compared with four-core cables, symmetrical shielded cables can reduce electromagnetic radiation as well as the current and loss of the motor cables.



Note: If the electrical conductivity of the motor cable shield layer does not meet the requirements, a separate PE conductor must be used.

To protect the conductors, the cross-sectional area of the shielded cables must be the same as that of the phase conductors if the cable and conductor are made of materials of the same type. This reduces grounding resistance, and thus improves impedance continuity.

To effectively restrict the emission and conduction of radio frequency (RF) interference, the conductivity of the shielded cable must at least be 1/10 of the conductivity of the phase conductor. This requirement can be well met by a copper or aluminum shield layer. The following figure shows the minimum requirement on motor cables of a VFD. The cable must consist of a layer of spiral-shaped copper strips. The denser the shield layer is, the more effectively the electromagnetic interference is restricted.

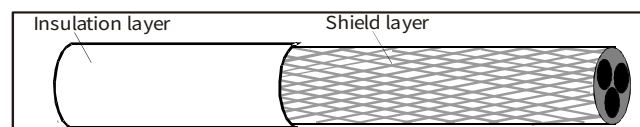


Figure E-2 Cable cross section

E.4.2 Control cable

All analog control cables and cables used for frequency input must be shielded cables. Analog signal cables need to be double-shielded twisted-pair cables (as shown in figure a). Use one separate shielded twisted pair for each signal. Do not use the same ground wire for different analog signals.

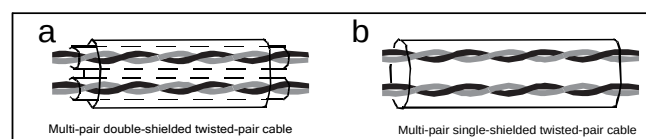


Figure E-3 Power cable arrangement

For low-voltage digital signals, double-shielded cables are recommended, but shielded or unshielded twisted pairs (as shown in figure b) also can be used. For frequency signals, however, only shielded cables can be used.

Relay cables need to be those with metal braided shield layers.

Keypads need to be connected by using network cables. In complicated electromagnetic environments, shielded network cables are recommended.

Note: Analog signals and digital signals cannot use the same cables, and their cables must be arranged separately.

Before delivery, each VFD undergoes an insulation withstand voltage test between the main circuit and the housing. In addition, the VFD has the internal voltage limiting circuit, which can automatically cut off the test voltage. Do not perform

any voltage withstand or insulation resistance tests, such as high-voltage insulation tests or using a megameter to measure the insulation resistance, on the VFD or its components.

Note: Before connecting the input power cable of the converter, check the insulation conditions of the cable according to local regulations.

Table E-1 Rectifier unit cable model selection

Rectifier unit model	Recommended cable size (mm ²)		Connectable cable size (mm ²)			Terminal screw	Fastening torque (Nm)
	RST	PE	RST	PB, (+)	PE		
GD600A-71-045-4-B	35	16	25–35	6–10	16–25	M6	4.5
GD600A-71-160-4	150	70	150–185	/	70–95	M12	35
GD600A-71-355-4	185*2P	150	185*2P	/	185	M12	35
GD600A-61-022-4-B(-S)	10	10	10–16	4–10	10–16	M6	4.5
GD600A-61-110-4-B(-S)	95	50	70–95	70–95	35–50	M10	22

Table E-2 Inverter unit cable model selection

Inverter unit model	Recommended cable size (mm ²)		Connectable cable size (mm ²)		Terminal screw	Fastening torque (Nm)
	UVW	PE	UVW	PE		
GD600A-51-1R5-4	2.5	2.5	2.5–6	2.5–6	M5	2.5
GD600A-51-2R2-4	2.5	2.5	2.5–6	2.5–6	M5	2.5
GD600A-51-004-4	2.5	2.5	2.5–6	2.5–6	M5	2.5
GD600A-51-5R5-4	2.5	2.5	2.5–6	2.5–6	M5	2.5
GD600A-51-7R5-4	2.5	2.5	2.5–6	2.5–6	M5	2.5
GD600A-51-011-4	4	4	4–35	4–16	M6	4.5
GD600A-51-015-4	6	6	6–35	6–16	M6	4.5
GD600A-51-018-4	10	10	10–35	10–16	M6	4.5
GD600A-51-022-4	10	10	10–35	10–16	M6	4.5
GD600A-51-030-4	16	16	16–35	16	M6	4.5
GD600A-51-037-4	25	16	16–35	16	M6	4.5
GD600A-51-045-4	35	16	35–95	16–50	M10	22
GD600A-51-055-4	50	25	50–95	25–50	M10	22
GD600A-51-075-4	70	35	70–95	35–50	M10	22
GD600A-51-090-4	95	50	95–185	50–95	M12	35
GD600A-51-110-4	120	70	120–185	70–95	M12	35
GD600A-51-132-4	150	70	150–185	70–95	M12	35
GD600A-51-160-4	185	95	185	95	M12	35

Note: The recommended cable sizes for the main circuit are applicable under the following conditions: ambient temperature at or below 40°C, wiring distance within 100m, and operation at rated current. If the ambient temperature exceeds 40°C, both the cables and the VFD must be derated accordingly.

E.4.3 Cable arrangement

Motor cables must be arranged away from other cables. The motor cables of several VFDs can be arranged in parallel. It is recommended that you arrange the motor cables, input power cables, and control cables separately in different trays. The output dU/dt of the VFDs may increase electromagnetic interference on other cables. Do not arrange other cables and the motor cables in parallel.

If a control cable and power cable must cross each other, ensure that the crossing angle between them is 90°.

The cable trays must be connected properly and well grounded. Aluminum trays can implement local equipotential.

The following figure shows the cable arrangement.

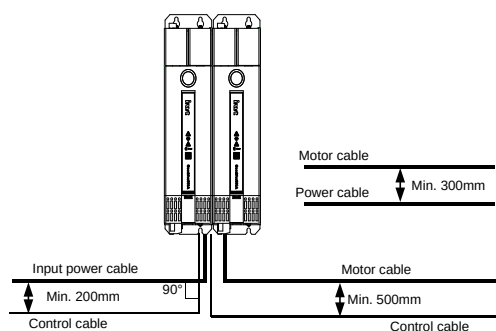


Figure E-4 Cable routing distance

E.4.4 Insulation inspection

Check the motor and the insulation conditions of the motor cable before running the motor.

1. Ensure that the motor cable is connected to the motor, and then remove the motor cable from the U, V, and W output terminals of the VFD.
2. Use a megohmmeter of 500V DC to measure the insulation resistance between each phase conductor and the protection grounding conductor. For details about the insulation resistance of the motor, see the description provided by the manufacturer.

Note: The insulation resistance is reduced if it is damp inside the motor. If moisture is suspected, dry and re-measure the motor.

E.5 Breaker and electromagnetic contactor

The circuit breaker is mainly used to prevent electric shock accidents and short circuits to the ground that may cause leakage current fire. The electromagnetic contactor is mainly used to control the main circuit power on and off, which can effectively cut off the input power of the VFD in case of system failure to ensure safety.

	According to the working principle and structure of breakers, if the manufacturer's regulation is not followed, hot ionized gases may escape from the breaker enclosure when a short-circuit occurs. To ensure safe use, exercise extra caution when installing and placing the breaker. Follow the manufacturer's instructions.
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Rectifier unit model	Fuse (A)	Breaker (A)	Contactor rated current (A)
GD600A-71-045-4-B	270	200	135
GD600A-71-160-4	870	630	450
GD600A-71-355-4	1860	1280	960
GD600A-61-022-4-B(-S)	80	63	65
GD600A-61-110-4-B(-S)	350	320	245

Note: The accessory specifications described in the preceding table are ideal values. You can select accessories based on the site conditions, but try not to use those with lower values.

E.6 Harmonic filters

To enhance grid protection, reduce harmonic interference from the VFD to the grid, and improve input power factor, consider configuring external DC reactors, input reactors, or passive harmonic filters based on your specific application needs.

If you want to use long cables between the VFD and the motor, select external output reactors, dv/dt attenuation filters, or sine-wave filters based on the motor cable length. This helps mitigate excessive dv/dt, reducing voltage stress on the

motor windings as well as protecting them, and extending the motor's lifespan. Refer to the table below for recommended output filter selections according to motor cable length.

Non-shielded cable length	50m–150m	150m–450m	450m–1000m
Shielded cable length	30m–100m	100m–230m	230m–500m
Output filter type	Output reactor (1%)	/	/
	/	dv/dt decrement filter	/
	/	/	Sine-wave filter

E.6.1 Reactor model selection table

Table E-3 Rectifier unit reactor model selection

Rectifier unit model	Input reactor
GD600A-61-022-4-B(-S)	GDL-ACL0051-4AL
GD600A-71-045-4-B	GDL-ACL0110-4AL
GD600A-61-110-4-B(-S)	GDL-ACL0220-4AL
GD600A-71-160-4	GDL-ACL0330-4AL
GD600A-71-355-4	GDL-ACL0580-4AL

Table E-4 Inverter unit reactor model selection

Inverter unit model	Output reactor
GD600A-51-1R5-4	GDL-OCL0005-4CU
GD600A-51-2R2-4	GDL-OCL0006-4CU
GD600A-51-004-4	GDL-OCL0010-4CU
GD600A-51-5R5-4	GDL-OCL0014-4CU
GD600A-51-7R5-4	GDL-OCL0020-4CU
GD600A-51-011-4	GDL-OCL0025-4CU
GD600A-51-015-4	GDL-OCL0035-4AL
GD600A-51-018-4	GDL-OCL0040-4AL
GD600A-51-022-4	GDL-OCL0050-4AL
GD600A-51-030-4	GDL-OCL0060-4AL
GD600A-51-037-4	GDL-OCL0075-4AL
GD600A-51-045-4	GDL-OCL0092-4AL
GD600A-51-055-4	GDL-OCL0115-4AL
GD600A-51-075-4	GDL-OCL0150-4AL
GD600A-51-090-4	GDL-OCL0220-4AL
GD600A-51-110-4	GDL-OCL0220-4AL
GD600A-51-132-4	GDL-OCL0265-4AL
GD600A-51-160-4	GDL-OCL0330-4AL

Note:

- The rated input voltage drop of input reactor is designed to 1.5%.
- The rated output voltage drop of output reactor is designed to 1%.
- The preceding table lists only external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.

E.6.2 Filter model selection table

Table E-5 Rectifier unit filter model selection

Rectifier unit model	Input filter
	Passive harmonic filter
GD600A-61-022-4-B(-S)	GDL-H0056-4AL
GD600A-71-045-4-B	GDL-H0100-4AL
GD600A-61-110-4-B(-S)	GDL-H0225-4AL
GD600A-71-160-4	GDL-H0320-4AL
GD600A-71-355-4	GDL-H0800-4AL

Table E-6 Inverter unit filter model selection

Inverter unit model	Output filter	
	dv/dt decrement filter	Sine-wave filter
GD600A-51-1R5-4	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD600A-51-2R2-4	GDL-DUL0005-4CU	GDL-OSF0005-4AL
GD600A-51-004-4	GDL-DUL0010-4CU	GDL-OSF0010-4AL
GD600A-51-5R5-4	GDL-DUL0014-4CU	GDL-OSF0014-4AL
GD600A-51-7R5-4	GDL-DUL0020-4CU	GDL-OSF0020-4AL
GD600A-51-011-4	GDL-DUL0025-4CU	GDL-OSF0025-4AL
GD600A-51-015-4	GDL-DUL0032-4CU	GDL-OSF0032-4AL
GD600A-51-018-4	GDL-DUL0040-4AL	GDL-OSF0040-4AL
GD600A-51-022-4	GDL-DUL0045-4AL	GDL-OSF0045-4AL
GD600A-51-030-4	GDL-DUL0060-4AL	GDL-OSF0060-4AL
GD600A-51-037-4	GDL-DUL0075-4AL	GDL-OSF0075-4AL
GD600A-51-045-4	GDL-DUL0100-4AL	GDL-OSF0095-4AL
GD600A-51-055-4	GDL-DUL0120-4AL	GDL-OSF0120-4AL
GD600A-51-075-4	GDL-DUL0150-4AL	GDL-OSF0150-4AL
GD600A-51-090-4	GDL-DUL0180-4AL	GDL-OSF0180-4AL
GD600A-51-110-4	GDL-DUL0220-4AL	GDL-OSF0220-4AL
GD600A-51-132-4	GDL-DUL0260-4AL	GDL-OSF0260-4AL
GD600A-51-160-4	GDL-DUL0320-4AL	GDL-OSF0320-4AL

Note: The input voltage of passive harmonic filter for 380V VFD models is 380–400V 50Hz.

E.7 EMC filter

EMC screws are connected in factory for the rectifier unit products, all of which meet the requirements of level C3.

Note: Disconnect the EMC screw in the following cases. (For the screw position, see Figure 4-13 EMC screw.)

- The EMC filter is applicable to grounded neutral systems (TN/TT). If the VFD is used in an IT system (ungrounded neutral system), the EMC screw must be disconnected (M3: tightening torque 5–6 kgf·cm).
- When a leakage circuit breaker (RCD) is configured, if nuisance tripping occurs during startup, please disconnect the EMC screw (M3: tightening torque 5–6 kgf·cm).

Note: Do not connect C3 filters in IT power systems.

Interference filters on the input side can reduce the VFD interference on the surrounding devices.

Noise filters on the output side can decrease the radio noise caused by the cables between VFDs and motors and the leakage current of conducting wires.

E.7.1 EMC filter model description

FLT – P 04 045 L – B
 A **B** **C** **D** **E** **F**

Field	Description
A	FLT: VFD filter series
B	Filter type P: Power input filter L: Output filter
C	Voltage class 04: AC 3PH 380V(-15%) – 440V(+10%) 06: AC 3PH 520V(-15%) – 690V(+10%)
D	3-digit code indicating the rated current. 045: 45A
E	Filter performance L: General H: High-performance
F	Filter application environment A: First environment (IEC61800-3:2004) category C1 (EN 61800-3) B: First environment (IEC61800-3:2004) category C2 (EN 61800-3) C: Second environment (IEC61800-3:2004) category C3 (EN 61800-3)

E.7.2 EMC filter model selection

Table E-7 Rectifier unit filter model selection

Rectifier unit model	Input filter
GD600A-61-022-4-B(-S)	FLT-P04065L-B
GD600A-71-045-4-B	FLT-P04100L-B
GD600A-61-110-4-B(-S)	FLT-P04240L-B
GD600A-71-160-4	FLT-P04400L-B
GD600A-71-355-4	FLT-P04800L-B

Table E-8 Inverter unit filter model selection

Inverter unit model	Output filter
GD600A-51-1R5-4	FLT-L04006L-B
GD600A-51-2R2-4	
GD600A-51-004-4	FLT-L04016L-B
GD600A-51-5R5-4	
GD600A-51-7R5-4	FLT-L04032L-B
GD600A-51-011-4	
GD600A-51-015-4	FLT-L04045L-B
GD600A-51-018-4	
GD600A-51-022-4	FLT-L04065L-B
GD600A-51-030-4	
GD600A-51-037-4	FLT-L04100L-B
GD600A-51-045-4	
GD600A-51-055-4	FLT-L04150L-B

Inverter unit model	Output filter
GD600A-51-075-4	
GD600A-51-090-4	FLT-L04240L-B
GD600A-51-110-4	FLT-L04240L-B
GD600A-51-132-4	FLT-L04240L-B
GD600A-51-160-4	FLT-L04400L-B

Note:

- The input EMI meets the C2 requirements after an input filter is configured.
- The preceding table lists only external accessories. You need to specify whether external or built-in accessories are needed in your purchase order.

E.8 Braking system

E.8.1 Braking component selection

When the VFD driving a high-inertia load decelerates or needs to decelerate abruptly, the motor runs in the power generation state and transmits the load-carrying energy to the DC circuit of the VFD, causing the bus voltage of the VFD to rise. If the bus voltage exceeds a specific value, the VFD reports an overvoltage fault. To prevent this from happening, you need to configure braking components.

	• The design, installation, commissioning, and operation of the device must be performed by trained and qualified professionals. • Follow all the "Warning" instructions during the operation. Otherwise, major physical injuries or property loss may be caused. • Only qualified electricians are allowed to perform the wiring. Otherwise, damage to the VFD or braking components may be caused. • Read the braking resistor or unit instructions carefully before connecting them to the VFD. • Connect braking resistors only to the terminals PB and (+), and braking units only to the terminals (+) and (-). Do not connect them to other terminals. Otherwise, damage to the braking circuit and VFD and fire may be caused.
	Connect the braking components to the VFD according to the wiring diagram. If the wiring is not properly performed, damage to the VFD or other devices may be caused.

E.8.2 Braking unit

The 22–110kW model is equipped with the built-in braking unit, and other rectifier unit models can be configured only with external braking units. Select braking resistors according to the specific requirements (such as the braking torque and braking usage) on site.

VFD model	Braking unit model	Resistance applicable for 100% braking torque (Ω)	Braking resistor dissipation power (kW)			Min. allowed braking ratio (Ω)
			10% braking utilization	50% braking utilization	80% braking utilization	
GD600A-61-022-4-B(-S)	Standard built-in	22	3	17	26	17
GD600A-71-045-4-B	Built-in braking unit	13	7	34	54	11
GD600A-61-110-4-B(-S)	Standard built-in	4.5	17	83	132	4.4
GD600A-71-160-4	DBU100H-320-4	3.1	24	120	192	2.2
GD600A-71-355-4	DBU100H-320-4 *2	3.2*2	24*2	118*2	189*2	2.2*2

Note:

- Select braking resistors according to the resistance and power data provided by INVT.
- The braking resistor may increase the braking torque of the VFD. The preceding table provides the resistor power ratings designed based on 100% braking torque and braking utilization levels of 10%, 50%, and 80%. You can select the braking system based on the actual operating conditions.
- When using an external braking unit, set the brake voltage class of the braking unit properly by referring to the manual of the DBU100H dynamic braking unit. If the voltage class is set incorrectly, the VFD may not run properly.

	Do not use braking resistors whose resistance is lower than the specified minimum resistance. The VFD does not provide protection against overcurrent caused by resistors with low resistance.
	In scenarios where braking is frequently implemented, that is, the braking usage is greater than 10%, you need to select a braking resistor with higher power as required by the operation conditions according to the preceding table.

E.8.3 Braking resistor cable selection

Braking resistor cables should be shielded cables.

E.8.4 Braking component installation

All resistors must be installed in places with good cooling conditions.

	The materials near the braking resistor or braking unit must be flame resistant. since the surface temperature of the resistor is high and air flowing from the resistor is of hundreds of degrees Celsius. Prevent any materials from coming into contact with the resistor.
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Braking resistor installation

	• The 22kW, 45kW, and 110kW rectifier units only require external braking resistors. • PB and (+) are the terminals for connecting braking resistors.
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Braking unit installation:

	• Except the 22kW, 45kW, and 110kW rectifier units, all the other rectifier units require external braking units. • (+) and (-) are the terminals for connecting braking units. • The connection cable length between the (+) and (-) terminals of the VFD and those of a braking unit must be shorter than 5m, and the connection cable length between the BR1 and BR2 terminals of a braking unit and the terminals of a braking resistor must be shorter than 10m.
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E.9 Other optional accessories

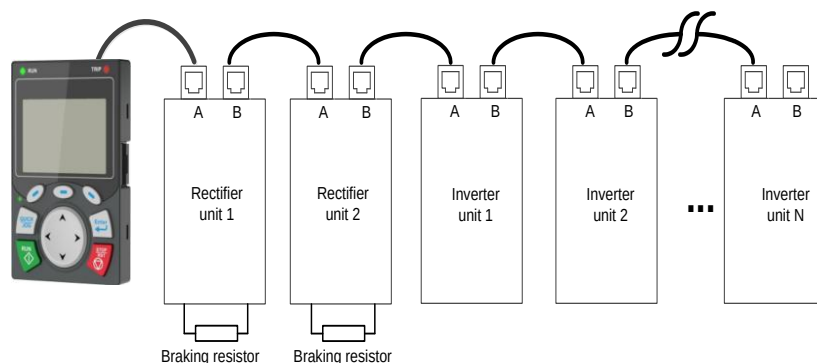
E.9.1 List of other optional accessories

No.	Name	Specifications	Applicable model
1	External DC connection terminal	GD600-CON1	Current-carrying capability: 100A; applicable to 1.57.5kW inverter unit models
2		GD600-CON2	Current-carrying capability: 200A; applicable to 45kW, 160kW rectifier unit models and 11– 75kW inverter unit models
3	External LCD keypad	SOP-600	Applicable to all rectifier and inverter unit models
4	USB-RS485 communication module	EC-TM485-USB	Used to connect the rectifier unit to the host controller

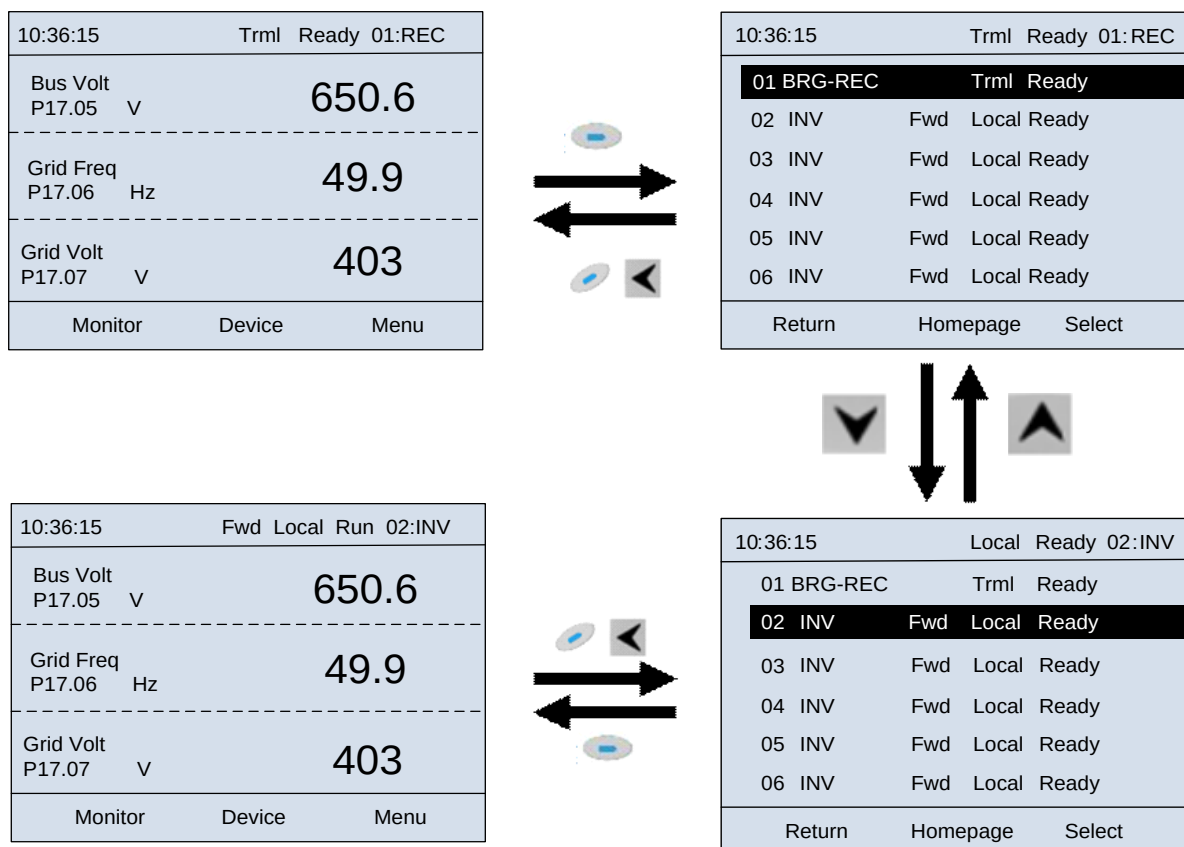
No.	Name	Specifications	Applicable model
5	Shield bracket	GD600A-SH1	50mm-wide shield bracket, applicable to 1.5–7.5 kW inverter units and 22kW rectifier units.
6		GD600A-SH2	100mm-wide shield bracket, applicable to 11–37 kW inverter units and 45kW rectifier units.
7		GD600A-SH2	200mm-wide shield bracket, applicable to 45–75kW inverter units
8		GD600A-SH2	300mm-wide shield bracket, applicable to 90–132kW inverter units
9	Flange-type installation bracket	GD600A-FLAN1	50mm mounting bracket, applicable to 1.5–7.5kW inverter units and 22kW rectifier units
10		GD600A-FLAN2	100mm mounting bracket, applicable to 11–37kW inverter units and 45kW rectifier units
11		GD600A-FLAN3	200mm mounting bracket, applicable to 45–75kW inverter units and 110kW rectifier units
12		GD600A-FLAN4	300mm mounting bracket, applicable to 160kW rectifier units and 90–160kW inverter units
13	Air deflector	GD600A-AD1	50mm air deflector, applicable to 1.5–7.5kW inverter units and 22kW rectifier units
14		GD600A-AD2	100mm air deflector, applicable to 11–37kW inverter units and 45kW rectifier units
15		GD600A-AD3	200mm air deflector, applicable to 45–75kW inverter units and 110kW rectifier units
16		GD600A-AD4	300mm air deflector, applicable to 160kW rectifier units and 90–160kW inverter units
17	Buffer unit	BUB600-7R5-4	Applicable to 1.5– 7.5kW inverter units
18		BUB600-037-4	Applicable to 11– 37kW inverter units
19		BUB600-075-4	Applicable to 45– 75kW inverter units

E.9.2 LCD keypad

The Goodrive600A external LCD keypad (model: SOP-600) is a commissioning assistant for INVT's new-generation variable-frequency drive systems and supports Goodrive600A series products. The keypad allows you to perform flexible interactive operations through the friendly and simple visual interface. It provides efficient data processing, powerful real-time monitoring and alarm functions, fast editing and commissioning, rich custom configuration functions, and large-capacity data storage. It also provides a user-friendly USB drive software (keypad software) upgrade function. For details, see the user manual for Goodrive600A series multifunction LCD keypad.

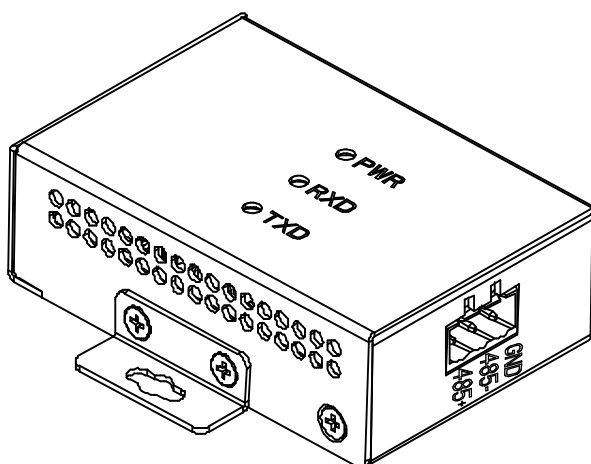


One LCD keypad can be connected to multiple rectifier and inverter units, allowing online unit switching for convenient commissioning.



Note: The units are connected via the RJ45 ports on their rear panels. Each unit must be assigned a unique RS485 address using the following parameter: P20.07 for gateway-type rectifier units, P20.00 for non-gateway-type rectifier units, and P14.00 for inverter units.

E.9.3 USB-RS485 communication module



The USB-to-RS485 communication module (model: EC-TM485-USB) is used to connect Workshop on a PC host controller to the 485 terminals of Goodrive600A series rectifier and inverter units. The module provides an RS485 interface and a Type-B interface, and is supplied with dedicated adapter cables (Type-B-to-USB communication cable and RJ45-to-RS485 communication cable).

E.9.4 Bus terminal

The 100A external bus terminal is applicable to 1.5–7.5kW inverter units (50mm wide). Only one can be installed on each unit.

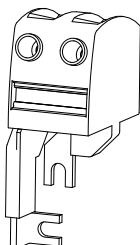
The 200A external bus terminal is applicable to the 11–75kW inverter units and the 45kW and 160kW rectifier units. Only

one can be installed on each 45 kW rectifier unit and each 11–37kW inverter unit. Two can be installed on each 45–75kW inverter unit and each 160kW rectifier unit.

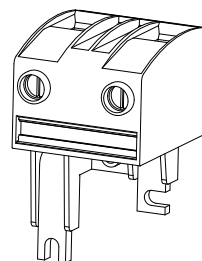
Table E-9 Wiring specifications for external bus terminals

No.	Name	Terminal specifications	Cable specifications
1	100A bus terminal	GD600-CON1	16AWG-2AWG
2	200A bus terminal	GD600-CON2	6AWG-150mm ²

The external bus terminal drawing is as follows.



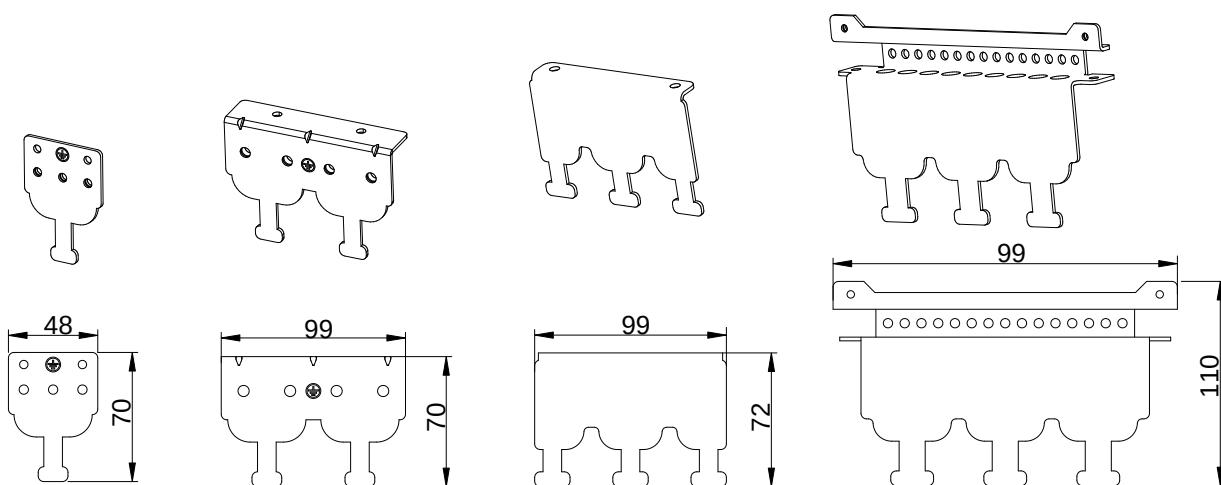
100 A busbar external connection terminal



200 A busbar external connection terminal

E.9.5 Shield bracket

You are recommended to use the cable with a shield layer as the inverter unit output cable. You can use a shield bracket to fix the shield layer (selecting different shield brackets according to width dimensions). The shield bracket structure is as follows.



For 50 mm models

For 100 mm models

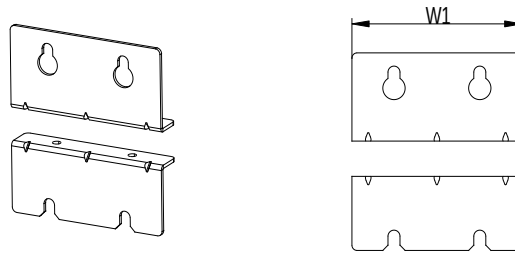
For 200 mm models

For 300 mm models

E.9.6 Flange-type installation bracket

Cooling air ducts can be installed on both rectifier units (except the 355kW model) and inverter units through the flange installation mode, and different models support different flange installation brackets.

The flange-mounting bracket structure is as follows.



The flange-mounting procedure is as follows:

Step 1 Install the middle bracket.

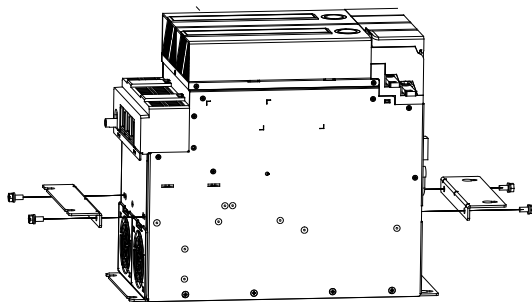


Figure a

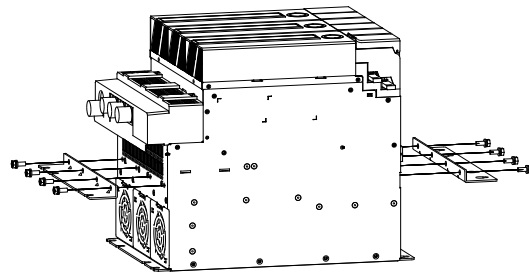
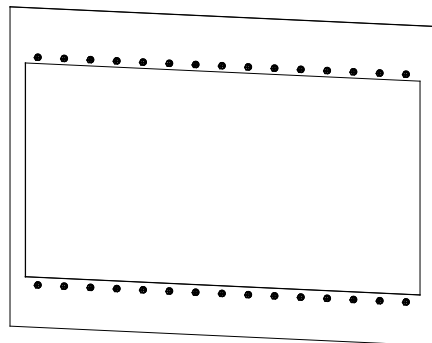


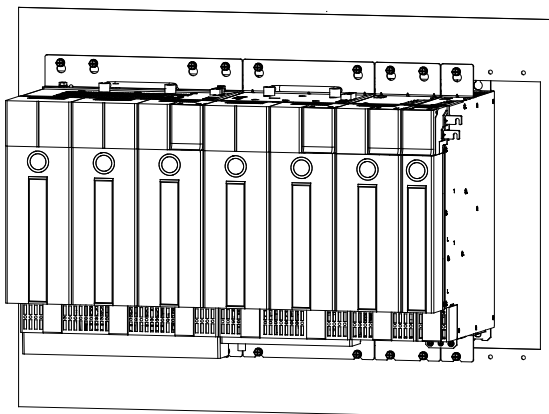
Figure b

Note: For 160kW rectifier and inverter units, the fastening screws are on the upper part of the bracket (see Figure b). For other models, the fastening screws are on the lower part (see Figure a).

Step 2 Pre-install the corresponding hex head SEMS screws for each power rating onto the mounting backplate. Do not tighten them; leave a 5mm clearance between the screw and the backplate.

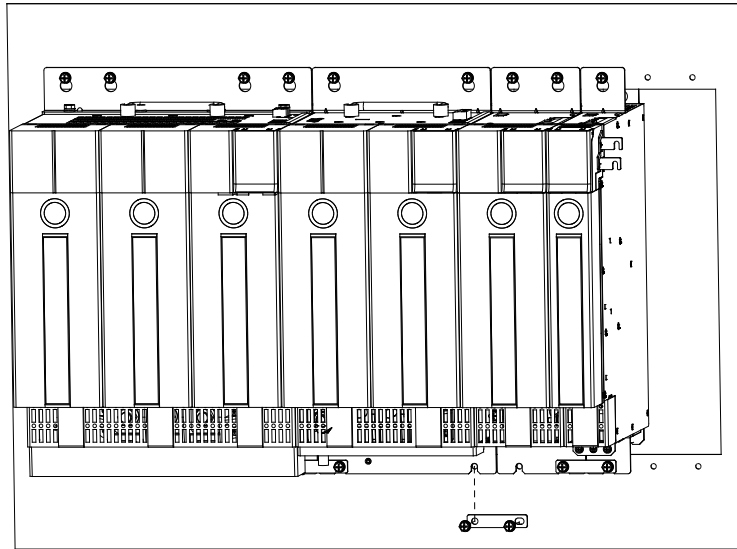


Step 3 Hang the rectifier/inverter unit on the pre-installed screws on the backplate, and then tighten the screws with a torque wrench.



Note: Do not tighten the lower screws of adjacent units yet. The grounding aluminum bar must be installed in the next step.

Step 4 Install the grounding aluminum bar between adjacent units.

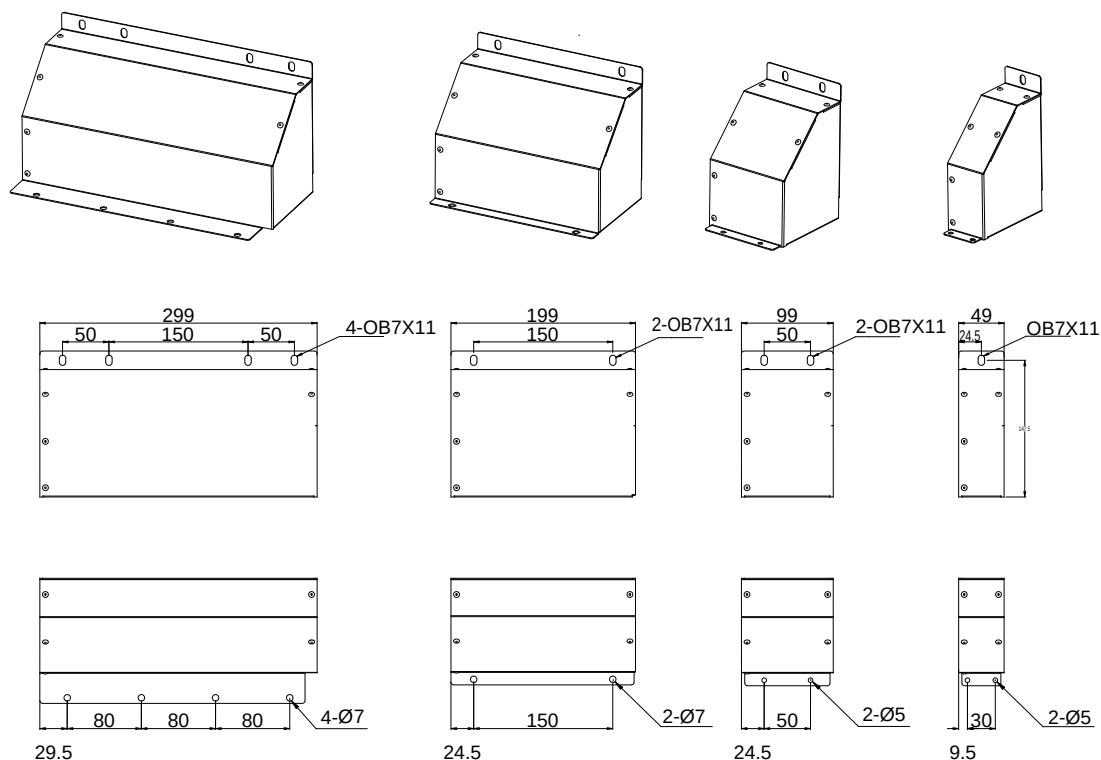


Step 5 Install the shield bracket. This bracket is optional and is not supplied as standard. Skip this step if it is not used.

E.9.7 Air deflector

When rectifier and inverter units are installed in an up and down configuration (wall-mounted) within a cabinet, an air deflector is recommended for the air outlet of the lower unit. This prevents the hot exhaust air from the lower unit from affecting the heat dissipation of the upper unit.

The structure of the air deflector is shown in the following.



E.9.8 Buffer unit

The BUB600 series is a DC buffer unit designed for Goodrive600A inverter units. Installed between the rectifier and inverter units and used in conjunction with a DC circuit breaker, it enables the replacement of a specific inverter unit without powering down the rectifier (maintaining normal DC bus voltage). This allows for independent power-up and power-down operations of individual inverter units.

E.9.8.1 Mounting dimensions

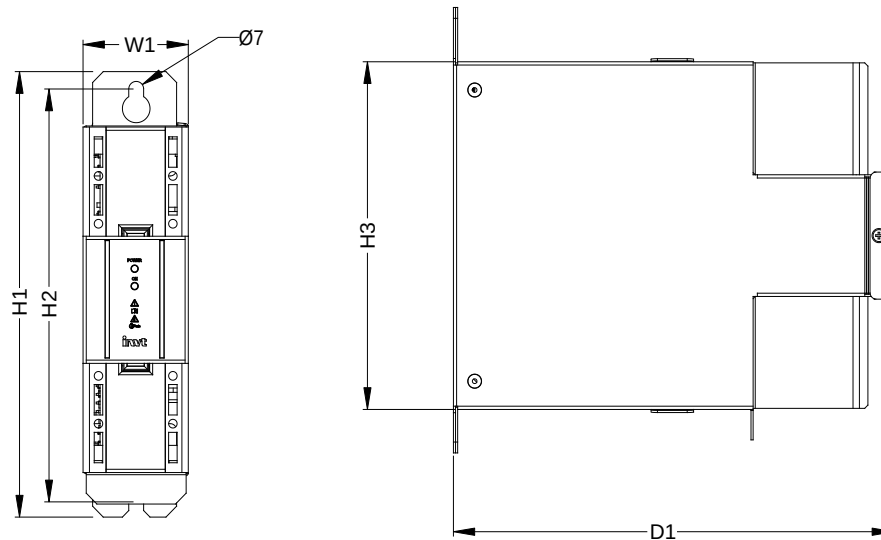


Figure E-5 Wall-mounting diagram of BUB600-7R5-4

Table E-10 Wall-mounting dimensions of BUB600-7R5-4

Specifications	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
BUB600-7R5-4	205	160	50	207	190	/	/	Ø7	1.3

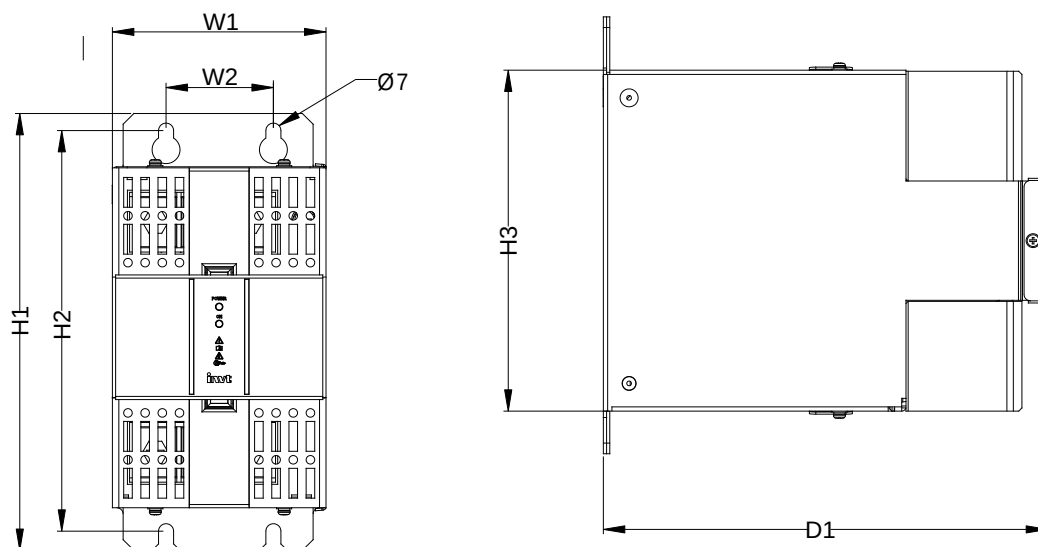
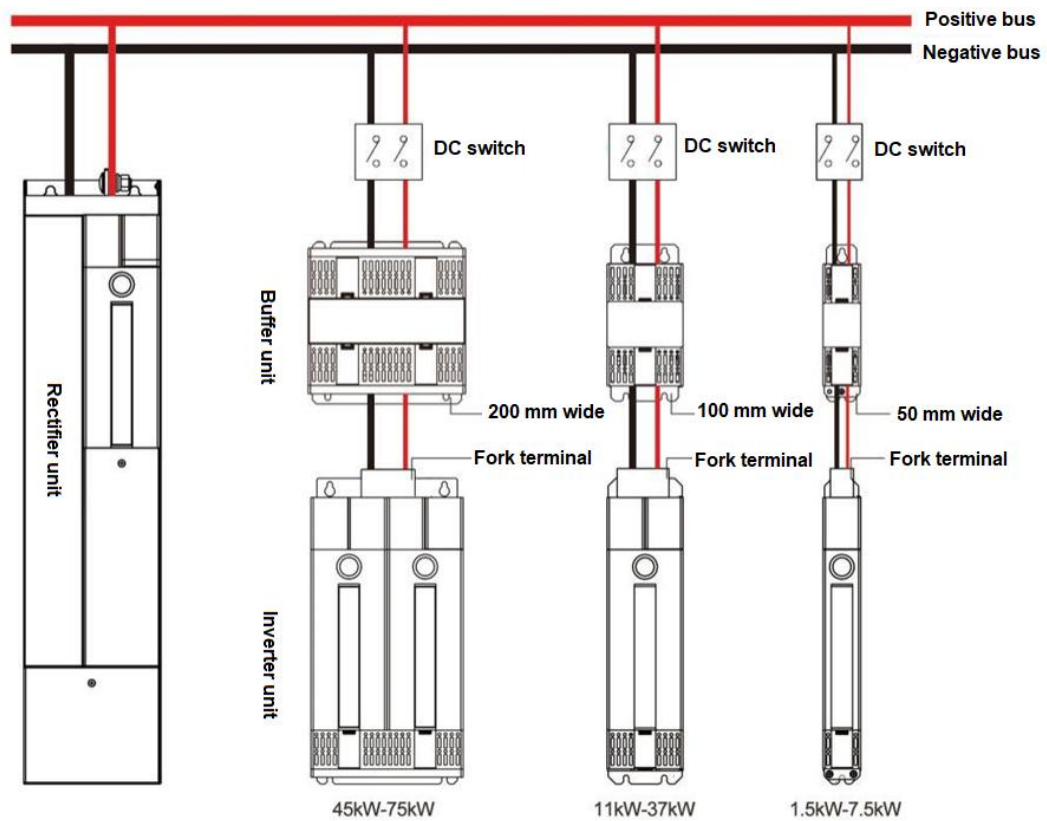


Figure E-6 BUB600-037-4/BUB600-075-4 wall-mounting diagram

Table E-11 BUB600-037-4/BUB600-075-4 wall-mounting dimensions

Specifications	Dimensions (mm)				Mounting hole spacing (mm)			Hole diameter (mm)	Weight (kg)
	H1	H3	W1	D1	H2	W2	W3		
BUB600-037-4	205	160	100	207	190	50	/	Ø7	2.3
BUB600-075-4	205	160	200	207	190	150	/	Ø7	4.1

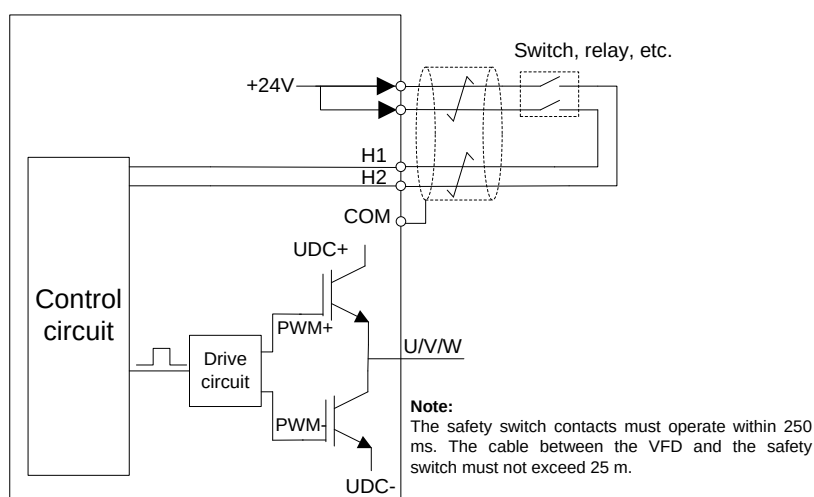
E.9.8.2 Main circuit wiring

For details about the buffer unit use instructions, see the user manual for the BUB600 series buffer unit.

Appendix F STO function description

Reference standards: IEC 61508-1, IEC 61508-2, IEC 61508-3, IEC 61508-4, IEC 62061, ISO 13849-1, and IEC 61800-5-2

You can enable the safe torque off (STO) function to prevent unexpected startups when the main power supply of the drive is not switched off. The STO function switches off the drive output by turning off the drive signals to prevent unexpected startups of the motor (see the following figure). After the STO function is enabled, you can perform some-time operations (such as non-electrical cleaning in the lathe industry) and maintain the non-electrical components of the device without switching off the drive.



F.1 STO function logic table

The following table describes the input states and corresponding faults of the STO function.

STO input state	Faults related to the STO functions
H1 and H2 opened simultaneously	The STO function is triggered, and the drive stops running. The corresponding fault code is as follows: E040: Safe torque off (STO)
H1 and H2 closed simultaneously	The STO function is not triggered, and the drive runs properly.
Either H1 or H2 is open, while the other is closed.	The STL1, STL2, or STL3 fault occurs. Fault code: E041: Channel H1 exception (STL1) E042: Channel H2 exception (STL2) E043: Exception to both channels H1 and H2 (STL3)

F.2 STO channel delay description

The following table describes the trigger and indication delay of the STO channels.

STO mode	STO trigger delay ¹ and indication delay ²
STO fault: STL1	Trigger delay < 10ms; Indication delay < 280ms
STO fault: STL2	Trigger delay < 10ms; Indication delay < 280ms
STO fault: STL3	Trigger delay < 10ms; Indication delay < 280ms
STO fault: STO	Trigger delay < 10ms Indication delay < 100ms

- STO trigger delay¹: time interval between trigger the STO function and switching off the drive output.

- STO indication delay²: Time interval between trigger the STO function and STO output state indication.

F.3 STO function installation checklist

Before installing the STO, check the items described in the following table to ensure that the STO function can be properly used.

	Item
☐	Ensure that the drive can run or stop randomly during commissioning.
☐	Stop the drive (if it is running), disconnect the input power supply, and isolate the drive from the power cable through the switch.
☐	Check the STO circuit connection according to the circuit diagram.
☐	Check whether the shielding layer of the STO input cable is connected to the +24V reference ground COM.
☐	Connect the power supply.
☐	Test the STO function as follows when the motor stops running: ● If the drive is running, send a stop command to it and wait until the shaft of the motor stops rotating. ● Activate the STO circuit and send a start command to the drive. Ensure that the motor does not start. ● Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.
☐	Test the STO function as follows when the motor is running: ● Start the VFD and ensure that the motor runs properly. ● Activate the STO circuit. ● The drive reports an STO fault (for details, see section 9.5.2 Inverter unit faults and solutions). Ensure that the motor coasts to stop rotating. ● Deactivate the STO circuit.
☐	Restart the drive, and check whether the motor is running properly.

Appendix G Further information

G.1 Product and service queries

If you have any queries about the product, contact the local INVT office. Please provide the model and serial number of the product you query about. You can visit www.invt.com to find a list of INVT offices.

G.2 Feedback on INVT VFD manuals

Your comments on our manuals are welcome. Visit www.invt.com, directly contact online service personnel or choose **Contact Us** to obtain contact information. You can also scan the QR code on the front of the machine to get the e-manual.

G.3 Documents on the Internet

You can find manuals and other product documents in the PDF format on the Internet. Visit www.invt.com and choose **Support > Download**.

Appendix H Ordering information

You can quickly find product models and order products by 10-digit order number.

Product category	Ordering information	Product model	Remarks
Power unit	11020-00762	GD600A-71-045-4-B	45kW rectifier unit
	11020-00764	GD600A-71-160-4	160kW rectifier unit
	11020-00763	GD600A-71-355-4	355kW rectifier unit
	11020-00755	GD600A-61-022-4-B	22kW rectifier unit
	11020-00761	GD600A-61-022-4-B-S	22kW rectifier unit
	11020-00512	GD600A-61-110-4-B-S	110kW rectifier unit
	11020-00765	GD600A-61-110-4-B	110kW rectifier unit
	11020-00723	GD600A-51-1R5-4	1.5kW inverter unit
	11020-00721	GD600A-51-2R2-4	2.2kW inverter unit
	11020-00722	GD600A-51-004-4	4kW inverter unit
	11020-00719	GD600A-51-5R5-4	5.5kW inverter unit
	11020-00720	GD600A-51-7R5-4	7.5kW inverter unit
	11020-00708	GD600A-51-011-4	11kW inverter unit
	11020-00705	GD600A-51-015-4	15kW inverter unit
	11020-00707	GD600A-51-018-4	18.5kW inverter unit
	11020-00704	GD600A-51-022-4	22kW inverter unit
	11020-00706	GD600A-51-030-4	30kW inverter unit
	11020-00709	GD600A-51-037-4	37kW inverter unit
	11020-00714	GD600A-51-045-4	45kW inverter unit
	11020-00712	GD600A-51-055-4	55kW inverter unit
	11020-00713	GD600A-51-075-4	75kW inverter unit
	11020-00514	GD600A-51-090-4	90kW inverter unit
	11020-00516	GD600A-51-110-4	110kW inverter unit
	11020-00515	GD600A-51-132-4	132kW inverter unit
	11020-00517	GD600A-51-160-4	160kW inverter unit
Expansion card	11023-00145	EC-PC701-02	PLC card
	11023-00099	EC-TX709	PROFINET communication card
	11023-00111	EC-TX703	PROFIBUS-DP communication card
	11023-00097	EC-TX704	EtherNet communication card
	11023-00127	EC-TX708	EtherCAT communication card
	11023-00143	EC-PG705-12B	Multifunction incremental PG card
	11023-00110	EC-PG704-00	Resolver PG card
	11023-00122	EC-PG707-24	24V simplified incremental PG card
	11023-00160	EC-PG705-24	Multifunction incremental PG card
	11023-00159	EC-PG708-24	SSI absolute PG card
	11023-00123	EC-IO702	IO card
Structural part	61001-01444	GD600-SH1	50mm-wide shield bracket
	61001-01446	GD600-SH2	100mm-wide shield bracket
	61001-05461	GD600A-SH3	200mm-wide shield bracket

Product category	Ordering information	Product model	Remarks
	61001-05325	GD600A-SH4	300mm-wide shield bracket
	62001-01985	GD600-FLAN1	50mm flange installation kit
	62001-01910	GD600-FLAN2	100mm-wide flange mounting kit
	62001-02092	GD600-FLAN3	200mm-wide flange mounting kit
	62001-02021	GD600-FLAN4	300mm-wide flange mounting kit
	60005-00128	GD600-AD1	50mm-wide air deflector
	60005-00127	GD600-AD2	100mm-wide air deflector
	60005-00133	GD600-AD3	200mm-wide air deflector
	60005-00134	GD600-AD4	300mm-wide air deflector
	19005-00354	GD600-CON1	100A DC bus terminals
	19005-00355	GD600-CON2	200A DC bus terminals
Network cable	37005-00020	/	1m, non-shield, common
	37005-00017	/	1.5m, non-shield, common
	37005-00021	/	2m, non-shield, common
Other	11022-00135	SOP-600	LCD keypad
	11023-00116	EC-TM485-USB	USB-RS485 communication module
Buffer unit	11029-00141	BUB600-7R5-4	Applicable to 1.5kW–7.5kW inverter units
	11029-00142	BUB600-037-4	Applicable to 11kW–37kW inverter units
	11029-00146	BUB600-075-4	Applicable to 45kW–75kW inverter units

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